JOINT FEDERAL/STATE APPLICATION FOR THE ALTERATION OF ANY FLOODPLAIN, WATERWAY, TIDAL OR NONTIDAL WETLAND IN MARYLAND

APPLICATION AMENDMENT 1

BEL AIR IMPOUNDMENT AND WINTERS RUN INTAKE PROJECT

Town of Bel Air
Harford County, Maryland

Prepared for:

Maryland American Water Company

Prepared by:

Gannett Fleming

November 30, 2015
Amended September 2016

MARYLAND AMERICAN WATER COMPANY

BEL AIR IMPOUNDMENT AND WINTERS RUN INTAKE PROJECT

TOWN OF BEL AIR, HARFORD COUNTY, MARYLAND

APPLICATION AMENDMENT I

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Chapter 1

1.1 Project Description, Summary of Impacts, and Location Maps

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1.1

Project Description, Summary of Impacts, and Location Maps

Project Description

Maryland American Water Company (MAWC) is proposing to construct an off-stream raw water storage impoundment to serve the Town of Bel Air. In addition to the off-stream impoundment, the proposed project requires a raw water intake structure on Winters Run and associated pipeline crossings of Winters Run to connect to the existing Winters Run Water Treatment Plant (WTP). The project will be completed in a phased approach with Phase IA consisting of the construction of the off-stream impoundment. Construction for the off-stream impoundment is proposed in an upland field currently used as agricultural land. Phase IB of the project will consist of the intake structure, pumping station, and connecting infrastructure between the impoundment and the WTP which will need to cross Winters Run and its floodplain.

The existing Bel Air water system is supplied primarily from the existing Winters Run Water Treatment Plant (2.0 MGD nominal capacity) that treats water from Winters Run. The Winters Run withdrawal is permitted by the Maryland Department of the Environment (MDE) at 1.4 MGD, annual average. The MAWC water system is also supplemented by water supply wells. MACW has an agreement with Harford County for a 0.5 MGD supply through an existing metered interconnection.

When stream flow drops below the minimum pass-by flow stipulated by MDE, water cannot be withdrawn by the WTP. During such times historically, Harford County has allowed the MAWC system to take water in excess of the agreement amount to meet system demands. The County is now facing projected long-term supply shortfalls and has alerted MAWC that they can no longer commit to supplemental supply. As a result, the MAWC identified and evaluated a number of options for a supplemental supply. The off-stream raw water storage impoundment addresses this concern to meet demand during low flow periods.

In working with Harford County and MDE to evaluate supply alternatives, the County identified a County-owned parcel adjacent to Winters Run, upstream of the Winters Run Water Treatment Plant that could potentially be used for construction of an off-stream storage impoundment. MAWC purchased the parcel in November 2015 with the intention to construct the impoundment and create raw water storage to supply the WTP when withdrawal from the stream is restricted or prohibited. The impoundment would be refilled from the stream when flows are sufficient to meet both the supply needs and the refill rates.

Phase IA – Construction of the Off-Stream Impoundment

The proposed Bel Air Impoundment will be an off-stream, lined, earthen embankment impoundment approximately 2,000 feet long and 62 feet high with a 20-foot wide crest and the capacity to store 90 million gallons. The impoundment design utilizes a manufactured lining material due to the existing soil permeability. Additionally, the liner allows the excavated material to be used for the embankment construction which will minimize the amount of site spoils and material import. The lining will be exposed on the bottom and interior slopes. There will be earth covering the anchor trenches.

The limit of disturbance (LOD) for Phase IA activities encompasses approximately 40 acres, and includes 0.520 acre of temporary impacts and 0.154 acre of permanent impacts to the floodplain along Winters Run.

Phase IB – Intake Structure, Pumping Station, and Transmission Pipelines

Additional facilities required for the off-stream storage impoundment system will include a raw water intake structure, pumping station, control vault, and water transmission pipelines. The proposed raw water intake structure, pumping station, and control vault are required to refill the impoundment when stream flow is available. The proposed raw water intake structure and pumping station will be constructed on the WTP-side of Winters Run, left bank facing downstream. The raw water pumping station will be located in a below-grade, concrete vault located 1 foot below the floodplain ground surface elevation with an access shaft to the surface. The raw water pumping station will include new pumps for the water treatment plant withdrawal from the proposed raw water intake structure and the off-stream storage impoundment. The water transmission pipeline from the raw water pump station to the impoundment will cross beneath Winters Run by horizontal directional drilling. With the proposed raw water intake structure and pumping station located on the WTP site, the same pipeline can be used for the impoundment withdrawal when stream flows are low and the impoundment's raw water supply is needed to meet water demands.
The water intake structure is a two, half-double barrel intake screens mounted on a concrete pad with 1/8-inch (nominal 3 mm) screens connected to the pumping station by concrete-encased pipelines. The proposed facilities constructed within the floodplain will be permanently located below the floodplain ground surface elevation; therefore, these facilities will not result in permanent impacts to the floodplain.

Walkways are proposed leading from the WTP's paved driveways to the intake and raw water pumps station locations. The walkways will be installed flush with the existing grade; therefore, there will be zero-net fill within the floodplain. The weir gate on the intake dam will be replaced with an inflatable weir gate. The weir gate replacement workspace will be controlled by sandbag diversion, and the new weir gate will be located within the existing dam structure in the existing footprint below water elevation. The 12-foot long, gabion retaining wall, serving as the downstream left bank of Winters Run, will be reconstructed with rock-filled, PVC-coated, steel wire-mesh gabion baskets within the existing gabion wall's footprint. The reconstructed gabion wall will be extended 24 feet upstream to stabilize the eroded bank and to prevent future stream bank subsidence and coarse woody debris in the stream that could damage the new intake structure.

The permitted average flow from Winters Run is 1.4 million gallons per day (MGD) with a flow-by requirement of 6.07 MGD. MAWC has requested that the average daily withdrawal for the WTP to be increased from 1.4 to 1.7 MGD and the maximum to be increased from 1.7 to 8.4 MGD. When high flow events occur in Winters Run, MAWC proposes a higher flow-by requirement of 10.62 MGD for withdrawals greater than 1.7

MGD up to a maximum of 8.4 MGD. This will enable the refilling of the off-stream storage impoundment. Retaining the intake's existing withdrawal rate will allow the WTP to continue to readily supply water to the Town of Bel Air, and the additional higher flow-by and withdrawal rate will maintain the normal pool and refill the impoundment supply for when higher flows occur in Winters Run. This scenario allows MAWC to take raw water during higher flow events and will not deprive downstream users and aquatic life.

The LOD necessary to accomplish Phase IB work will encompass approximately 2 acres. At this time, Phase IB work is estimated to temporarily impact 1.448 acres of floodplain and 0.064 acre across 97 linear feet of Winters Run, and permanently impact 0.006 acre across 35 linear feet of Winters Run.

Summary of Impacts

The proposed project has been designed to avoid impacts to non-tidal wetlands and non-tidal wetland buffers. Unavoidable impacts necessary to construct the project have been minimized.

Phase IA – Construction of the Off-Stream Impoundment

- One temporary floodplain impact to construct the impoundment impact basin outfall structure.
- One permanent floodplain impact for the impoundment impact basin outfall structure.

Phase IB – Intake Structure, Pumping Station, and Transmission Pipelines

- One temporary floodplain impact to construct the proposed raw water pumping station, install raw water transmission pipelines, construct the raw water intake structure, and install gravel walkways. These structures and pipelines will be permanently located below the floodplain ground surface elevation; therefore, will not result in permanent impacts to the floodplain. The concrete walkways will be installed flush with the existing grade, which will result in no net fill and no permanent impact to the floodplain.
- One temporary stream impact to construct the proposed raw water intake structure, replace the weir gate on intake dam, and reconstruct and extend the gabion retaining wall.
- One permanent stream impact for the proposed raw water intake structure within the bed and banks of Winters Run.
- One permanent stream impact for the proposed extension of the gabion retaining wall.

Total impacts to resources are summarized in **Table 1**. Regulated activities are described and summarized in **Table 2** and depicted on **Figure 3**.

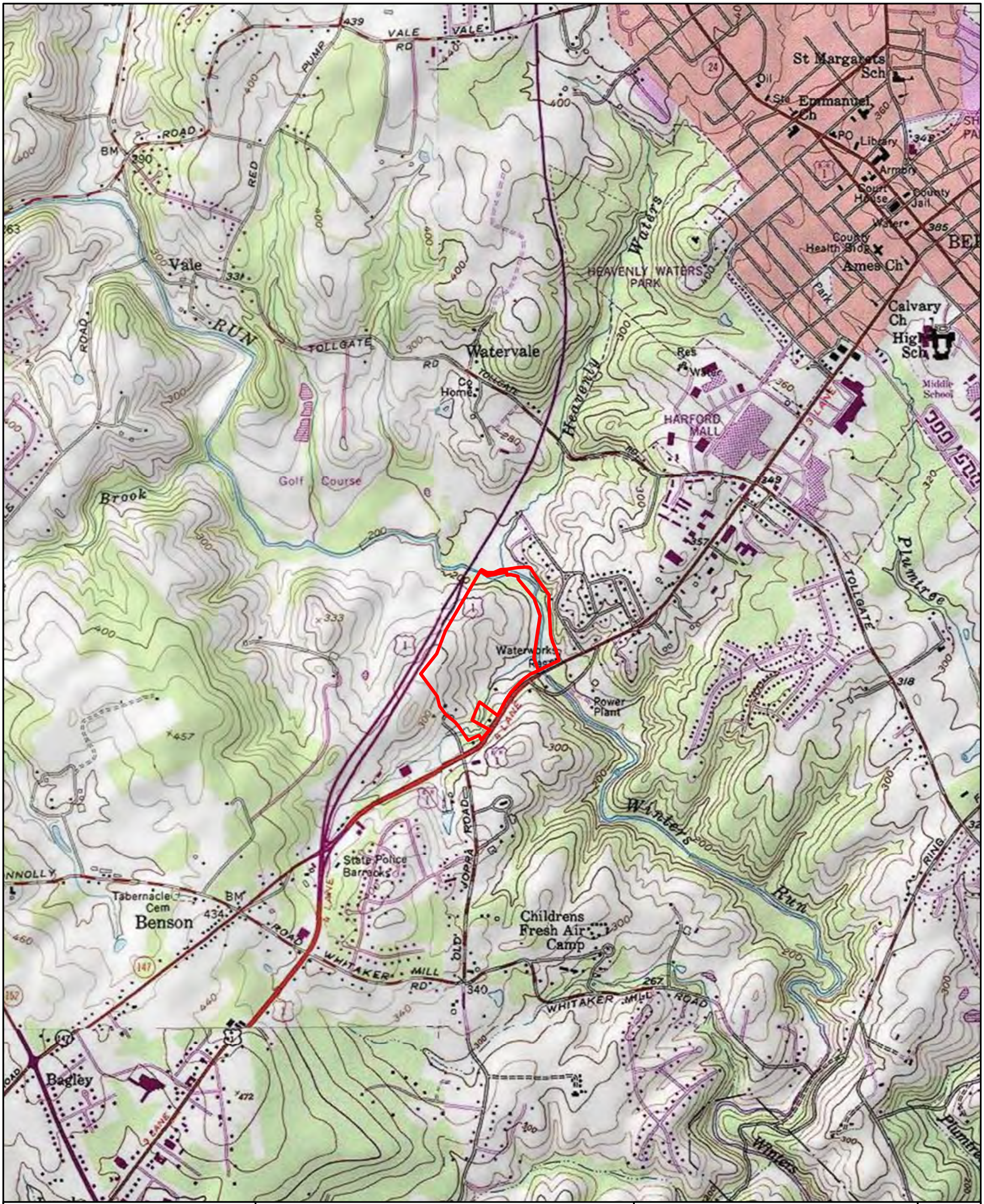
Table 1.
Total Impacts to Natural Resources

Natural Resource Type	**Temporary Impacts**			**Permanent Impacts**		
	SQ-FT	AC	LF	SQ-FT	AC	LF
PHASE IA – CONSTRUCTION OF THE OFF-STREAM IMPOUNDMENT						
Non-Tidal Wetland	-	-	-	-	-	-
Non-Tidal Stream	-	-	-	-	-	-
100-Year (FEMA) Floodplain	22,660	0.520	-	6,690	0.154	-
Non-Tidal Wetland Buffer	-	-	-	-	-	-
Phase IA Total	**22,660**	**0.520**	**-**	**6,690**	**0.154**	**-**
PHASE IB – INTAKE STRUCUTRE, PUMPING STATION, AND TRANSMISSION PIPELINES						
Non-Tidal Wetland	-	-	-	-	-	-
Non-Tidal Stream	2,800	0.064	97	568	0.013	59
100-Year (FEMA) Floodplain	39,725	0.910	-	-	-	-
Non-Tidal Wetland Buffer	-	-	-	-	-	-
Phase IB Total	**42,525**	**0.974**	**97**	**568**	**0.013**	**59**
OVERALL PROJECT						
Non-Tidal Wetland	-	-	-	-	-	-
Non-Tidal Stream	2,800	0.064	97	568	0.013	59
100-Year (FEMA) Floodplain	62,385	1.43	-	6,690	0.154	-
Non-Tidal Wetland Buffer	-	-	-	-	-	-
Overall Total	**65,185**	**1.494**	**1.494**	**7,258**	**0.167**	**59**
SQ-FT = Square Feet; AC = Acres; LF = Linear Feet						

Table 2.
Summary of Regulated Activities

	Regulated Activity, Location, and Description	**Temporary Impacts**			**Permanent Impacts**		
		SQ-FT	AC	LF	SQ-FT	AC	LF
PHASE IA – CONSTRUCTION OF THE OFF-STREAM IMPOUNDMENT							
1.	***Floodplain Impact (Winters Run Downstream Right Bank)*** Limit of Disturbance to Construct the Impact Basin Outfall Structure and Install Water Transmission Pipelines	22,660	0.520	-	-	-	-
2.	***Floodplain Impact (Winters Run Downstream Right Bank)*** Footprint Area of the Impact Basin Outfall Structure	-	-	-	6,690	0.154	-
PHASE IB – INTAKE STRUCUTRE, PUMPING STATION, AND TRANSMISSION PIPELINES							
3.	***Floodplain Impact (Winters Run Downstream Right Bank)*** Limit of Disturbance to Install Water Transmission Pipelines by Horizontal Directional Drilling	1,885	0.043	-	-	-	-
4.	***Floodplain Impact (Winters Run Downstream Left Bank)*** Limit of Disturbance to Construct the Raw Water Pumping Station, Install Water Transmission Pipelines, and Install Concrete Walkways	37,840	0.867	-	-	-	-
5.	***Temporary Stream Impact (Winters Run within the Bed & Banks)*** Limit of Disturbance to Construct the Proposed Raw Water Intake Structure, Replace the Weir Gate on the Intake Dam, Reconstruction of the Existing Gabion Wall (12 ft)	2,800	0.064	97	-	-	-
6.	***Permanent Stream Impact (Winters Run within the Bed & Banks)*** Proposed Raw Water Intake Structure Footprint	-	-	-	280	0.006	35
7.	***Permanent Stream Impact (Winters Run Downstream Left Bank)*** Proposed Gabion Wall Extension (24 ft)	-	-	-	288	0.007	24
	Total	**65,185**	**1.494**	**97**	**568**	**0.013**	**59**

SQ-FT = Square Feet; AC = Acres; LF = Linear Feet



Legend

🟥 Project Study Area Parcel Boundaries

FIGURE 1
USGS TOPOGRAPHIC LOCATION MAP

Bel Air Impoundment Project
MARYLAND AMERICAN WATER
Town of Bel Air, Harford County, Maryland

Feet

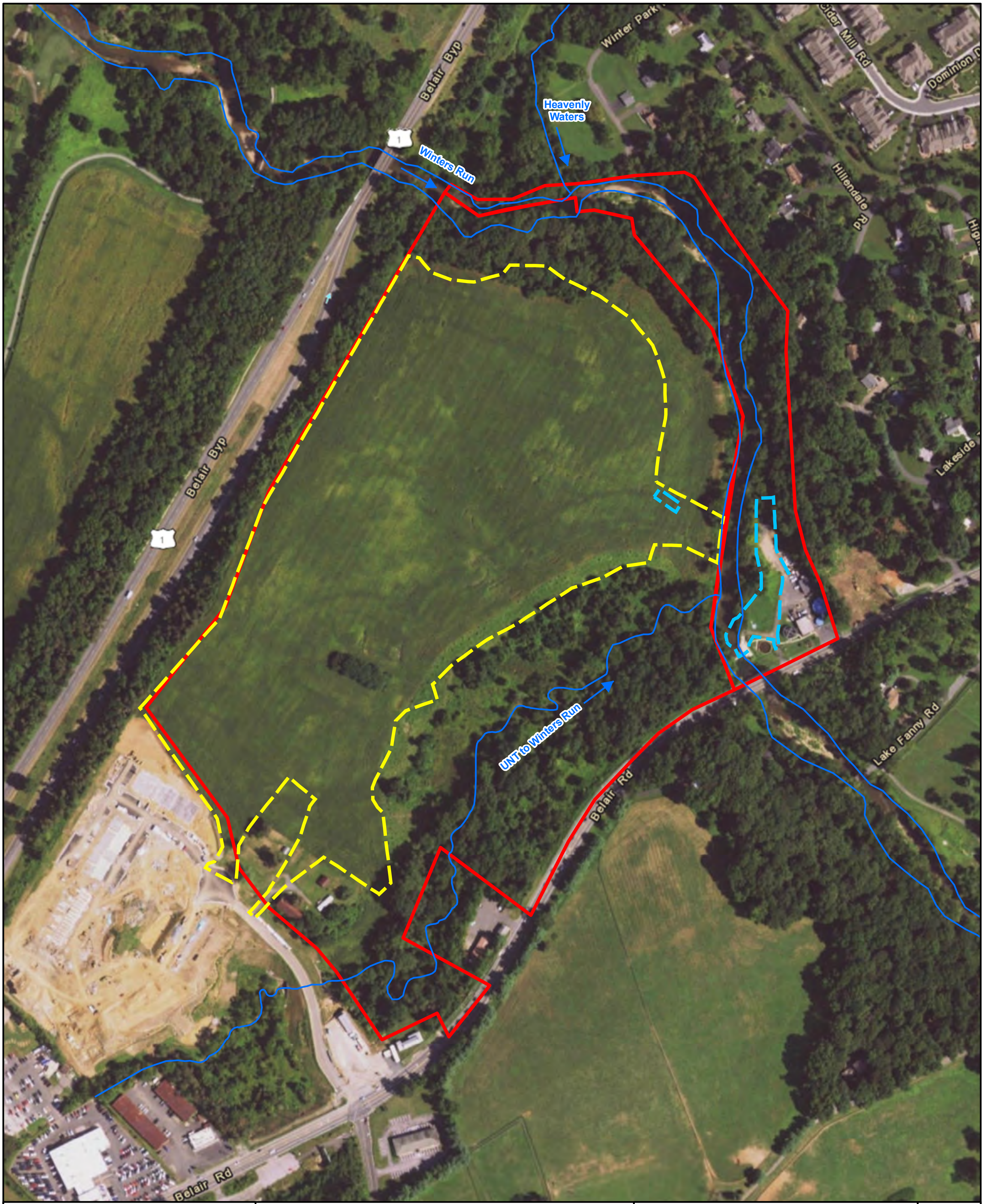
2,000 1,000 0 2,000

Gannett Fleming

Source: USGS topographic basemapping provided by ESRI ArcGIS Online webservices.

N

Map Prepared: 08/17/2016
GF Project No. 059267



Legend

- 🟥 Project Study Area Parcel Boundaries
- ▭ Phase IA LOD
- ▭ Phase IB LOD
- — Streams

FIGURE 2
PROJECT LOCATION & STUDY AREA MAP

Bel Air Impoundment Project
MARYLAND AMERICAN WATER
Town of Bel Air, Harford County, Maryland

Feet
400 200 0 400

Gannett Fleming

Source: Aerial imagery and transportation basemapping provided by ESRI ArcGIS Online webservices.

N

Map Prepared: 08/17/2016
GF Project No. 059267

1.2

Completed Joint Federal/State Permit Application Form

JOINT FEDERAL/STATE APPLICATION FOR THE ALTERATION OF ANY FLOODPLAIN, WATERWAY, TIDAL OR NONTIDAL WETLAND IN MARYLAND

FOR AGENCY USE ONLY
Application Number ____________ **Date Determined Complete** ____________
Date Received by State ____________ **Date(s) Returned** ____________
Date Received by Corps ____________ ____________
Type of State permit needed ____________ **Date of Field Review** ____________
Type of Corps permit needed ____________ **Agency Performed Field Review** ____________

+++

- Please submit 1 original and 6 copies of this form, required maps and plans to the Wetlands and Waterways Program as noted on the last page of this form.
- Any application which is not completed in full or is accompanied by poor quality drawings may be considered incomplete and result in a time delay to the applicant.

Please check one of the following:

RESUBMITTAL: ____ **APPLICATION AMENDMENT:** X **MODIFICATION TO AN EXISTING PERMIT:** ____
JURISDICTIONAL DETERMINATION ONLY ____ **APPLYING FOR AUTHORIZATION** X
PREVIOUSLY ASSIGNED NUMBER (RESUBMITTALS AND AMENDMENTS) AI No. 151858; Application No. 20156803/15-NT0386

DATE September 30, 2016

1. APPLICANT INFORMATION:

APPLICANT NAME:

A. Name: Robert F. McIntyre B. Daytime Telephone: 410-838-8404
C. Company: Maryland American Water Company D. Email Address: robert.mcintyre@amwater.com
E. Address: 260 Gateway Drive, Suite 17-18B
F. City: Bel Air State: MD Zip: 21014-399

AGENT/ENGINEER INFORMATION:

A. Name: Sophia Liskovich, P.E. B. Daytime Telephone: 443-348-2017 x. 8337
C. Company: Gannett Fleming, Inc. D. Email Address: sliskovich@gfnet.com
E. Address: Rutherford Plaza, 7133 Rutherford Road, S-300
F. City: Baltimore State: MD Zip: 21244

ENVIRONMENTAL CONSULTANT:

A. Name: David H. Graff B. Daytime Telephone: 717-763-7211 x. 2073
C. Company: Gannett Fleming, Inc. D. Email Address: dgraff@gfnet.com
E. Address: 207 Senate Avenue
F. City: Camp Hill State: PA Zip: 17011

CONTRACTOR (If known): Not known at this time.

A. Name: ____________ B. Daytime Telephone: ____________
C. Company: ____________ D. Email Address: ____________
E. Address: ____________
F. City: ____________ State: ____________ Zip: ____________

PRINCIPAL CONTACT:

A. Name: David H. Graff B. Daytime Telephone: 717-763-7211 x. 2073
C. Company: Gannett Fleming, Inc. D. Email Address: dgraff@gfnet.com
E. Address: 207 Senate Avenue
F. City: Camp Hill State: PA Zip: 17011

2. PROJECT DESCRIPTION

a. GIVE WRITTEN DESCRIPTION OF PROJECT:

Maryland American Water proposes to construct an off-stream raw water storage impoundment to serve the Town of Bel Air in Harford County. The proposed project will be constructed in a phased approach with Phase IA consisting of the construction of the off-stream impoundment, and Phase IB consisting of the intake structure, pumping station, and connecting infrastructure.

Has any portion of the project been completed? _____ Yes X No If yes, explain _____

Is this a residential subdivision or commercial development? _____ Yes X No

If yes, total number of acres on property N/A acres

b. ACTIVITY: Check all activities that are proposed in the wetland, waterway, floodplain, and nontidal wetland buffer as appropriate.

A. X filling
B. _____ dredging
C. X excavating
D. X flooding or impounding water
E. _____ draining
F. X grading
G. X removing or destroying vegetation
H. X building structures

Area for item(s) checked: Wetland 0 (sq. ft.) Buffer (Nontidal Wetland Only) 0 (sq. ft.)

Expanded Buffer (Nontidal Wetland Only) 0 (sq. ft.)

Area of stream impact 2,800 (sq. ft.)

Length of stream affected 97 (linear feet)

c. TYPE OF PROJECTS: Project Dimensions

For each activity, give overall length and width (in feet), in columns 1 and 2. For multiple activities, give total area of disturbance in square feet in column 3. For activities in tidal waters, give maximum distance channelward (in feet) in column 4. For dam or small ponds, give average depth (in feet) for the completed project in column 5. Give the volume of fill or dredged material in column 6.

			Length (Ft.) 1	Width (Ft.) 2	Area Sq. Ft. 3	Maximum/Average Channelward Encroachment 4		Pond Depth 5	Volume of fill/dredge material (cubic yards) below MHW or OHW 6
A.		Bulkhead					-		
B.		Revetment							
C.		Vegetative Stabilization							
D.	X	Gabions	24	12		12	-		107
E.		Groins							
F.		Jetties							
G.		Boat Ramp							
H.		Pier							
I.		Breakwater							
J.	X	Repair & Maintenance	27	27	729	27	-		55
K.		Road Crossing							
L.	X	Utility Line	1,475	1.5	1.448				
M.	X	Outfall Construction	150	150	22,660	-	-		
N.		Small Pond							
O.	X	Dam	2,000	950	815,214			45	-
P.		Lot Fill							
Q.		Building Structures							
R.		Culvert							
S.		Bridge							
T.		Stream Channelization							
U.		Parking Area							
V.		Dredging							

1. _____ New 2. _____ Maintenance 3. _____ Hydraulic 4. _____ Mechanical

W. _____ Other (explain) _____

d. PROJECT PURPOSE: Give brief written description of the project purpose:

The existing Bel Air water system is supplied primarily from the existing Winters Run Water Treatment Plant (WTP, 2.0 MGD nominal capacity) that treats water from the existing raw water intake on Winters Run (MDE permitted 1.4 MGD annual average withdrawal). When stream flow drops below the minimum pass-by-flow stipulated by MDE, water cannot be withdrawn by the WTP. During these events and drought conditions, Harford County's water supply has supplied water to the Town via an existing metered interconnection. Due to projected long-term shortfalls, Harford County will not be able to provide flows greater than 0.5 MGD in the future. The proposed off-stream storage impoundment would be used to supply the WTP when stream withdrawal is restricted or prohibited. The impoundment would be refilled from the stream when flows are sufficient to meet both supply needs and refill rates.

3. PROJECT LOCATION:
a. LOCATION INFORMATION:

A. County: Harford B. City: Bel Air C. Name of waterway or closest waterway Winters Run
D. State stream use class designation: Recreational Trout Waters and Public Water Supply (IV-P)
E. Site Address or Location: 303-301 Old Jopa Rd, Bel Air, MD 21014;
Parcel Address: 1120 Baltimore Pike, Bel Air, MD 21014
F. Directions from nearest intersection of two state roads: From the intersection of Route 147 (Harford Road) and US Route 1 (Bel Air Bypass), continue on Belair Rd/Baltimore Pike for 0.8 miles. Turn left onto Old Joppa Road for 0.2 miles, the project site is located on the right and accessible on a gravel driveway.

G. Is your project located in the Chesapeake Bay Critical Area (generally within 1,000 feet of tidal waters or tidal wetlands)?:
_______ Yes X No
H. County Book Map Coordinates (Alexandria Drafting Co.); Excluding Garrett and Somerset Counties:
Map: 0048 Letter: E Number: 0004 (to the nearest tenth)
I. FEMA Floodplain Map Panel Number (if known): 24025C0163E
J. 1. 39°31'1.21"N latitude 2. 76°22'22.78"W longitude

b. ACTIVITY LOCATION: Check one or more of the following as appropriate for the type of wetland/waterway where you are proposing an activity:

A. _____ Tidal Waters
B. _____ Tidal Wetlands
C. _____ Special Aquatic Site (e.g., mudflat, vegetated shallows)
D. _____ Nontidal Wetland
E. _____ 25-foot buffer (nontidal wetlands only)
F. _____ 100-foot buffer (nontidal wetland of special State concern)
G. X In stream channel
1. _____ Tidal 2. X Nontidal
H. X 100-year floodplain (outside stream channel)
I. _____ River, lake, pond
J. _____ Other (Explain)

c. LAND USE:

A. Current Use of Parcel Is: 1. X Agriculture: Has SCS designated project site as a prior converted cropland?
_______ Yes _______ No 2. X Wooded 3. X Marsh/Swamp 4. _______ Developed
5. _____ Other

B. Present Zoning Is: 1. ____ Residential 2. ____ Commercial/Industrial 3. ____ Agriculture 4. ____ Marina 5. X Other
Other: Least Protective
C. Project complies with current zoning X Yes _______ No

THE FOLLOWING INFORMATION IS REQUIRED BY THE STATE (blocks 4-7):

4. REDUCTION OF IMPACTS: Explain measures taken or considered to avoid or minimize wetland losses in F. Also check Items A-E if any of these apply to your project.

A. X Reduced the area of disturbance
B. _____ Reduced size/scope of project
C. X Relocated structures
D. _____ Redesigned project

E. _____ Other

F. Explanation The limit of disturbance has been positioned within the upland, agricultural land to avoid wetland impacts and to minimize impacts to waterways and floodplains. The proposed impacts to Winters Run and its floodplain are unavoidable and required to connect the off-stream storage impoundment with the existing water treatment plan and raw water intake.

Describe reasons why impacts were not avoided or reduced in Q. Also check Items G-P that apply to your project.

G. X Cost
H. ______ Extensive wetlands on site
I. X Engineering/design constraints
J. ______ Other natural features

K. ______ Parcel size
L. ______ Other regulatory requirement
M. ______ Failure to accomplish project purpose

N. ______ Safety/public welfare issue
O. ______ Inadequate zoning
P. ______ Other ______

Q. Description Wetland impacts were avoided. The proposed waterway and floodplain disturbances were limited to allow only for the work area needed to install pipelines and other necessary structures with the limit of disturbance as shown on the drawings.

5. LETTER OF EXEMPTION: If you are applying for a letter of exemption for activities in nontidal wetlands and/or their buffers, explain why the project qualifies:

A. ______ No significant plant or wildlife value and wetland impact
  1. ______ Less than 5,000 square feet
  2. ______ In an isolated nontidal wetland less than 1 acre in size

B. ______ Repair existing structure/fill
C. ______ Mitigation Project
D. ______ Utility Line
  1. ______ Overhead
  2. ______ Underground

E. Other (explain) ______

F. X Check here if you are **not** applying for a letter of exemption.

IF YOU ARE APPLYING FOR A LETTER OF EXEMPTION, PROCEED TO BLOCK 11

6. ALTERNATIVE SITE ANALYSIS: Explain why other sites that were considered for this project were rejected in M. Also check any items in D-L if they apply to your project. **(If you are applying for a letter of exemption, do not complete this block):**

A. ______ 1 site
B. X 2 - 4 sites
C. ______ 5 or more sites

Alternative sites were rejected/not considered for the following reason(s):

D. X Cost
E. X Lack of availability
F. ______ Failure to meet project purpose
G. ______ Located outside general/market area

H. X Greater wetlands impact
I. ______ Water dependency
J. ______ Inadequate zoning
K. X Engineering/design constraints

L. ______ Other ______

M. Explanation: Another site located further upstream along Winters Run was considered. However, due to its distance from the existing water treatment plant, presence of environmental resources and historic features, the other site was removed from further engineering and design consideration for this project.

7. PUBLIC NEED: Describe the public need or benefits that the project will provide in F. Also check Items in A-E that apply to your project. **(If you are applying for a letter of exemption, do not complete this block):**

A. X Economic
B. ______ Safety

C. X Health/welfare
D. ______ Does not provide public benefits

E. ______ Other ______

F. Description See Section 1.1 Project Description

8. OTHER APPROVALS NEEDED/GRANTED:

A. Agency	B. Date Sought	C. Decision 1. Granted	2. Denied	D. Decision Date	E. Other Status
MHT	11/18/2015	12/23/2015			
MDNR W&H	8/27/2014	9/17/2014			
USFWS	8/27/2014	9/22/2014			
MDE - Water Appropriations	9/30/2015	Pending			

9. MITIGATION PLAN: Please provide the following information:

a. Description of a monetary compensation proposal, if applicable (for **state requirements** only). Attach another sheet if necessary. N/A

b. Give a brief description of the proposed mitigation project. N/A

c. Describe why you selected your proposed mitigation site, including what other areas were considered and why they were rejected. N/A

d. Describe how the mitigation site will be protected in the future. N/A

10. HAVE ADJACENT PROPERTY OWNERS BEEN NOTIFIED?: A. X Yes B. No

Provide names and mailing addresses below (Use separate sheet, if necessary):

a. See Section 1.3

b.

c.

11. HISTORIC PROPERTIES: Is your project located in the vicinity of historic properties? (For example: structures over 50 years old, archeological sites, shell mounds, Indian or Colonial artifacts). Provide any supplemental information in Section 13.

A. X Yes B. No C. Unknown

12. ADDITIONAL INFORMATION: Use this space for detailed responses to any of the previous items. Attach another sheet if necessary:

Check box if data is enclosed for any one or more of the following (see checklist for required information):

A. ______ Soil borings
B. __X__ Wetland data sheets
C. __X__ Photographs

D. __X__ Field surveys
E. ______ Alternate site analysis
F. ______ Market analysis

G. __X__ Site plan
H. ______ Avoidance and minimization analysis

I. __X__ Other (explain) See Permit Application Table of Contents

CERTIFICATION:

I hereby designate and authorize the agent named above to act on my behalf in the processing of this application and to furnish any information that is requested. I certify that the information on this form and on the attached plans and specifications is true and accurate to the best of my knowledge and belief. I understand that any of the agencies involved in authorizing the proposed works may request information in addition to that set forth herein as may be deemed appropriate in considering this proposal. I certify that all Waters of the United States have been identified and delineated on site, and that all jurisdictional wetlands have been delineated in accordance with the Corps of Engineers Wetlands Delineation Manual (Wetlands Research Program Technical Report Y-87-1). I grant permission to the agencies responsible for authorization of this work, or their duly authorized representative, to enter the project site for inspection purposes during working hours. I will abide by the conditions of the permit or license if issued and will not begin work without the appropriate authorization. I also certify that the proposed works are consistent with Maryland's Coastal Zone Management Plan. I understand that none of the information contained in the application form is confidential and that I may request that additional required information be considered confidential under applicable laws. I further understand that failure of the landowner to sign the application will result in the application being deemed incomplete.

LANDOWNER MUST SIGN: ______________________________ DATE: ______________

WHERE TO MAIL APPLICATION

Maryland Department of the Environment
Water Management Administration
Regulatory Services Coordination Office
1800 Washington Boulevard, Suite 430
Baltimore, Maryland 21230
Telephone: (410) 537-3762
1-800-876-0200

BEFORE YOU MAIL… DON'T FORGET…

- **SIGN AND DATE THE APPLICATION. THE LANDOWNER MUST SIGN.**
- **SEVEN (7) COPIES OF ALL DOCUMENTS (APPLICATION, PLANS, MAPS, REPORTS, ETC.) MUST BE RECEIVED TO BEGIN OUR REVIEW.**
- **INCLUDE FIVE COPIES OF A VICINITY MAP (LOCATION MAP) WITH THE PROJECT SITE PINPOINTED.**
- **SEND AN APPLICATION FEE OF $750 ALONG WITH A COPY OF THE FIRST PAGE OF THE APPLICATION TO MARYLAND DEPARTMENT OF THE ENVIRONMENT, P.O. BOX 2057, BALTIMORE, MD 21203-2057. PLEASE REFER TO OUR WEBSITE http://www.mde.state.md.us/wetlands FOR FURTHER INSTRUCTIONS.**

SAMPLE PLANS MAY BE OBTAINED BY PHONE (1-800-876-0200)
OR E-MAIL acunabaugh@mde.state.md.us.

1.3

Adjacent Property Owner Notification Addresses

CERTIFICATION OF NOTIFICATION

ATTENTION APPLICANT:

Please complete this form and return to Wetlands and Waterways Program, Water Management Administration, 1800 Washington Boulevard, Baltimore, MD 21230. Be sure to include the Division number, a copy of the tax map and your notification letter, and sign the form. Please include complete names and complete addresses, including zip codes. Your application is incomplete until this certification is received.

Tracking No: 201561803/15-NT-0386 Division No: 150858
Assigned Staff: Tamene Dilnesahu

Description of the project:
The Bel Air Impoundment Project proposes to construct an off-stream, lined earthen embankment impoundment with the capacity to store 360 acre-feet of water. The impoundment will be connected to the existing Winters Run Water Treatment Plant through raw water transmission pipes that will cross beneath the streambed of Winters Run. The existing raw water intake and pump station will be replaced.

Please list all persons notified below: (continue on reverse side or attach additional sheets if necessary)

NAME	ADDRESS
See attached table.	

If delivery was not made to certain persons, please list those persons and the reasons for non-delivery on the reverse side of this form.

I hereby certify that I have notified all persons who own properties which have a common boundary with my property. The appropriate local officials have been notified. I have notified them by certified mail or in person.

4.15.16

Signature of Applicant
Date

Robert F. McIntyre, Maryland American Water
Please Print Name

410-838-8404
Telephone Number

CERTIFICATION OF NOTIFICATION

ATTENTION APPLICANT:

Please complete the form below and return to , MDE Dam Safety Division, Water Management Administration, 1800 Washington Blvd, Suite 440, Baltimore, Maryland 21230-1708. Be sure to include the WMA File number, and to sign and date the form. Please include complete names and complete addresses, including zip codes.

CERTIFICATION NOTICE

I hereby certify that I have properly notified (by certified mail or in person) the contiguous property owners and appropriate local officials of: See attached table.

WMA File No. for a permit to (describe project):

The Bel Air Impoundment Project proposes to construct an off-stream, lined earthen embankment impoundment with the capacity to store 360 acre-feet of water. The impoundment will be connected to the existing Winters Run Water Treatment Plant through raw water transmission pipes that will cross beneath the streambed of Winters Run. The existing raw water intake and pump station will be replaced.

Persons notified were (continue on reverse side if necessary):

Name	Address
See attached table.	

If delivery was not made to certain persons, please list those persons and the reasons for non-delivery on the reverse side of this form.

Signature of Applicant

4.15.16

Date

Robert F. McIntyre, Maryland American Water

Please Print Name

Gannett Fleming

*Excellence Delivered **As Promised***

<Month Day, Year>

CERTIFIED MAIL NO. <0000 0000 0000 0000 0000>
RETURN RECEIPT REQUESTED

<Property Owner>
<Mailing Address – Line 1>
<Mailing Address – Line 2>

RE: This is an Adjacent Property Owner Notification Pursuant to Maryland Annotated Code, Environment Article §5-204 and §5-506.

Permit Applicant Name	Maryland American Water Company
Project Name	Bel Air Impoundment Project
Project Location	Town of Bel Air, Harford County, Maryland
Permit Application File Names	Wetlands & Waterways Tracking No. 201561803/15-NT-0386 and AI No. 150858
	Dam Safety Permit No. 16-OB-0036
	Water Appropriation and Use Permit Application No. HA1976S015/07

Dear <Property Owner>:

You are receiving this letter because your property boundary is shared or near property owned by Maryland American Water Company (MAWC), a local water company. As part of permit application requirements (pursuant Maryland Annotated Code, Environmental Article §5-204 and §5-506), all adjacent property owners must be notified to obtain input from the public; therefore, MAWC is notifying you of this project through this letter. You do not need to take any actions as a result of this letter. Enclosed is a map depicting the proposed project location and its proximity to your property (refer to **Figure 1**).

Project Information

MAWC has submitted a permit application to the Maryland Department of the Environment's (MDE) Wetlands and Waterways Program and the Dam Safety Division requesting authorization to construct a drinking water storage impoundment on property that is owned by MAWC. MAWC submitted a permit application to MDE's Water Supply Program, Source Protection and Appropriation Division, to increase the existing water intake appropriation and withdrawal from Winters Run in order to fill and operate the proposed impoundment.

Rutherford Plaza Building • Suite 300 • 7133 Rutherford Road • Baltimore, MD 21244
t: 443.348.2017 • f: 443-298-3940
www.gannettfleming.com

The project name is the Bel Air Impoundment Project and it proposes to construct a drinking water impoundment in an open field (Parcel No. 0048-0004E-0106) along Winters Run. The proposed Bel Air Impoundment (Dam Safety Permit No. 16-OB-0036) will be an off-stream, lined earthen embankment impoundment approximately 2,300 feet long and 58 feet high with a 20-foot wide crest and the capacity to store 360 acre-feet of water (90 million gallons). The impoundment will be connected to the existing Winters Run Water Treatment Plant through pipes that will cross beneath the streambed of Winters Run. The existing water intake structure on Winters Run, as well as the existing pump station, will be replaced or upgraded as part of the project. Winters Run will not be impounded as part of this project. No changes to adjacent property owners, downstream owners, or water users are proposed as part of this project.

In order to fill the proposed off-stream drinking water storage impoundment, MAWC has applied for a Permit to Appropriate and Use Waters of the State, and has been assigned permit application number HA1976S015/07. MAWC seeks to increase the existing appropriation from 1,400,000 gallons per day (gpd) on a yearly basis to 1,700,000 gpd on a yearly basis, and increase the existing maximum daily withdrawal from 1,700,000 gpd to 8,400,000 gpd. Water will be withdrawn from Winters Run and used for the community water supply serving the Town of Bel Air. Gannett Fleming, Inc. serves as MAWC's engineering and environmental consultants and is assisting MAWC with the design and permitting of the project.

Notification Information & Points of Contact

Since you are a contiguous property owner, you are being notified of this application, as required by Maryland Annotated Code, Environmental Article §5-204 and §5-506. MDE will place your name on the "List of Interested Persons" for this project. At a later date, you will be provided a second notice with an opportunity for submitting comments or additional information about the application or request a public informational hearing.

Project notifications have also been issued to the following Executive Offices for the Town of Bel Air and Harford County. If you would like to speak with the Executive Officers notified, their contact information is provided below.

	Name	Executive Office	Phone Number
Town of Bel Air	Susan U. Burdette	Chair of the Board of Town Commissioners	(410) 638-4550
	Jesse Bane	Town Administrator	(410) 638-4550
Harford County	Richard Slutzky	County Council President	(410) 638-3522
	Barry Glassman	County Executive	(410) 638-3350

If you wish to review the States' application files, provide comments, or speak with MDE regarding this project, the following MDE contact information is provided below.

Name of Regulator MDE Division & Program	Mailing Address	Phone Number
Tamene Dilnesahu Waterways Construction Division Wetlands and Waterways Program	1800 Washington Blvd. Suite 430 Baltimore, MD 21230	(410) 537-3803
John Roche Dam Safety Division Sediment, Stormwater and Dam Safety Program	1800 Washington Blvd. Suite 440 Baltimore, MD 21230	(410) 537-3552
John Grace Source Protection and Appropriation Division Water Supply Program	1800 Washington Blvd. Baltimore, MD 21230	(410) 537-3590

If you have any questions concerning the permit applications submitted to MDE, you may contact me at (443) 348-2017, extension 8337 or at the address below.

Very truly yours,

Sophia Z. Liskovich, P.E.
GANNETT FLEMING, INC.
Rutherford Plaza Building, Suite 300
7133 Rutherford Road, Baltimore, MD 21244

Enclosures: Figure 1 – Project Vicinity Map

cc: T. Nokovich, P.E. (MAWC)
C. Beenenga, P.E. (GF)
D. Graff (GF)

Gannett Fleming

Excellence Delivered ***As Promised***

<Month Day, Year>

CERTIFIED MAIL NO. <0000 0000 0000 0000 0000>
RETURN RECEIPT REQUESTED

<Executive Officer>, <Position>
<County/Town Government>
<Mailing Address – Line 1>
<Mailing Address – Line 2>

RE: This is a <County/Town Executive Officer> Notification Pursuant to Maryland Annotated Code, Environment Article §5-204 and §5-506.

Permit Applicant Name	Maryland American Water Company
Project Name	Bel Air Impoundment Project
Project Location	Town of Bel Air, Harford County, Maryland
Permit Application File Names	Wetlands & Waterways Tracking No. 201561803/15-NT-0386 and AI No. 150858
	Dam Safety Permit No. 16-OB-0036
	Water Appropriation and Use Permit Application No. HA1976S015/07

Dear <Executive Officer>:

Gannett Fleming, Inc. (GF) on behalf of Maryland American Water Company (MAWC) has submitted applications to Maryland Department of the Environment's (MDE) Wetlands and Waterways Program and Dam Safety Division of the Water Management Administration (WMA) for permits to construct an off-stream raw water storage impoundment to serve the Town of Bel Air (**Figures 1** and **2**). Also, GF on behalf of MAWC submitted a permit application to MDE's Water Supply Program, Source Protection and Appropriation Division, to increase the existing water intake appropriation and withdrawal from Winters Run in order to fill and operate the proposed impoundment.

Project Information

The project name is the Bel Air Impoundment Project and it proposes to construct a drinking water impoundment in an open field (Parcel No. 0048-0004E-0106) along Winters Run. The proposed Bel Air Impoundment (Dam Safety Permit No. 16-OB-0036) will be an off-stream, lined earthen embankment impoundment approximately 2,300 feet long and 58 feet high with a 20-foot wide crest and the capacity to store 360 acre-feet of water (117.3 million gallons). The impoundment will be connected to the existing Winters Run Water Treatment Plant through pipes that will cross beneath the streambed of Winters Run. The existing water intake structure on Winters Run, as well as the existing pump station, will be replaced or upgraded as part of the project. Winters Run will not be impounded as part of this project. No changes to adjacent property owners, downstream owners, or water users are proposed as part of this project.

In order to fill the proposed off-stream drinking water storage impoundment, MAWC has applied for a Permit to Appropriate and Use Waters of the State, which has been assigned permit application number HA1976S015/07. MAWC seeks to increase the existing appropriation from 1,400,000 gallons per day (gpd) on a yearly basis to 1,700,000 gpd on a yearly basis, and increase the existing maximum daily withdrawal from 1,700,000 gpd to 8,400,000 gpd. Water will be withdrawn from Winters Run and used for the community water supply serving the Town of Bel Air. Gannett Fleming, Inc. serves as MAWC's engineering and environmental consultants and is assisting MAWC with the design and permitting of the project.

Notification Information & Points of Contact

In accordance with Maryland Annotated Code, Environmental Article §5-204 and §5-506, we are hereby notifying you, as the <Position> for <County/Town Government>, of the proposed project and permit applications submitted to MDE's Wetlands and Waterways Program and Dam Safety Division of the Water Management Administration, and the Source Protection and Appropriation Davison of the Water Supply Program. MDE will place your name on the "List of Interested Persons" for this project. At a later date, you will be provided a second notice with an opportunity for submitting comments or additional information about the permit applications or request a public informational hearing.

If you wish to review the States' application files, provide comments, or speak with MDE regarding this project, the following MDE contact information is provided below.

Name of Regulator MDE Division & Program	Mailing Address	Phone Number
Tamene Dilnesahu Waterways Construction Division Wetlands and Waterways Program	1800 Washington Blvd. Suite 430 Baltimore, MD 21230	(410) 537-3803
John Roche Dam Safety Division Sediment, Stormwater and Dam Safety Program	1800 Washington Blvd. Suite 440 Baltimore, MD 21230	(410) 537-3552
John Grace Source Protection and Appropriation Division Water Supply Program	1800 Washington Blvd. Baltimore, MD 21230	(410) 537-3590

If you have any questions concerning the permit applications submitted to MDE, you may contact me at (443) 348-2017, extension 8337 or at the address below.

Very truly yours,

Sophia Z. Liskovich, P.E.
GANNETT FLEMING, INC.
Rutherford Plaza Building, Suite 300
7133 Rutherford Road, Baltimore, MD 21244

Enclosures: Figure 1 – USGS Topographic Location Map
Figure 2 – Project Vicinity Map with Adjacent Property Owner Notification Table

cc: T. Nokovich, P.E. (MAWC)
C. Beenenga, P.E. (GF)
D. Graff (GF)

1.4

Public Notice
Billing Approval Form

MARYLAND DEPARTMENT OF THE ENVIRONMENT
WATER MANAGEMENT ADMINISTRATION
NONTIDAL WETLANDS AND WATERWAYS DIVISION
1800 WASHINGTON BLVD., SUITE 430
BALTIMORE, MARYLAND 21230
410-537-3745

PUBLIC NOTICE BILLING APPROVAL FORM

PROJECT NUMBER 16-OB-0036

I agree to pay all expenses associated with the publishing of a public notice for the Nontidal Wetlands and Waterways Application submitted by Maryland American Water (Applicant's Name), which was dated and signed by you on 11·25·15.

RF McIntyre
Applicant/Agent Signature

Robert F. McIntyre
Printed Name of Signee

TRACKING NO. 201561803

Please Print

Billing Address
Maryland American Water
Attn: Robert F. McIntyre
260 Gateway Drive,Suite 17-18B
Bel Air, MD 21014-399

Phone Number 410-838-8404

NOTICE TO APPLICANTS

Certain projects involving nontidal wetlands and waterways permits require that a description of the proposed project be published in a local newspaper. This advertisement is necessary to fulfill legal public notice requirements. Projects that require public notice include, but are not limited to, the following:

- **Certain projects regulated by the U. S. Army Corps of Engineers that require a State Water Quality Certification.**
- **Projects resulting in a loss of more than 5,000 square feet of nontidal wetlands.**
- **Projects in nontidal wetlands of special State concern or wetlands having special plant or wildlife values.**
- **Projects resulting in a loss of more than 1 acre if isolated nontidal wetlands.**
- **Projects affecting waters of the State, including their 100 year frequency floodplain, except roads, bridges, and culverts that meet minimum design standards, temporary construction, minor repairs, or routine maintenance.**

The Water Management Administration will arrange advertisement of the project for you. However, as the applicant for the project, you are responsible for paying the publishing costs. In order for this process of public notice to occur, your approval is necessary prior to publishing. Please complete the form on the other side of this page and return it to the Water Management Administration so that your proposed project may be advertised without delay. Please make sure to sign the form. Processing of your application cannot continue until a signed form is received.

Please call the Nontidal Wetlands and Waterways Division at 410-537-3745 if you have any questions.

Thank you for your assistance in this matter.

PLEASE COMPLETE THE OTHER SIDE OF THIS PAGE

Also, please provide the names and mailing addresses of adjacent property owners. Add additional pages if needed.

See attached tables.

1.5

Site Photographs

Legend

▭ Project Study Area

— Streams

Site Photographs
Photo Location and Orientation Map

Bel Air Impoundment Project

MARYLAND AMERICAN WATER
Town of Bel Air, Harford County, Maryland

Feet
400 200 0 400

Gannett Fleming

N

Source: Aerial imagery basemapping provided by ESRI ArcGIS Online webservices.

Photo 1 (09-29-2015)
View of the agricultural field looking southwest from the approximate reservoir location. New residential construction and the barn are visible in the distance.

Photo 2 (09-29-2015)
View of the agricultural field and reforestation planting area looking east.

Photo 3 (09-29-2015)
View of the agricultural field and approximate reservoir location looking south from the floodplain forest tree line.

Photo 4 (09-29-2015)
View of the agricultural field and floodplain forest tree line looking east from the northwestern most corner of the agricultural field.

Photo 5 (10-19-2015)
View of Winters Run looking downstream from near the proposed floodplain and stream crossing. View is south.

Photo 6 (10-19-2015)
View of the downstream right bank of Winters Run at the approximate location of the proposed outfall structure and water pipeline crossing. View is west.

Photo 7 (10-19-2015)
View of the downstream left bank of Winters Run at the approximate water pipeline crossing. View is east.

Photo 8 (11-02-2015)
View of springhouse located downslope of the reforestation planting area and the wetland complex.

Photo 9 (09-30-2015)
Downstream view from the spring house. The watercourse drains into a palustrine emergent (PEM) wetland complex, then to an unnamed tributary to Winters Run. View is east.

Photo 10 (08-23-2015)
View of improvements to Old Joppa Road near the barn. View is southeast.

Photo 11 (08-23-2015)
View of the driveway and road improvements adjacent to the barn. View is northeast.

Photo 12 (08-23-2015)
View of the agricultural field and proposed project area in the distance. View is north from the driveway in front of the barn.

Photo 10 (08-23-2015)
View of improvements to Old Joppa Road near the barn. View is southeast.

Photo 11 (08-23-2015)
View of the driveway and road improvements adjacent to the barn. View is northeast.

Photo 12 (08-23-2015)
View of the agricultural field and proposed project area in the distance. View is north from the driveway in front of the barn.

1.6

MDE Pre-Application Meeting Request Coordination

MARYLAND DEPARTMENT OF THE ENVIRONMENT
Water Management Administration • Wetlands and Waterways Program
1800 Washington Boulevard • Suite 430 • Baltimore, Maryland 21230
410-537 3745 • 800-633-6101 • www.mde.state.md.us

Pre-Application Meeting Request

*All fields with an asterisk * are required unless noted otherwise.*
Use the SUBMIT by EMAIL button to send your request. READ the sending instructions.
Optionally, save this form, attach it to an email, and return it to: wetlandspreap.mde@maryland.gov.

Project location

*Complete **all** of the following project location fields*

Site Address

If a site address is not available. Be sure to describe the project location in the available field below.

House, lot, or location number	
Street name	
* City	Bel Air
* State	MD
* Zip	21014

http://www. latlong.net

* **Latitude** / * **Longitude**	39° 31' 1.21" N	76° 22' 22.78" W

* **County** Select a county	Harford

* **ADC Map**

No ADC map coordinates required for Garrett, Allegheny, or Somerset counties

Map#	Alpha	Number	Edition
0048	E	0004	

Describe project location
i.e. 200 yards NE of Rte 50 and Tempo Roads

From Bel Air Rd, turn west onto Old Joppa Road, the project site is approximately 0.2 miles from the intersection and is on the right.

Property owner

May be different from Project location address

** At least one telephone*

* **Full name**	Maryland American Water - Robert F. McIntyre, Operations Manager
* Mailing address	260 Gateway Drive, Suite 17-18B
* City, State Zip	Bel Air, MD 21014-399
Telephone Home	N/A
Work	410-838-8404
Cell	443-807-0410
Email	robert.mcintyre@amwater.com

Primary contact

** At least one telephone*

* **Full name**	David H. Graff, Senior Environmental Scientist
Company	Gannett Fleming, Inc.
* Mailing address	207 Senate Avenue
* City, State Zip	Camp Hill, PA 17011
Telephone Work	717-763-7211 x2073
Cell	N/A
Email	dgraff@gfnet.com

Project

* **My project is**
Place an 'x' under one selection

Tidal ☐ NonTidal ☐ Waterway Floodplain ☒ Unsure ☐

Describe your project

MAWC proposes to construct an off-stream raw water storage reservoir to supply the Winters Run Water Treatment Plant during low flow events in Winters Run and continue to serve the Town of Bel Air.

By submitting this form, the property owner grants permission to the representatives of the Maryland Department of the Environment to enter the property during business hours for the purpose of making observations of the proposed project site. If this form is being submitted by the primary contact and not the property owner, the primary contact certifies that he or she is the agent authorized to act on behalf of the property owner and, as the agent, has obtained the property owner's permission for the representatives of the Maryland Department of the Environment to enter the property during business hours for the purpose of making observations of the proposed project site.

Submit by Email | Print Form | Clear Form

Rev: 130918 cmh

Hockenberry, Samantha <shockenberry@gfnet.com>

Pre-Application Meeting Request

1 message

Hockenberry, Samantha <shockenberry@gfnet.com> Wed, Nov 11, 2015 at 12:57 PM
To: wetlandspreap.mde@maryland.gov, David Graff <dgraff@gfnet.com>

Dear MDE Representative,

Please find attached a completed Pre-Application Meeting Request Form.

We are requesting a pre-application meeting to support a Joint Federal and State Permit Application for Marlyland American Water's Bel Air Impoundment Project located in the Town of Bel Air, Harford County, Maryland.

If you have any questions, please feel free to contact me or David Graff (dgraff@gfnet.com). We look forward to your prompt response and working in Maryland.

Thank you,

Samantha
--

Samantha R. Hockenberry, Environmental Scientist
Gannett Fleming, Inc. | 207 Senate Avenue, Camp Hill, PA 17011
t 717.763.7212 x2144 | shockenberry@gfnet.com
Excellence Delivered As Promised
Gannett Fleming is ISO 9001:2008 Certified.
www.**gannettfleming**.com | Stay connected: *Twitter* | *Facebook* | *LinkedIn* | *YouTube*

Pre-App Request Form_MAW Bel Air Imoundment Project.pdf
76K

MARYLAND AMERICAN WATER

Gannett Fleming

INFORMATION PACKET - PRE-APPLICATION & SITE VISIT MEETING

Project Name: Bel Air Impoundment Project

Date: February 19, 2016

Meeting Location: On-Site Visit
Winters Run Water Treatment Plant
Town of Bel Air, Harford County, Maryland

Time: 11:00am to 12:30pm

Attendees:

Rob McIntyre	Maryland American Water (MAW) (Applicant)
Mike Youshock	
Moe Davenport	Harford County Planning & Zoning
Tony McClune	
John Roche	MDE Dam Safety
Lou Parnes	MDE - NTW
Tamene Dilnesahu	MDE Waterways Construction
Greg Golden	MDNR
Steve Elinsky	USACE Regulatory
Sophia Liskovich, P.E. (Assistant Project Manager)	Gannett Fleming, Inc. (GF) (Applicant's Agent)
David Graff (Permit Coordinator)	
Samantha Hockenberry (Environmental Scientist)	

Introductions

This meeting served as the pre-application meeting for the Bel Air Impoundment Project. The attendees gathered outside the MAW Winters Run Water Treatment Plant (WTP) between 11:00am and 11:15am. Introductions were made and meeting materials were distributed by GF. A sign-in sheet was circulated (see Attachment I).

David Graff (GF) began the meeting and guided the discussion of the project background and walk of the project site.

Main Discussion Points of the Meeting

The main purpose of this project is to construct an off-stream raw water storage impoundment to serve the Town of Bel Air. The proposed project requires a raw water intake structure on Winters Run and associated pipeline crossings beneath Winters Run to connect the existing Winters Run WTP to the off-stream impoundment. To accomplish these goals, the impoundment will be constructed in an upland field currently used as agricultural land. The connecting infrastructure between the impoundment and the WTP is located within the floodplain and will be directionally drilled beneath Winters Run. The new raw water intake structure will be located within Winters Run.

The group viewed the location of the existing and proposed raw water intake structure on Winters Run. Greg Golden (MDNR) inquired about the possibility fish passage and if that was considered as part of the proposed project. D. Graff responded that fish passage was not proposed at this time and not part of the project's objectives. MDNR would review the local waterway maps to inquire what the gains would be if fish passage would be made part of the project. It was uncertain at the time of the field visit, how much of Winters Run would be made accessible if fish passage was provided. D. Graff noted the concern and explained that fish passage will be discussed with the project team.

The Corps of Engineers explained that work proposed below the Ordinary High Water Mark (OHWM) requires federal authorization and that if more than 200 linear feet of Winters Run would be impacted, that tribal coordination with the Delaware Tribe and Nation and other native tribes would be required.

Stream stabilization measures along the banks of Winters Run, specifically along the right bank before reaching the Bel Air Road bridge abutment was viewed as a stream bank in-need of stabilization. D. Graff explained that the bank of Winters Run is in a similar condition throughout the reach and that stabilization efforts outside the immediate work area for intake construction were not part of the proposed project. D. Graff noted the concern and explained that the streambank stabilization measures will be discussed with the project team.

Downstream scour was a concern raised by John Roche of Dam Safety and that part of the proposed project should be to address downstream scour pools and scour issues between the existing intake, areas near and immediately downstream of the Bel Air Road bridge crossing of Winters Run. John took this site visit as an opportunity to conduct his yearly inspection of the existing dam and he noted the scour on his inspection log. D. Graff noted the concern and explained that the downstream scour area will be discussed with the project team.

The group reviewed the location of the raw water pumping station. Tamene Dilnesahu, MDE Waterways Construction pointed out that any new structures proposed in the floodplain would need to meet current standards and subject to floodplain regulations. Tamene also explained that his office will issue a letter requiring that additional technical information be provided within 45 days in order to continue the permit review process. If the project is not able to provide the additional technical review information by that time, the project team will have to send him a formal request to him in order to allow for the permit application to be placed on hold for up to one year.

The group reviewed the proposed crossing of Winters Run where the impoundment would be connected to the water treatment plant. D. Graff pointed out the wooden stakes marked with pink flagging that identified the proposed limits of the work area in reference to project drawings. Directional drill and bore pits were discussed and that open trench was not currently considered. The agencies raised a concern of an inadvertent return of slurry as part of the boring efforts and that an in-stream restriction of March 1 thru May 31 would be expected as a permit condition along with a plan to address any inadvertent returns that could escape into Winters Run. A frack-out contingency plan would also have to be submitted and accepted before the permit will be issued.

The agencies raised a concern about the potential discrepancies in discharge temperatures between the impoundment water temperature and Winters Run depending on the seasonal condition of a discharge. Discharge limits of temperature and other parameters would likely follow existing discharge requirements. S. Liskovich pointed out that normal operation of the impoundment would not involve any discharge into Winters Run. Discharge would only occur during emergency conditions where the spillway would be activated

The Natural Resource District (NRD) boundaries were discussed and explained. The NRD boundaries were provided on a map in the handout materials. Agencies confirmed the interpretation of the NRD boundaries as explained by D. Graff and shown on mapping.

Harford County rejected the effort to individually count trees that would be removed as part of the project and required that a Forest Stand Delineation (FSD) be conducted on the entire parcel. Harford County provided guidance to identify specimen trees or those that are 30 inches or greater in diameter. The County requested a minimum of two plots per forest stand and also a narrative description of the forest stand community and stand breaks. The County provided guidance on considering the land use of the parcel and removing developed areas and agricultural areas from the calculations. The County instructed D. Graff to consider the proposed development and proposed land use change. It is anticipated that this effort will result in American Water not needing to plant trees to mitigate for forest loss.

The group visited the footprint area of the proposed impoundment. D. Graff oriented the group according to project mapping and pointed out the orientation to wetlands, structures and geographic alignment to the water treatment plant. The US Army Corps of Engineers inquired about the wetland delineation methods and requested to return to the site later to review runoff coming from the agricultural fields to determine if they constituted ephemeral channels and may be under the jurisdiction of the Corps. D. Graff and S. Hockenberry explained that the runoff from the field was not mapped as part of the wetland and waterways identification and delineation effort since criteria for jurisdictional waterways was not met by these features.

The group adjourned at 12:30.

Action Items

1. Gannett Fleming to conduct a Forest Stand Delineation (FSD).
2. Additional project design details are still pending for inclusion in the permit application.
3. Corps to confirm that field features were not jurisdictional.
4. MDE to investigate fish passage on Winters Run

5. MDE Wasterways Construction to issue a letter requiring additional information within 45-days.

Enclosures

- Attachment I – Sign-in Sheet

MARYLAND AMERICAN WATER

PRE-APPLICATION & SITE VISIT MEETING

Bel Air Impoundment Project
February 19, 2016
On-Site Visit – Winters Run Water Treatment Plant
Town of Bel Air, Harford County, Maryland
11:00 AM

Gannett Fleming

NAME	AGENCY/COMPANY	PHONE	EMAIL
Mike Youshock	MD American Water	804-446-7824	mike.youshock@amwater.com
Dave Graff	Gannett Fleming	717-763-7211	dgraff@gfnet.com
Rob McINTYRE	MD AMERICAN WR	410-838-8404	ROBERT.MCINTYRE@AMWATER.COM
Samantha Hackenberry	GF	717-763-7211	shackenberry@gfnet.com
Sophia Liskovich	Gannett Fleming	443-348-2017	sliskovich@gfnet.com
Moe Davenport	Ha Co. planning & Z	410-638-3232	mdavenport@harfordcountymd.gov
Tony McClune	" " "	"	amcclune@harfordcountymd.gov
JOHN ROCHE	MDE DAM SAFETY	410 537 3552	JOHN.ROCHE@MARYLAND.GOV
Lou Parns	MDE NTW	410-537-3786	Lois.Parns@MARYLAND.GOV
STEVE ELINSKY	USACE	410.962.4503	
TAMENE DILNESHAHU	MDE	410-537-3803	tamene.dilnesahu@maryland.gov
Greg Golden	DNR	410-260-8331	greg.golden@maryland.gov

1.7

Agency Meeting Minutes, Correspondence, and Dam Safety Submission Summary

Gannett Fleming
100 Years of Excellence Delivered **As Promised**

November 30, 2015

Maryland Department of the Environment
Water Management Administration
Regulatory Services Coordination Office
1800 Washington Boulevard, Suite 430
Baltimore, Maryland 21230

**RE: JOINT FEDERAL/STATE APPLICATION
FOR DAM SAFETY AND THE ALTERATION OF ANY FLOODPLAIN, WATERWAY, TIDAL OR NONTIDAL WETLAND IN MARYLAND**
Bel Air Impoundment Project
Town of Bel Air, Harford County, Maryland

Attn: Tamene Dilnesahu

Dear Permit Reviewer:

Gannett Fleming, Inc. (Gannett Fleming) on behalf of Maryland American Water (MAW) is submitting for your review the enclosed Joint Federal/State Application for the Bel Air Impoundment Project as referenced above. This application submittal is for both the dam safety permit as well as floodplain and waterways impacts. A request for a pre-application meeting was submitted to your office electronically on November 11, 2015. We look forward to discussing this project with you and will schedule a meeting at your convenience. Design aspects of the project are in-progress. As additional supporting information is made available, we will furnish those details to your office in order to facilitate your review and supplement the application.

Should you have any questions or require additional information, we welcome an opportunity to discuss the project with you. Please contact me at 717-763-7211 ext. 2073 or via email at dgraff@gfnet.com.

Sincerely,
Gannett Fleming, Inc.

David H. Graff, PWS, SCE, CWB
Senior Environmental Scientist

MDE
NOV 30 2015
1:10 pm

Enclosure: Joint Federal/State Application

Cc: Robert F. McIntyre, MAW
Tony Nokovich, P.E. MAW
Sophia Liskovich, P.E., Gannett Fleming

Gannett Fleming, Inc.
P.O. Box 67100 • Harrisburg, PA 17106-7100 | 207 Senate Avenue • Camp Hill, PA 17011-2316
t: 717.763.7211 • f: 717.763.8150
www.gannettfleming.com

Maryland
Department of
the Environment

Larry Hogan
Governor

Boyd Rutherford
Lieutenant Governor

Ben Grumbles
Secretary

April 4, 2016

Maryland American Water Company
260 Gateway Drive, Suite 17-18B
Bel Air Maryland 21014
Attn: Mr. Robert McIntyre

Re: AI Number: **151858**
Nontidal Wetlands and Waterways Application Number: **201561803/15-NT-0386**
Response Due Date: **May 20, 2016**

Dear **Mr. McIntyre:**

The Maryland Department of the Environment ("MDE" or "the Department") received your Joint Federal/State Application for the Alteration of Any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland ("Application") on **December 2, 2015**. In your Application, you requested authorization to **construct an off –stream raw water storage impoundment to serve the town of Bel Air and surrounding areas in Harford County Maryland. The proposed project requires pipeline crossings on Winters Run and its floodplain to connect the existing raw water intake on Winters Run and the water treatment plant to the proposed impoundment.** This letter is to inform you that MDE has determined that your Application is incomplete. Please find attached an explanation of the additional information necessary to complete your Application.

In order for MDE to provide certainty for the regulated community and meet its published turn-around time for your Application, MDE implemented new application review standards on August 1, 2011. These standards, which are enclosed for your information, impose strict deadlines on both MDE and the applicant in order to keep the application process moving forward. In order to complete your Application, you must submit the additional information requested by the Department by **May 20, 2016.** If the Department does not receive the requested information by the above date or if the information provided is inadequate or insufficient, MDE will deny your Application. The Department would like to help you successfully complete the application review process. If you have any questions or if I can assist you in any way, please do not hesitate to contact me by telephone at (410) 537-3803 or by email at tamene.dilnesahu@maryland.gov Please refer to the above referenced AI Number when corresponding with this office.

Sincerely,

Tamene G. Dilnesahu

Tamene G. Dilnesahu
Regulatory and Compliance Engineer
Waterways Construction Division

Additional Information Needed to Complete Your Application

The Maryland Department of the Environment (MDE), Non-tidal Wetlands and Waterways Division of the Water Management Administration (WMA) has completed its initial review of Joint Federal/State Application for the alteration of any floodplain, waterway, tidal or non-tidal wetland in Maryland, for the above referenced project. At this time, the application is considered incomplete, because additional information concerning the project is required. Please review the following comments and provide the requested information by **May 20, 2016.**

1. Please provide two sets of full-size detailed construction plans for the project. Plans must include Approved Erosion and Sediment Control Plans, stormwater management practices and Best Management Practices for Working in Nontidal Wetlands, Wetland Buffers, Waterways, and 100-Year Floodplains

2. As discussed during the site visit on February 19, 2016 please revise the impacts to the regulated resources and resubmit a revised impact matrix. All impacts to the waterway need to be quantified in linear feet and square feet. Impacts to the floodplain need to be quantified in square feet.

3. Please provide detailed stream crossing methods (please specify if you are using open cut or horizontal directional drilling). If you are proposing to use horizontal directional drill, please submit a frac-out contingency plan for horizontal directional drilling. Also the plan must show the profile of the crossing.

4. The routine environmental screening process has determined that this project may potentially impact to Tier II water. Angel Valdez from MDE Science Services Administration is reviewing this project and we will forward her comment to you as soon as we get it from her. In the mean time if you have any question regarding Tire II water please contact Angel Valdez Science Services Administration Maryland Department of the Environment at **410- 537-3606** or **angel.valdez@maryland.gov**

5. Provide the hydrologic and hydraulic study analysis for the 2, 10, and 100 year storm events for the proposed structure in 100 year nontidal floodplain. The hydrologic and hydraulic study analysis should demonstrate the proposed structure in 100 year nontidal floodplain will not increase flooding to habitable structures, roads, and adjacent properties.

Processing of this application will continue following receipt of a point by point response to these comments. If you have any questions please do not hesitate to contact me by telephone at **(410) 537-3803** or by email at **tamene.dilnesahu@maryland.gov**

Sincerely

Tamene G. Dilnesahu

Tamene G. Dilnesahu
Regulatory and Compliance Engineer
Maryland Department of the Environment
Waterways Construction Division
1800 Washington Boulevard, Suite 430
Baltimore, MD, 21230-1708
E-mail: tamene.dilnesahu@maryland.gov
Phone: (410)-537-3803 Fax: (410)-537-3751

MARYLAND DEPARTMENT OF THE ENVIRONMENT
Water Management Administration • Dam Safety Division
1800 Washington Blvd, Suite 440 • Baltimore, MD 21230-1708
Phone: (410) 537-3538 or 1-800-633-6101 ext.3538 • FAX (410) 537-3553

Larry Hogan
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Secretary

December 11, 2015

Robert F. McIntyre
Maryland American Water Company
260 Gateway Drive, Suite 17-18B
Bel Air, MD 21014-399

File No.: **16-OB-0036**
Agency Interest (AI): **150858**
Tracking Number: **201561803**
Project Description: **Bel Air Impoundment**
Assigned Staff: **John Roche, P.E.**

Dear Mr. McIntyre:

The Department of the Environment, Water Management Administration, Dam Safety Division ("the Department") has received your application for a permit to Construct a new earthen dam adjacent to Winters Run in Bel Air, Maryland. The application has been assigned a file number and staff member as noted above. Should you have questions, please refer to the File Number when responding.

Pursuant to § 5-506, Environment Article, Annotated Code of Maryland, you are required to serve notice of the application to owners of property within 100-year floodplain and contiguous to the parcel on which the dam will be constructed, as well as the downstream property owners affected by the proposed construction. Please submit a copy of the tax map identifying the property owners notified. In addition, you must notify the mayor or chief executive official of each affected City or County. The notice must be sent by certified mail and shall include the location and a description of the project. Attached is a sample letter for your use and a "Certification of Notification" form which must be submitted before your application will be processed. The Department will compile a list of interested persons including those on the "Certification of Notification".

After the application is considered complete in accordance with Code of Maryland Regulations ("COMAR") 26.17.04.13D (1) and (2), the Department shall prepare a notice of completed application that will include your name and address, a description of your project and instructions on how persons may submit comments on your project and how they may request a public informational hearing. This notice will be mailed to the individuals on the interested persons list and will be published for one day in a newspaper of general circulation in your area. You will be billed by the Department for the cost of publication in the local newspaper. Please complete and submit the enclosed "Public Notice Billing Approval Form."

In accordance with COMAR 26.17.04.05, the plans must be prepared by a professional engineer, registered in the State of Maryland, and experienced in dam design and construction. The applicant is also required to hire a professional engineer, referred to as the Engineer-In-Charge, to supervise the construction in order to assure that the dam is built according to the approved plans and the design assumptions. It is strongly recommended that the design engineer or a qualified member of the design team be retained to supervise the construction. Please have your engineer complete and submit the enclosed affidavit attesting to their qualifications in design and/or construction supervision.

You or your engineer must also prepare a maintenance plan describing the steps to be followed for the continued maintenance of the dam and reservoir during the expected life of the structure. This plan shall describe what work is to be called for at periodic intervals or when necessary to keep the structure in good condition. Among other items it shall address mowing or cutting of brushy growth on the embankment, preventing erosion or gullying of embankment surfaces, clearing of toe drains, removing accumulated trash and debris, protecting against rust and spalling, and exercising valves or other mechanical equipment. The description of this program shall be submitted to the Department for approval and will be included as a condition of the construction permit.

For dams classified as High or Significant Hazard, you or your engineer must also submit an Emergency Action Plan ("EAP"), for evacuation of downstream residents and road closures downstream of the dam which would be inundated should the dam fail.

Attached you will find a "Memorandum of Land Restrictions" that will alert potential subsequent owners of the dam and the future legal and maintenance responsibilities associated with the dam. Please complete the first page, sign the memorandum and submit a check, payable to the Clerk of the Court for Harford County to cover the land recordation fees. Please contact the Clerk of the Court for the fee amount. The Department will record the document. The completed document and the recording fee must be received prior to issuance of a permit.

You will also be required to post a construction bond, irrevocable letter of credit, or other security acceptable to the Department to assure that funds are available to complete the construction of the proposed project and for continued maintenance of the project throughout the life of the structure.

A decision will be made on your application after the Department has received all the necessary supporting information and after the public informational hearing, if requested, has been held. A reproducible set of the construction plans ("mylars") must be submitted for approval prior to the issuance of the permit. Five copies of the final approved construction plans and specifications must be submitted. You and your engineer each will receive a copy of the approved plans with an original/copy of the permit.

For your information, a permit-processing outline is enclosed. If you have any questions or require any additional information, please contact John Roche, P.E. of the Dam Safety Division at (410) 537-3552, email John.Roche@maryland.gov, or call me at (410) 537-3538.

Sincerely,

HaroldW. V-all

Hal Van Aller, P.E., Chief
Dam Safety Division

Enclosures

cc: David Graff, Gannett Fleming, Inc. w/enclosures
John Roche, P.E. w/enclosures
Tamene Dilnesahu, MDE Wetlands and Waterways

Gannett Fleming

Excellence Delivered ***As Promised***

Rutherford Plaza
7133 Rutherford Road, Suite 300
Baltimore, MD 21244

Office: (443) 348-2017
Fax: (410) 298-3940

May 17, 2016

Maryland Department of the Environment
1800 Washington Blvd.
Suite 430
Baltimore MD 21230
Attention: Tamene Dilnesahu
Regulatory Compliance Engineer

RE: AI Number: **151858**
Nontidal Wetlands and Waterways Application Number: **201561803/15-NT-0386**
Bel Air Impoundment Project

Dear Mr. Dilnesahu,

This letter is in response to the MDE letter dated April 4, 2016. The Joint Permit Application (JPA) for the Bel Air Impoundment Project was submitted in November 2015, due to a permit application submission date dictated by a consent decree. The design for this project is currently at the 50% completion mark and therefore, the missing JPA information is not yet available. Due to these circumstances, Gannett Fleming, on behalf of Maryland American Water, requests that MDE leave the application **201561803/15-NT-0386** open for a year to enable the completed JPA package to be submitted for review.

If you have any questions or need additional information, please feel free to contact me at sliskovich@gfnet.com or 443-348-2017.

Sincerely,

Sophia Liskovich, PE
Gannett Fleming Inc.

CC: Mr. Tony Nokovich, American Water
Mr. David Graff, Gannett Fleming, Inc.

From: David Graff
Sent: Wednesday, December 09, 2015 3:30 PM
To: 'steve.elinksy@usace.army.mil'
Cc: Sophia Liskovich; Dennis Funk; Cari Beenenga
Subject: Bel Air Impoundment Project

Steve,

Thank you for calling this morning. We look forward to working with you on this project.

At this time we would like to request a temporary suspension of the Corps' review of the permit application until we can provide the final design elements. I will contact you again when we are ready to provide additional details which should be within a few weeks. My understanding is that our review clock will be stopped and will start again when we submit the additional items.

Thanks,

Dave

David H. Graff| Project Manager | Sr. Environmental Scientist

Gannett Fleming, Inc. | 207 Senate Avenue, Camp Hill, PA 17011

t 717.763.7212, extension 2073 | **c** 717.342.1418 | dgraff@gfnet.com

---

From:	Liskovich, Sophia Z.
Sent:	Thursday, July 28, 2016 10:44 AM
To:	Graff, David H.
Cc:	Hockenberry, Samantha
Subject:	FW: Maryland America Water Bel Air Impoundment and Intake Project

For your information.

Cal me if you want to discuss.

Sophia Liskovich, PE
Gannett Fleming, Inc.
T: 443-348-2017 ex. 8337

-----Original Message-----
From: Elinsky, Stephen M (Steve) NAB [mailto:Steve.Elinsky@usace.army.mil]
Sent: Thursday, July 28, 2016 8:58 AM
To: Liskovich, Sophia Z. <sliskovich@GFNET.com>
Subject: RE: Maryland America Water Bel Air Impoundment and Intake Project

Good morning Sophia,

Other than the modified plans, no further action is necessary. Once I have received them along with your request to reactivate the Corps review, I'll get going with the authorization. Please remember that the current general permit will expire at the end of September and that the authorization for any project that is not under contract or construction will also expire. To get around this, please request the reactivation of the Corps review on or after October 1st so it can be authorized under the new general permit. That authorization would be viable for a period of 5 years.

Have a good day.

-Steve

Steve Elinsky
Biologist
U.S. Army Corps of Engineers - Baltimore District Regulatory Branch - Maryland Section Northern

410.962.4503 (Desk)
410.935.3614 (Cell)

-----Original Message-----
From: Liskovich, Sophia Z. [mailto:sliskovich@GFNET.com]
Sent: Tuesday, July 26, 2016 3:03 PM
To: Elinsky, Stephen M (Steve) NAB <Steve.Elinsky@usace.army.mil>
Subject: [EXTERNAL] RE: Maryland America Water Bel Air Impoundment and Intake Project

Hello Steve,

I apologize for the delay in getting back to you. Yes, thankfully we were able to greatly reduce all impacts to the waters. Do we need some sort of letter from you stating that there are no impacts to phase 1A (therefore that can move forward)? We are currently putting together the official permit modification request with the appropriate drawings, revised impacts, and the impact plates for phase 1A as well as phase 1B. We are looking to have that submitted in early August.

If there is a specific GP form that we have to complete after October 1st, would you be able to send me a copy?

Thank you for all of your assistance,
Sophia

Sophia Liskovich, PE
Gannett Fleming, Inc.
T: 443-348-2017 ex. 8337

-----Original Message-----
From: Elinsky, Stephen M (Steve) NAB [mailto:Steve.Elinsky@usace.army.mil]
Sent: Monday, July 25, 2016 7:55 AM
To: Liskovich, Sophia Z. <sliskovich@GFNET.com>
Subject: RE: Maryland America Water Bel Air Impoundment and Intake Project

Good Morning Sophia,

Wow, the proposed impacts are low. Nice job with the avoidance and minimization. The project qualifies for authorization under Category A of the current general permit as it would with the next one. As I indicated, the current GP expires on September 30th. Since Phase 1A has no impacts perhaps the permitting required for Phase 1B could wait until after October 1st.

Please let me know what you think.

Thanks,

Steve Elinsky
Biologist
U.S. Army Corps of Engineers - Baltimore District Regulatory Branch - Maryland Section Northern

410.962.4503 (Desk)
410.935.3614 (Cell)

-----Original Message-----
From: Liskovich, Sophia Z. [mailto:sliskovich@GFNET.com]
Sent: Friday, July 22, 2016 10:42 AM
To: Elinsky, Stephen M (Steve) NAB <Steve.Elinsky@usace.army.mil>
Subject: [EXTERNAL] RE: Maryland America Water Bel Air Impoundment and Intake Project

Hello Steve,

Our revised stream impact numbers are: 2,800 sq. ft and 97 linear feet of disturbed area. It seems as though we are way under the 5,000 sq. ft and 200' lf criteria. Please let me know the best way to move this forward with the Corps.

Thank you

Sophia Liskovich, PE
Gannett Fleming, Inc.
T: 443-348-2017 ex. 8337

-----Original Message-----
From: Elinsky, Stephen M (Steve) NAB [mailto:Steve.Elinsky@usace.army.mil]
Sent: Thursday, July 21, 2016 3:22 PM
To: Liskovich, Sophia Z. <sliskovich@GFNET.com>
Subject: RE: Maryland America Water Bel Air Impoundment and Intake Project

Sophia,

Please don't forget to re-quantify the new impact numbers.

Have a good night.

-Steve

Steve Elinsky
Biologist
U.S. Army Corps of Engineers - Baltimore District Regulatory Branch - Maryland Section Northern

410.962.4503 (Desk)
410.935.3614 (Cell)

-----Original Message-----
From: Liskovich, Sophia Z. [mailto:sliskovich@GFNET.com]
Sent: Tuesday, July 12, 2016 3:29 PM
To: Elinsky, Stephen M (Steve) NAB <Steve.Elinsky@usace.army.mil>
Subject: [EXTERNAL] RE: Maryland America Water Bel Air Impoundment and Intake Project

Hello Steve,

Thank you for your voicemail. The previous email can be found below.

A JPA application was actually submitted back in November 2015. I have attached the application portion showing the impacts. These have to be updated but should give you a good idea of the impacts (for example we have reduced the permanent stream impact).

If you have any questions or would like additional information please let me know. Thank you for your help.

Sophia Liskovich, PE

Gannett Fleming, Inc.

T: 443-348-2017 ex. 8337

From: Liskovich, Sophia Z.
Sent: Monday, July 11, 2016 12:36 PM
To: Elinsky, Steve NAB <steve.elinsky@usace.army.mil>
Subject: Maryland America Water Bel Air Impoundment and Intake Project

Hello Steve,

I wanted to follow up on the email Tamene Dilnesahu from MDE sent and copied you on July 5th which I have also attached to this email. The project team for the Bel Air Impoundment and Intake project spoke to Tamene about the potential for splitting of the contract. In the consent decree between American water and MDE, the complete project has to be completed and the impoundment able to take water within 18 months of all permits received. Because of the much greater environmental impacts in the proposed phase 1 B (see attached) which involves the actual stream intake, and pump station and control building within the floodplain and the longer construction duration required for the impoundment itself, the team was exploring the possibility to permit the project in two phases as to give a "head start" to the impoundment project construction. In additional to the additional permitting iterations that may be required for phase 1B, the current state of the design of the impoundment, phase 1A) is ahead of the aspects in phase 1B.

As you can see from the attached email, Tamene has agreed to splitting up the permit as long as the total project stays below the public notice impact number. Because MDE is only half of the permission needed regarding the JPA, I wanted to reach out to you to determine if the Corps of Engineers would be open to permitting this project as a phase 1 and phase 2.

Please let me know your thoughts. Feel free to give me a call to discuss if that would be more helpful. In addition, I currently have a 70% drawings set for the impoundment and 60% set for the intake, pump station, and control building. If you would be interested in seeing the current state of design I would be more than happy to share that with you (either electronically or hard copy).

Thank you very much,

Sophia Liskovich, PE

Gannett Fleming, Inc.
T: 443-348-2017 ex. 8337

MARYLAND AMERICAN WATER COMPANY
BEL AIR IMPOUNDMENT AND WINTERS RUNS INTAKE PROJECT
TOWN OF BEL AIR, HARFORD COUNTY, MARYLAND

Summary of Reports and Documents Submitted to MDE Dam Safety

	Report/Title Description	Date Submitted
1	Preliminary Dam Design Summary	November 2015
2	Dam Breach Analysis	April 2016
3	Proof of Dam Safety Adjacent Property Owner Notification	April 19, 2016
4	70% Dam Safety and Design Report	July 8, 2016
5	Detail of Toe Drain (for review/approval)	July 14, 2016

Chapter 2

2.1 Dam Design Criteria Technical Memorandum

2.2 Project Plans – Phase IA

2.3 Project Plans – Phase IB

2.4 Frac-Out Plan – Phase IB

2.5 Floodplain Analysis

2.1

Dam Design Criteria Technical Memorandum

PRELIMINARY DAM DESIGN SUMMARY

FOR THE

BEL AIR WATER SUPPLY SYSTEM

Prepared for

MARYLAND AMERICAN WATER COMPANY

Contract Task Order No. MD-15-GF-3

Prepared by

Gannett Fleming

HARRISBURG, PENNSYLVANIA

GF Project No. 059267

NOVEMBER 2015

1.0 Background and Objectives

Gannett Fleming was authorized by Maryland American Water Company to evaluate an off-stream storage impoundment along Winters Run to serve as an emergency water supply for the existing water system serving the Town of Bel Air, Maryland. This concept will ensure a reliable source of raw water for the system during periods of drought.

The Bel Air water system serves primarily the town of Bel Air in Harford County, Maryland. The system is operated by the Maryland American Water Company (MAWC). The water system consists of the Winters Run Water Treatment Plant (WTP) that primarily treats raw water from Winters Run. Two existing groundwater wells, the Winters Run Well and the Bynum Well, also provide raw water to the distribution system.

In addition to the raw water supply, the Bel Air system has a finished water supply available from the Harford County water system. MAWC constructed a metered connection to the County system on MacPhail Road and has purchased a supply capacity for up to 0.5 MGD. The County bills the Town for the actual water used at a bulk water rate. This supply is used to supplement the supply from the WTP and the wells.

The primary water supply for the system is Winters Run, which is currently permitted for a 1.4 MGD annual average withdrawal and a 1.7 MGD maximum daily withdrawal. The current withdrawal permit also includes a restriction that only allows MAWC to withdraw from the stream if the passing flow is 6.07 MGD or greater. Thus, during periods of low stream flow, the primary raw water supply to the system is either restricted or unavailable.

During such periods, the Bel Air system has historically relied on the wells and the Harford County supply to meet the system demand. This has required more than the contractual 0.5 MGD of supply from the County. With recent changes in water supply planning for the region, Harford County has identified long-term water supply shortfalls, and so the availability of surplus County water in excess of the contracted supply is no longer a reliable supply option for the Bel Air system.

To address these concerns, MAWC is constructing an off-stream raw water storage impoundment which will provide a reliable raw water supply source when water from Winters Run, the wells, and the County is not sufficient to meet demand. The objective of this memorandum is to summarize the preliminary dam embankment and spillway designs. The design information included in this document is preliminary and will be subject to revision and refinement in subsequent design phases.

2.0 Summary of Proposed Design

The proposed impoundment will be located on a parcel of land immediately upstream of the Winters Run Water Treatment Plant. The site is adjacent to the Winters Run stream east of the Bel Air Bypass. The proposed pump-storage impoundment will allow raw water to be pumped from Winters Run during high flows, and stored in the impoundment until needed during low flow, drought, or other emergency events. The groundcover at the site consists mostly of farmland. The site also has some environmental features along the eastern portion of the property including a reforestation zone. The proposed impoundment at this site is located such that it will not impact these features, but the discharge channel and supply piping may impact approximately 0.1 acres of the 2.67 acre reforestation area. We will work with regulating authorities to identify an alternate reforestation area on the property to account for these limited impacts.

There are four main components of the proposed pump-storage facility: 1) the impoundment embankment, 2) the control tower, 3) the raw water transmission pipeline and 4) the Winters Run intake structure and pumping station. The raw water from Winters Run will enter the intake structure and be pumped into the raw water transmission pipeline, which will discharge into the impoundment through the control tower. The control tower will also include intake portals for releasing water back into the raw water pipeline to the water treatment plant during periods of withdrawal. A plan of the proposed impoundment and its appurtenant features is included as Attachment A. A rendering of the impoundment is included as Attachment B.

Per Maryland Dam Safety guidance on hazard classification of state regulated dams, it is anticipated that the impoundment will be either a High Hazard or Significant Hazard Potential structure. A breach analysis will be performed to determine the appropriate hazard classification of the structure.

2.1 Impoundment Storage

In order to simulate daily operation of an off-line impoundment at Bel Air over an extensive period of record, a custom computer model of the impoundment and supply system was programmed using Microsoft Visual Basic Express software. The purpose of this model was to simulate the operation of the proposed impoundment and supply system for an extended period of record to estimate water availability during drought events under proposed conditions. The model was used to estimate the required storage volume, establish appropriate flowby and withdrawal constraints, and evaluate impacts of withdrawals on the downstream users and ecosystem.

Pending MDE approval of the recommended water appropriation and flowby requirements, the total storage of the proposed impoundment will be equal to 90 million gallons (276 acre-feet). This includes a 10 percent dead storage volume for the purpose of maintaining aquatic habitat within the impoundment during extreme droughts and an additional 2 percent sediment storage volume. It also assumes that during the drought of record, the water system intake would be able to capture 67 percent of allowable withdrawals from Winters Run when flows in the stream intermittently spike above the permitted flowby requirement. A breakdown of the impoundment storage is provided in Table 1.

Table 1. Breakdown of Impoundment Storage

	Type of Storage	Volume (MG)	Percent of Total (%)
USABLE	Minimum Storage Required to Meet Demand[1]	70.0	77.8%
	Additional Storage Required Assuming 67% Capture Efficiency[2]	9.2	10.2%
UNUSABLE	Dead Storage to Maintain Aquatic Habitat and Water Quality	9.0	10.0%
	Sediment Storage	1.8	2.0%
	TOTAL STORAGE	**90.0 MG**	**100.0%**

[1] *This is the minimum volume required to meet demand during the drought of record as estimated by an 88-year computer model simulation of the Bel Air raw water supply system.*

[2] *During the drought of record, the model simulation indicates that a total of 27.7 MG was withdrawn from Winters Run to meet demands or partially refill the impoundment. To account for operational inefficiencies and uncertainties, only 67 percent (or 18.5 MG) of this water was assumed to be successfully withdrawn from Winters Run and the required storage was increased accordingly.*

2.2 Embankment Design

As shown on Attachment A, the impoundment is cut into the hillside with depths of excavation ranging between 20 feet and 30 feet. The embankment will be constructed of on-site soils, and the excavation and fill quantities will be balanced such that there will be no need to spoil material. Based on the current geotechnical investigations, the embankment and impoundment bottom will require a liner system to control seepage. It is anticipated that the liner system will be exposed on the upstream slope of the embankment. Anchoring of the liner system to the upstream slope and drainage beneath the liner will be included in the design as appropriate. Table 2 summarizes the preliminary design of the embankment.

Table 2. Embankment Design Summary

Parameter	Value
Maximum Height of Dam	51 feet
Length of Embankment	2,300 feet
Crest Width	20 feet
Upstream Slope	2.5H:1V
Downstream Slope	3H:1V
Top of Dam Elevation	259.0 feet (NAVD 88)
Normal Pool Elevation	256.0 feet (NAVD 88)
Normal Pool Storage	90 million gallons
Volume of Excavation	225,000 cubic yards
Volume of Fill	225,000 cubic yards

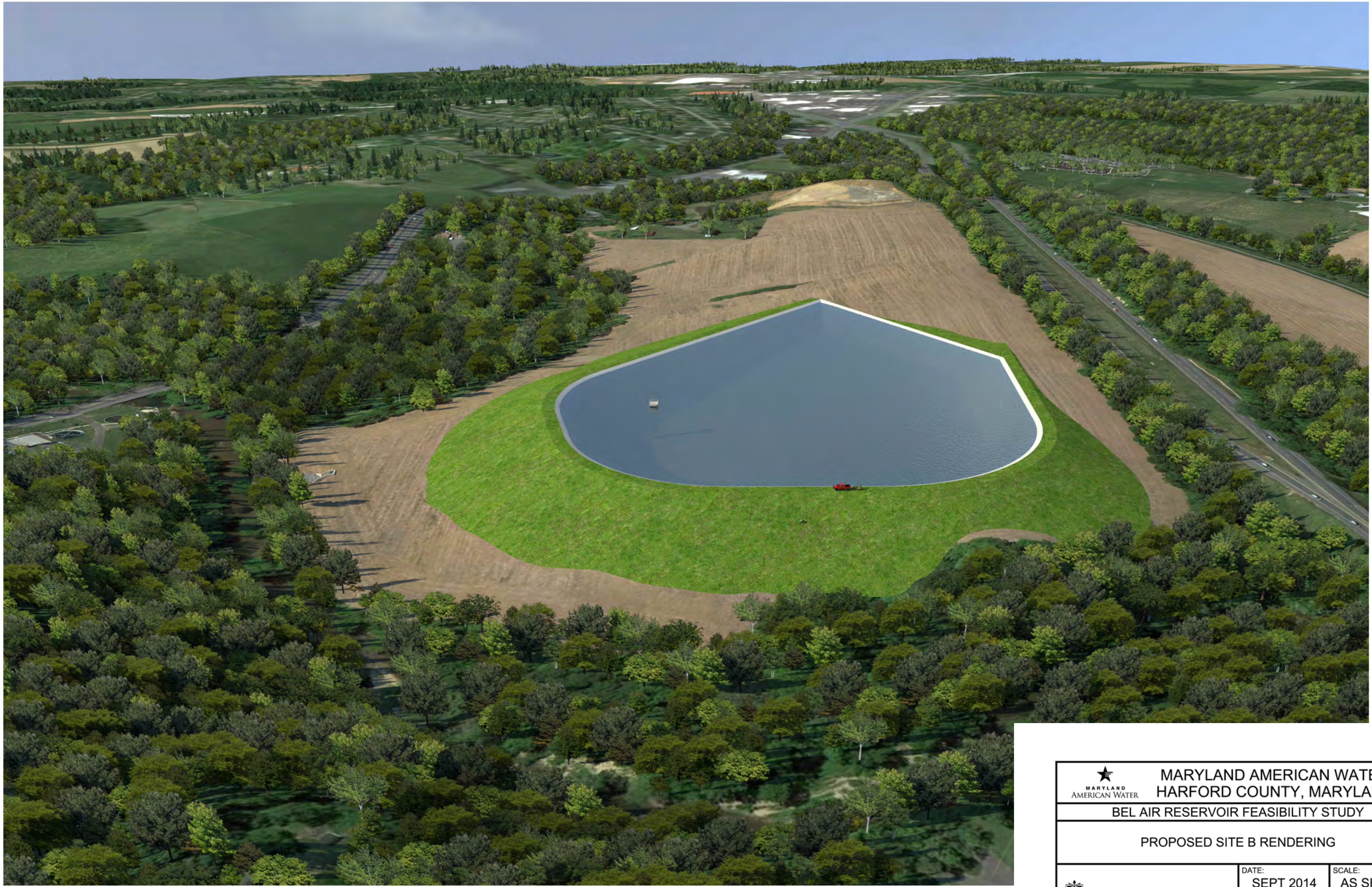
2.3 Control Tower Design

The control tower will most likely be a free-standing reinforced concrete riser structure approximately 50 feet high with an operating platform and multiple interior chambers. The riser will provide the ability to both fill and withdraw water from the impoundment. The riser will also serve as an auxiliary spillway with a weir opening to discharge excess water. Although the impoundment does not have any contributing drainage area, this spillway serves as a safeguard against overtopping due to extreme precipitation events centered over the impoundment or accidentally over-filling the impoundment. The spillway crest will be higher than the normal pool elevation and will activate during events larger than the 24-hour, 100-year precipitation event, thus restricting discharge from the impoundment to Winters Run except during extreme events. The spillway will be sized to pass the Probable Maximum Precipitation with one foot of freeboard.

The raw water transmission pipelines and outlet pipe will be supported on a concrete cradle and run parallel through the dam embankment. At the toe of the dam embankment, the raw water transmission pipes will divert away from the outlet pipe towards the pumping station and water treatment plant. The outlet pipe will exit into a standard reinforced concrete impact basin located near the toe of the dam embankment, where an excavated channel lined with riprap will connect the impact basin to the stream.

ATTACHMENT B

Rendering of Proposed Impoundment



MARYLAND AMERICAN WATER
HARFORD COUNTY, MARYLAND

BEL AIR RESERVOIR FEASIBILITY STUDY

PROPOSED SITE B RENDERING

Gannett Fleming

DATE: SEPT 2014

SCALE: AS SHOWN

EXHIBIT 5

S:\DIV-4\059267 - MAWC Reservoir Study\05 Working\CADD\Design Set\Sections.dwg
Plot Date: 9/23/2014 4:30 PM, Plotted By: Hoover, Chad T.

2.4

Frac-Out Plan – Phase IB

HORIZONTAL DIRECTIONAL DRILLING CONTINGENCY PLAN

If a release of bentonite is detected, call Rob McIntyre immediately at (410) 838-8404

1.0 INTRODUCTION

Maryland American Water Company (MAWC) is proposing to construct a 16 inch raw water transmission pipeline from its existing water treatment plant (WTP) site to a proposed 90 million gallon raw water storage impoundment. The existing WTP is situated on the east side of Winters Run on Bel Air Road in Bel Air, Harford County, Maryland. The proposed impoundment will be situated on the west side of Winters Run just west of the existing WTP site. The Winters Run crossing will be accomplished using horizontal directional drilling (HDD) methods and materials.

The purpose of this document is to provide guidance in order to eliminate or minimize any adverse effects from directional drilling fluid seepage or drill failure.

2.0 ROLES & RESPONSIBILITIES

The following is a general delineation of the roles and responsibilities of representatives of MAWC and the HDD Contractor:

- MAWC shall only use a firm who specializes in HDD to perform the proposed stream and wetland crossing.
- MAWC is responsible for the supervision of the drilling contractor and retains the right to shut down operations.
- MAWC will assign a Resident Project Representative (RPR) and a Project Manager (PM) who will act on behalf of MAWC for the project.
- The HDD Contractor will assign a Project Supervisor (PS) who will be responsible for on-site visual monitoring of the construction area during construction operations.
- The PS shall walk the construction area at least every four hours during drilling operations, where access is permissible, to visually monitor for inadvertent releases.
- HDD Drilling Crew
- If a loss of circulation is detected, the PS shall immediately notify MAWC’s Resident Project Representative (RPR) and Project Manager (PM).
- PS shall perform visual inspections of the construction area until the pressure of the drilling fluid has stabilized and the PS has confirmed that surface seepage has not resulted.

2.1 PRELIMINARY PREPARATIONS

Prior to the start of drilling operations, the HDD Contractor will do the following:

- Install sediment barriers (straw bales and silt fences) between the bore pits and nearby sensitive resources to prevent released material at the bore pits from reaching the resource.
- Conduct on-site briefings with all field personnel to identify and locate sensitive resources at the site.
- Brief all field employees on proper protocol for notification in the event a frac-out occurs.

2.2 FRAC-OUT DETECTION

The most obvious signs of a frac-out are surface seepage or loss of circulation/pressure of the drilling fluid. One of the functions of the drilling fluid is to seal the hole to maintain the downhole pressure. The loss of the returning fluid is a sign that pressure is not being contained in the drill hole and surface seepage is occurring outside the hole. Providing adequate boring depth for the installation commonly reduces this potential. In some cases, drilling fluid seepages can be caused by pre-existing fractures or porous layers in the geological strata, even if the down hole pressures are low.

If there is a reduction in the quantity of drilling fluid returning to the drilling site (i.e., loss of circulation), this could be a warning sign. However, some loss of drilling fluid is also normal in the drilling process. There can be instances during the drilling process when a small layer of loose sand, a small gravel layer or a small rock fracture is encountered. These occurrences will require minimal, additional drilling fluids to fill in the voids. Consequently, a small drilling fluid loss in and of itself is not an indication of a potential frac-out condition. It is the loss of drilling fluid in combination with other factors, which may indicate a potential frac-out condition. For example, if there is a loss of drilling fluid and the return of cuttings do not show a large quantity of gravel that could indicate a loss of containment pressure within the hole.

Early detection and prevention will be the key elements in implementing this plan successfully. The HDD crew will monitor the drill rig’s on board gauges at all times. Drill rates and pump pressures will be monitored and controlled within acceptable parameters to ensure that drilling mud is ultimately controlled within HDD standards. The crew will also make multiple visual inspections along the bore path each day looking for early signs of frac-outs or drilling fluid loss on the surface.

2.3 GENERAL PROCEDURES FOR DRILLING

Drill rates and pull speeds will be controlled at all times to allow for pressure equalization within the bore during drilling and pull back. This will allow the drill mud to stay within the bore itself without being pushed into the surrounding soil, wetlands and/or water. By controlling drilling operations in all phases from drilling through final pipe installation, frac-outs should also be controlled.

2.4 General Corrective Action

In the event that a frac-out is detected, drilling operations will be immediately stopped and the drilling crew will take immediate corrective action to stop the loss of fluids, as follows:

<u>If the frac-out is terrestrial</u>:

1. Isolate the area with hay bales, sand bags, silt fence and/or a vent hole*.
2. Mobilize a vacuum trailer to the frac-out location to remove any drilling fluid lost on the surface.
3. Once the fluid has been safely contained and/or cleaned up, drilling operations can continue.
4. If the frac-out continues, isolate and excavate a vent hole* at the frac-out location and continue to remove fluid with the vacuum trailer.
5. When drilling operations are complete, the area of the disturbance can be restored with seed and straw.
6. Documentation of corrective measure must be made and maintained by the contractor and provided to MAWC.
7. The Contractor must follow any special instructions from MAWC’s Resident Project Representative (RPR).

   ∗ A vent hole is viable option for controlling fluid loss in some situations. A vent hole is a small excavation either on the drill string itself or at the spot of the frac-out. The Vacuum trailer can then be used to remove the fluid from the vent hole.

<u>If the frac-out is aquatic (under water)</u>:

1. Monitor the frac-out to determine if the drilling fluid congeals. (Bentonite will usually harden, effectively sealing the frac-out location)
2. If the drilling fluid congeals, take no further action that would potentially suspend sediments in the water column.
3. If the frac-out continues, deploy a boom to contain the frac-out and prevent sediment suspension in the surrounding water column until the Bentonite can congeal.
4. Documentation of corrective measure must be made and maintained by the contractor and provided to MAWC.
5. The Contractor must follow any special instructions from MAWC’s Resident Project Representative (RPR).

2.5 Response and Reporting Personnel

If a release of bentonite is detected, the drilling contractor will immediately notify MAWC's RPR. The RPR has been given "stop work authority" by MAWC and his/her instructions must be followed. The RPR will immediately notify Rob McIntyre, MAWC Project Manager who will be responsible for notifying the Maryland Department of the Environment at (410) 537-3000 and U.S. Army Corps of Engineers, as may be necessary for compliance with the Section 401 Non-Tidal Wetlands and Waterways and Section 404 authorizations.

2.6 Response Equipment

The drilling contractor will be responsible for having all response materials and equipment required for containment/remediation during a frac-out on site at all times during the drilling process. Such materials will include at a minimum:

- Vacuum trailer
- Silt fence
- Straw bales
- Sand Bags
- Hand excavation equipment
- Vacuum excavation equipment (vacmasters system 4000)
- Trash pumps
- Silt bags
- Boom

2.7 Follow-Up

After the frac-out has been contained, the drilling contractor will make every effort to determine why it occurred. Once the cause of the frac-out has been determined, measures will be developed to control the factors causing it and to minimize the chance of recurrence. Developing the corrective measure will be the responsibility of the drilling contractor.

2.5

Floodplain Analysis

FLOODPLAIN IMPACT ANALYSIS

FOR THE

BEL AIR WATER SUPPLY SYSTEM

Prepared for

MARYLAND AMERICAN WATER COMPANY

Prepared by

Gannett Fleming

HARRISBURG, PENNSYLVANIA

GF Project No. 059267

AUGUST 2016

1.0 Background and Objectives

The Bel Air water system serves the town of Bel Air in Harford County, Maryland. The system consists of the Winters Run Water Treatment Plant that treats raw water from Winters Run and other sources. It is operated by the Maryland American Water Company (MAWC).

Gannett Fleming was authorized by MAWC to design an off-stream storage impoundment along Winters Run to serve as an emergency water supply for the existing water system serving the Town of Bel Air, Maryland. This impoundment will ensure a reliable source of raw water for the system during periods of drought.

The new impoundment will include multiple appurtenances which are located within the existing regulatory floodway (See Attachment A). New features associated with the impoundment that encroach on the floodway include a plunge pool and discharge channel, water intake, and multiple concrete vaults to house meters, pumps, and other equipment that are used in the transfer of water from the impoundment to the water treatment plant. A hydraulic analysis of the floodplain at Winters Run was performed to determine if these encroachments would increase the base flood elevations and extents on Winters Run as defined by the effective Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS). The purpose of this memorandum is to summarize the findings this analysis.

2.0 Effective Flood Insurance Study

In April 2016, a FEMA FIS was published delineating the 100-year floodplain and floodway for the Town of Bel Air. Figure 1 shows an excerpt from the FEMA Flood Insurance Rate Map (FIRM) for Winters Run in the vicinity of the proposed impoundment and associated water treatment plant additions. In the effective FEMA study, base flood elevations were determined using the U.S. Army Corps of Engineers' River Analysis System (HEC-RAS v4.1) software. A copy of the effective HEC-RAS model was obtained from FEMA as part of this effort.

The proposed project is located adjacent to a reach in which FEMA established base flood elevations through detailed study. The FEMA study includes hydrologic and hydraulic analyses and mapping of the floodplain and floodway. In accordance with FEMA regulations and Harford County ordinances, any encroachment within the floodway cannot cause an increase in base flood elevation of 0.01 feet or greater. For encroachments within the floodplain (Zone AE) outside of the floodway, FEMA allows an increase in the base flood elevation of up to 1.0 feet.

As shown in Attachment A, new features associated with the impoundment that encroach on the floodway are the plunge pool and discharge channel located between the spillway conduit outlet and Winters Run near the downstream toe of the impoundment; a new raw water intake located upstream of the existing low-head diversion dam across Winters Run; a recycle meter vault; a raw water pump station vault; and an impoundment supply meter vault. All of these features will be constructed within the regulatory floodway and are, therefore, subject to the "no rise" in water surface elevation requirement.

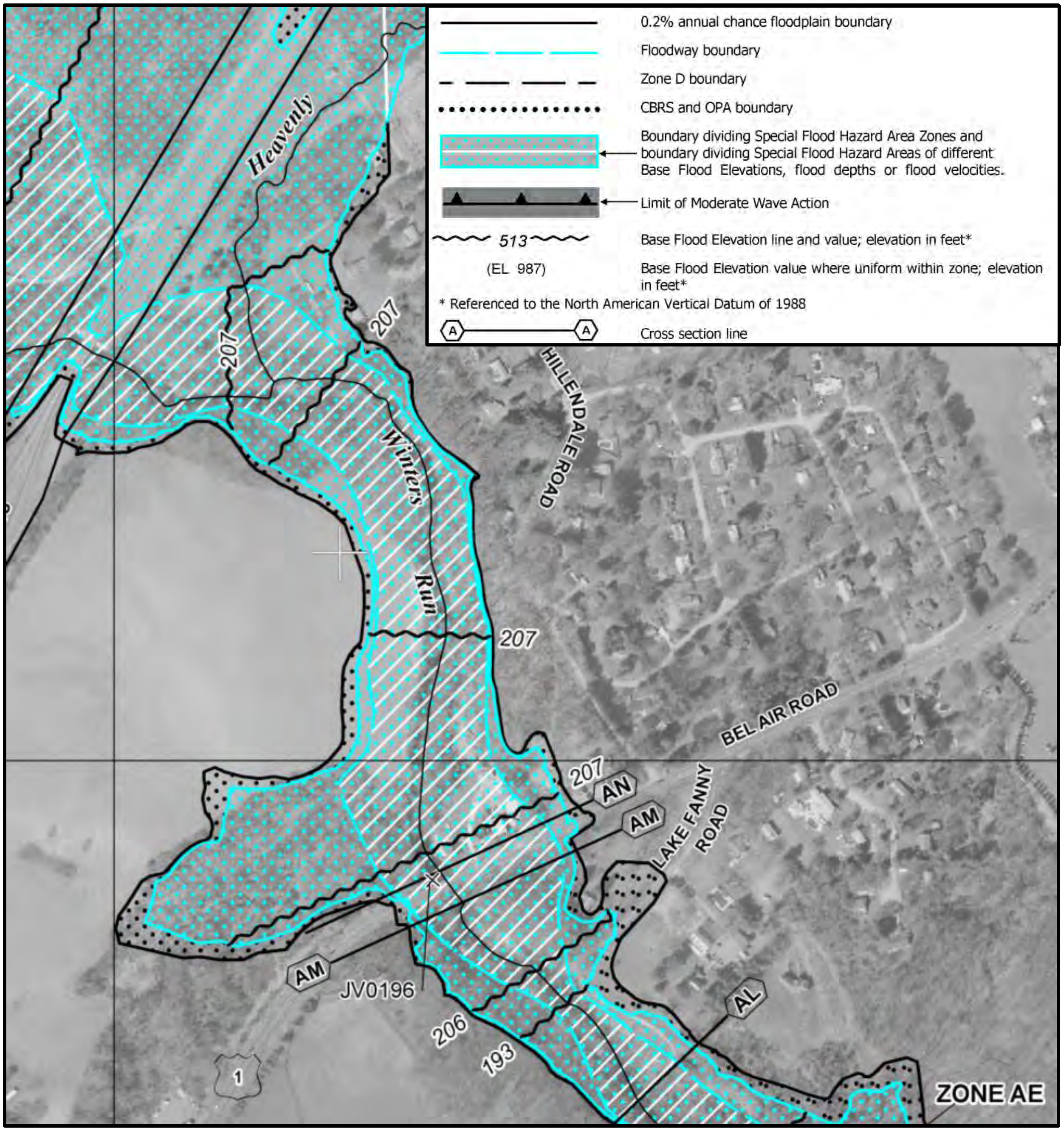


Figure 1. Excerpt from FEMA FIRM in Vicinity of Proposed Bel Air Impoundment

3.0 Hydraulic Analysis

3.1 Hydraulic Model Development

Hydraulic analyses were performed to determine the impact that the proposed project will have on the water surface elevations in Winters Run during the regulatory 100-year flood. The original effective FEMA HEC-RAS model for Winters Run served as the basis for the floodplain analysis. FEMA discharge estimates from the effective study were used in the HEC-RAS model. No new hydrologic analyses were completed as part of this study.

Because the effective model only includes three cross sections within the project limits (Stations 23189, 23542, and 23954), model data was supplemented with 8 additional cross sections between river stations 23189 and 23954 based upon project survey and the best available LiDAR elevation data. HEC-RAS cross sections in the vicinity of the proposed impoundment are shown in Figure 2. All elevations in the HEC-RAS model developed for this project are referenced to NAVD88.

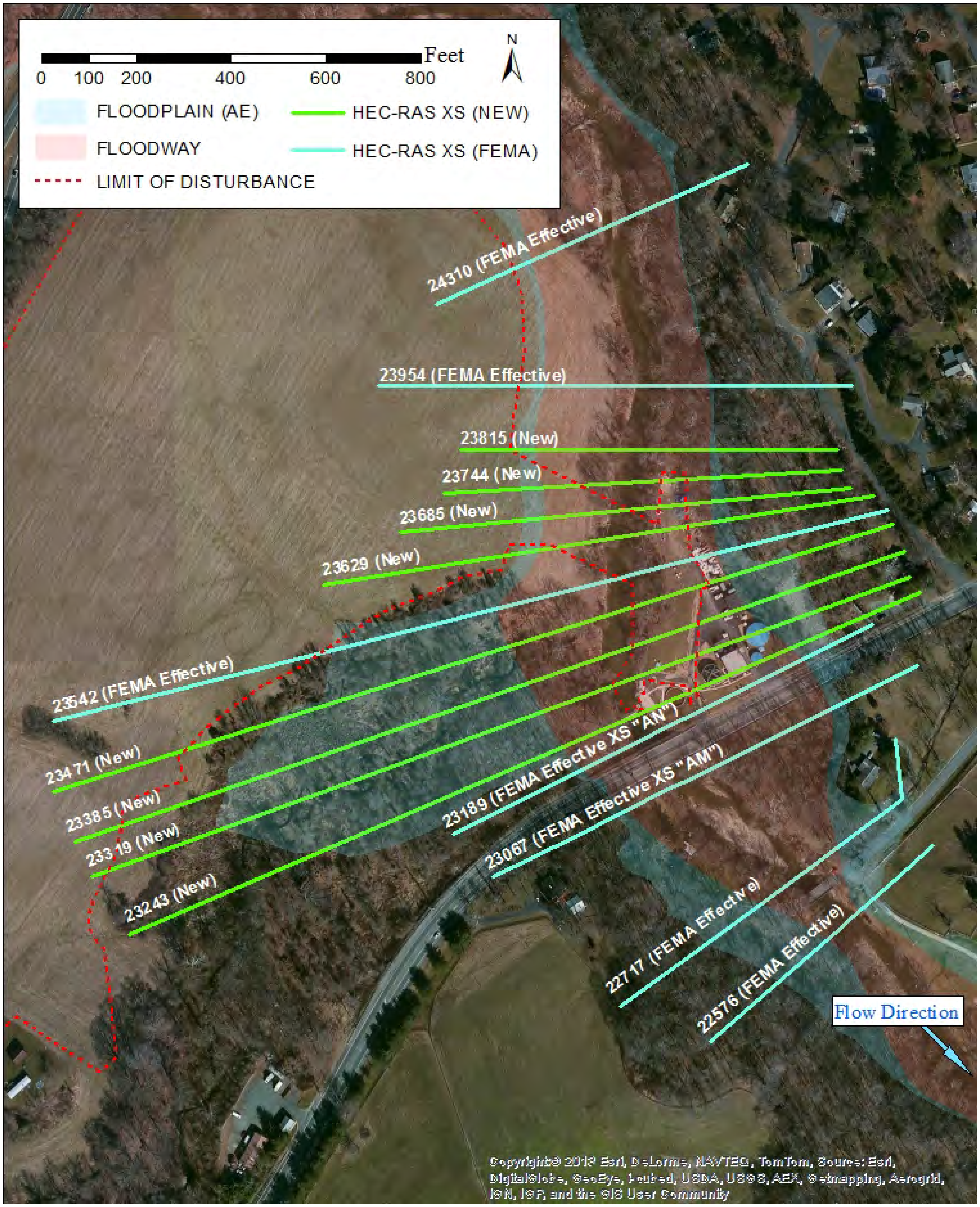
Manning's roughness coefficients and ineffective flow areas were applied to the new cross sections in a manner that was consistent with the effective FEMA model. As a result, roughness values of 0.035 for the channel and 0.046-0.120 for the overbank areas were assigned to the new cross sections.

Three new simulations were run in the HEC-RAS model: existing conditions, temporary conditions, and proposed conditions. The "existing conditions" simulation represents the study reach of Winters Run without any of the construction or modifications currently proposed by MAWC. The "temporary conditions" simulation was modeled to estimate the flooding impacts of a large sediment trap that will be installed as a temporary means of erosion and sediment (E&S) control during construction of the impoundment. The "proposed conditions" simulation represents the study reach with all permanent proposed modifications.

Where cross-sections extended through proposed structures at the water treatment plant, blocked obstructions were modeled in the proposed geometry. The existing low-head diversion dam was also added as a blocked obstruction to all geometries since it has a significant impact on the hydraulics of the area of interest but was not included in the effective FEMA analysis. Differences in model geometry between the existing, temporary, and proposed condition simulations are listed in Table 1.

3.2 Analysis Results

Table 1 summarizes the model results for the 100-year peak flow for existing conditions versus proposed conditions as well as existing conditions versus temporary conditions. HEC-RAS model output for all three simulations is included as Attachment B.



Copyright© 2013 Esri, DeLorme, NAVTEQ, TomTom, Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

Figure 2. HEC-RAS Cross Section Location Map

Table 1. Summary of HEC-RAS Analysis Results

HEC-RAS Station	100-year WSE (feet)			100-year WSE Difference (feet)	
	Existing	Temporary	Proposed	Temporary minus Existing	Proposed minus Existing
23954 (FEMA)	206.970	206.987	206.970	0.017	0.000
23815 (New)	206.902	206.919	206.902	0.017	0.000
23744 (New) *Proposed Stilling Basin*	206.849	206.866	206.848	0.017	-0.001
23685 (New) *Proposed Discharge Channel; Temporary Sediment Trap*	206.829	206.915	206.837	0.086	0.008
23629 (New) *Proposed Outlet of Discharge Channel*	206.837	206.840	206.841	0.003	0.004
23542 (FEMA)	206.963	206.963	206.965	0.000	0.002
23471 (New)	206.975	206.975	206.977	0.000	0.002
23385 (New) *Proposed Raw Water Pump Station and Impoundment Supply Meter Vaults*	206.894	206.894	206.895	0.000	0.001
23319 (New) *Proposed Intake and Recycle Meter Vault*	206.906	206.906	206.910	0.000	0.004
23243 (New) *Existing Low-head Diversion Dam*	206.861	206.861	206.861	0.000	0.000
23189 (FEMA) *Immediately Upstream of Bel Air Road*	206.859	206.859	206.859	0.000	0.000

**Red text denotes increases in water surface elevation.*

The analysis indicates that the temporary condition will result in a maximum increase 0.086 feet at the location of the temporary sediment trap during the regulatory 100-year flood event. This increase is reduced to less than 0.02 feet immediately upstream of the sediment trap which propagates approximately 0.85 miles upstream of the site. This temporary condition increase in water surface elevation is not anticipated to cause significant increase in flood risk to upstream structures during construction.

The proposed condition will not result in any significant increase (equal to or greater than 0.01 feet) in water surface elevation during the regulatory 100-year flood event. A maximum increase of 0.008 feet occurs at the location of the proposed discharge channel outlet. Insignificant increases are also observed at the cross sections between the proposed intake and the proposed discharge channel. These increases are localized and do not propagate upstream or downstream of the site of interest.

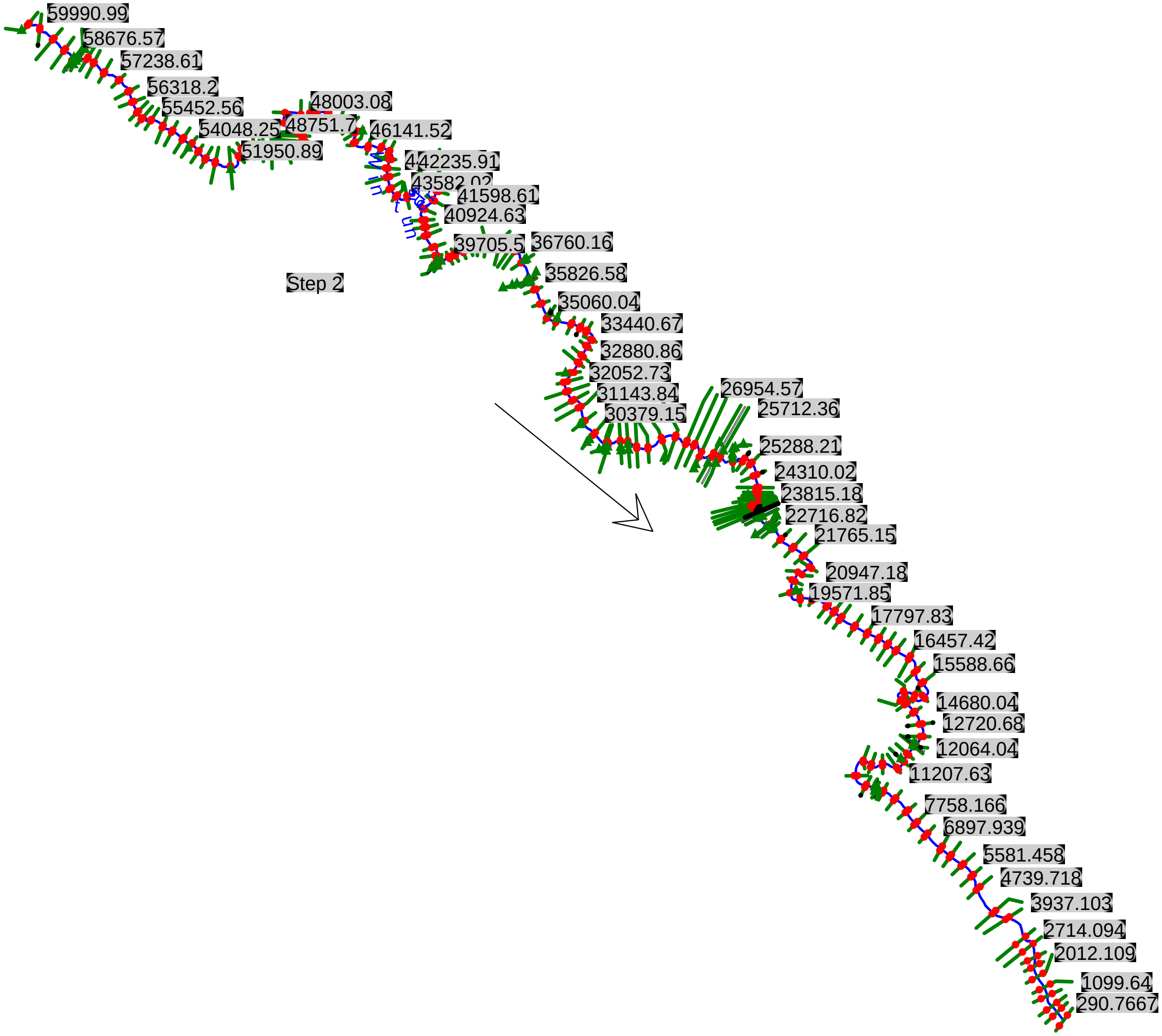
4.0 Conclusion

The Bel Air Impoundment project site along Winters Run is located in the FEMA study area for Harford County. The proposed permanent modifications to the intake and water treatment plant as well as the construction of the new impoundment result in no significant increase to the existing regulatory base flood elevations. During construction, temporary E&S measures will increase the base flood elevation by 0.086 feet at the site; however, impacts of this magnitude do not propagate upstream and are not anticipated to cause significant increase in flood risk to upstream structures during construction.

In conclusion, the proposed plan for construction of the impoundment and its associated appurtenances adequately meets current floodplain management criteria. The proposed project will ensure a reliable source of raw water for the system during periods of drought.

ATTACHMENT B

HEC-RAS Analysis Output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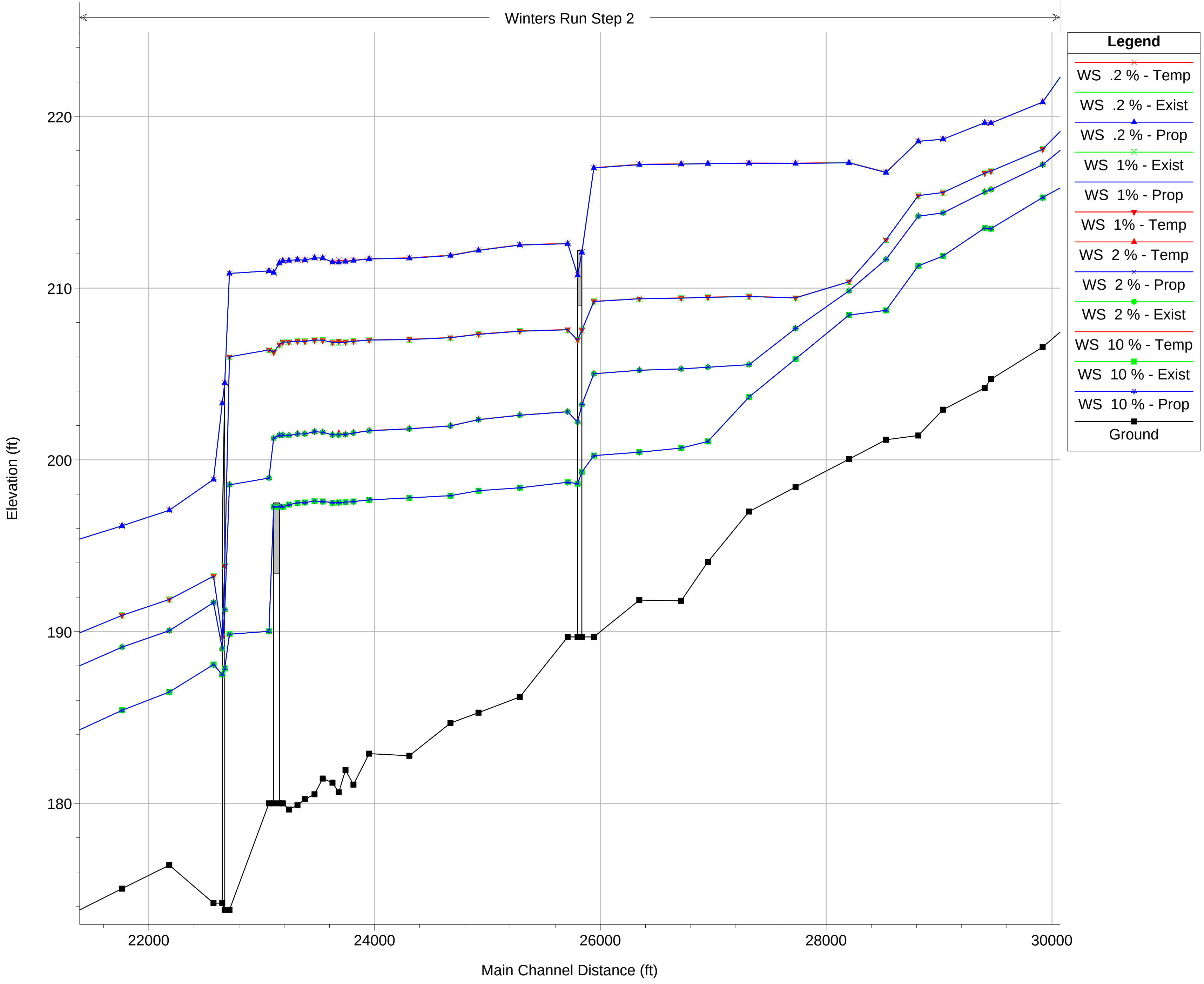

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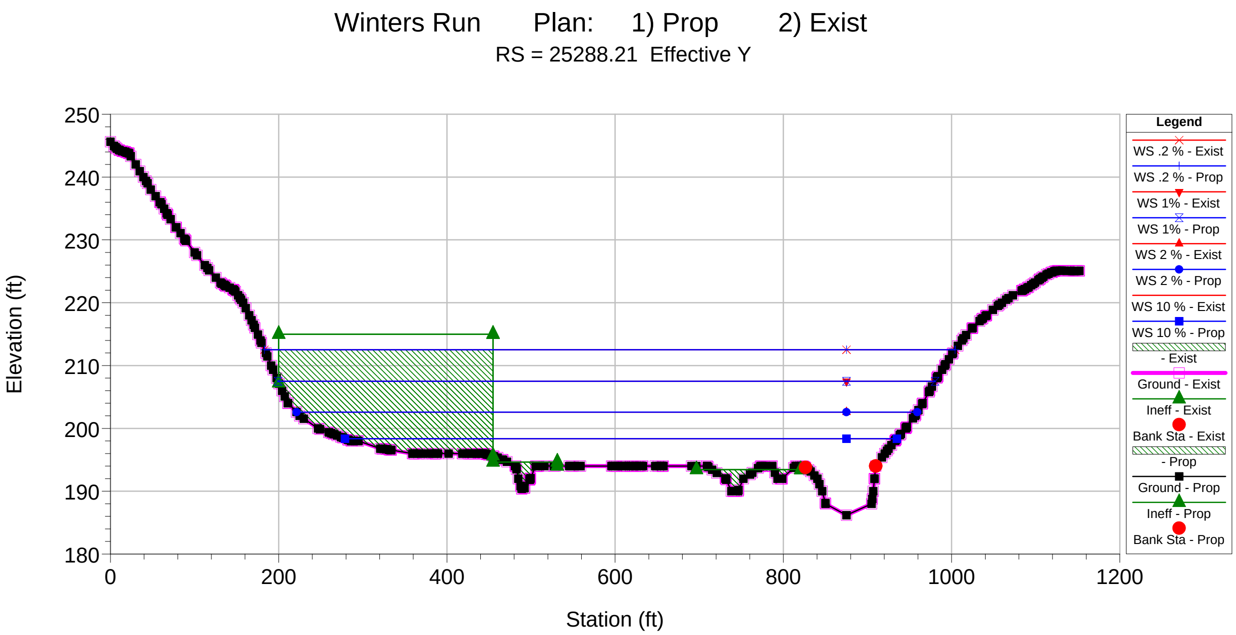
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800
1000
1200
Legend
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WS .2 % - Prop
WS 1% - Exist
WS 1% - Prop
WS 2 % - Exist
WS 2 % - Prop
WS 10 % - Exist
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- Exist
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Ineff - Exist
Bank Sta - Exist
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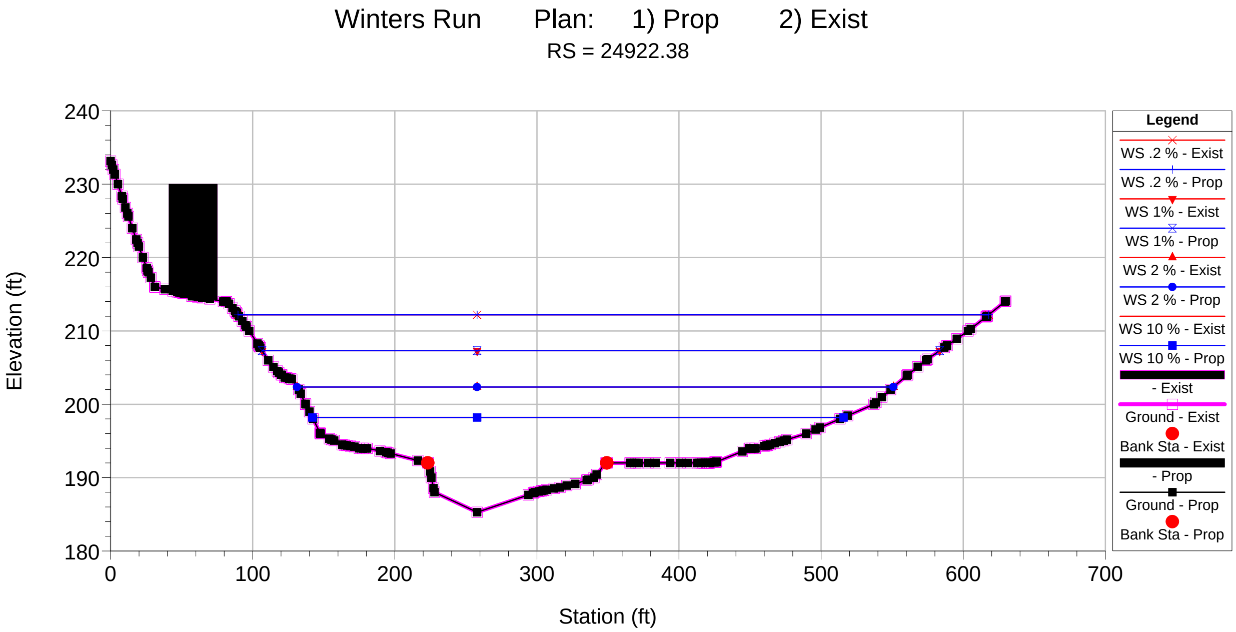
Ground - Prop
Ineff - Prop
Bank Sta - Prop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WS .2 % - Prop
WS 1% - Exist
WS 1% - Prop
WS 2 % - Exist
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- Prop
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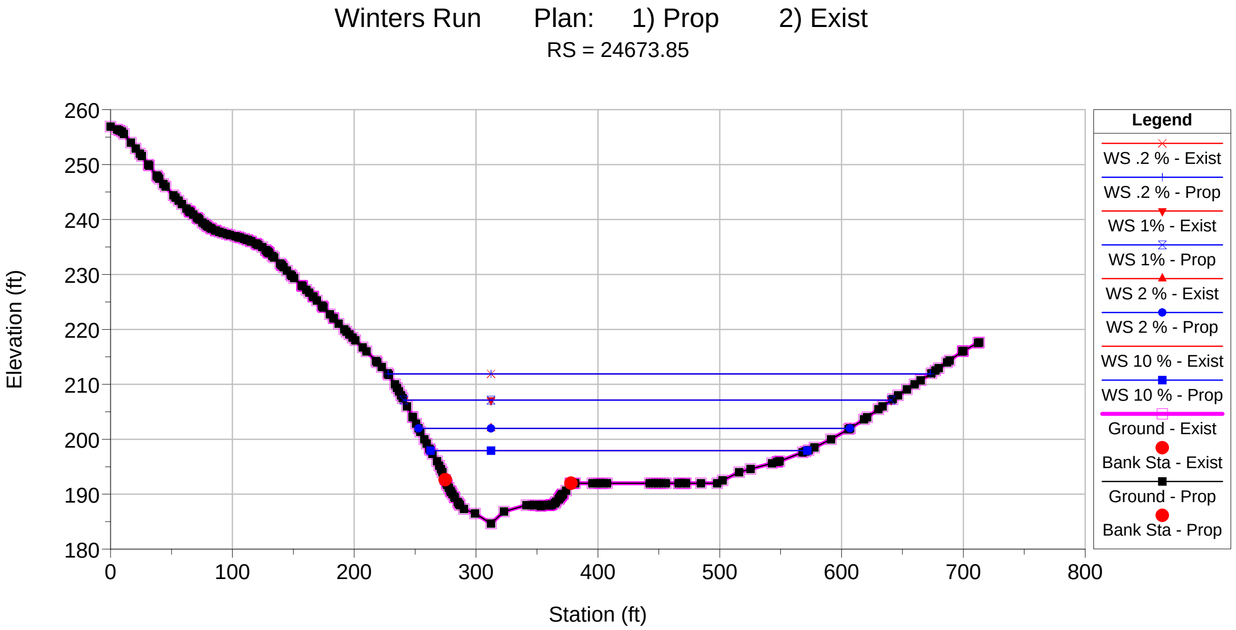
Bank Sta - Prop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Legend
WS .2 % - Exist
WS .2 % - Prop
WS 1% - Exist
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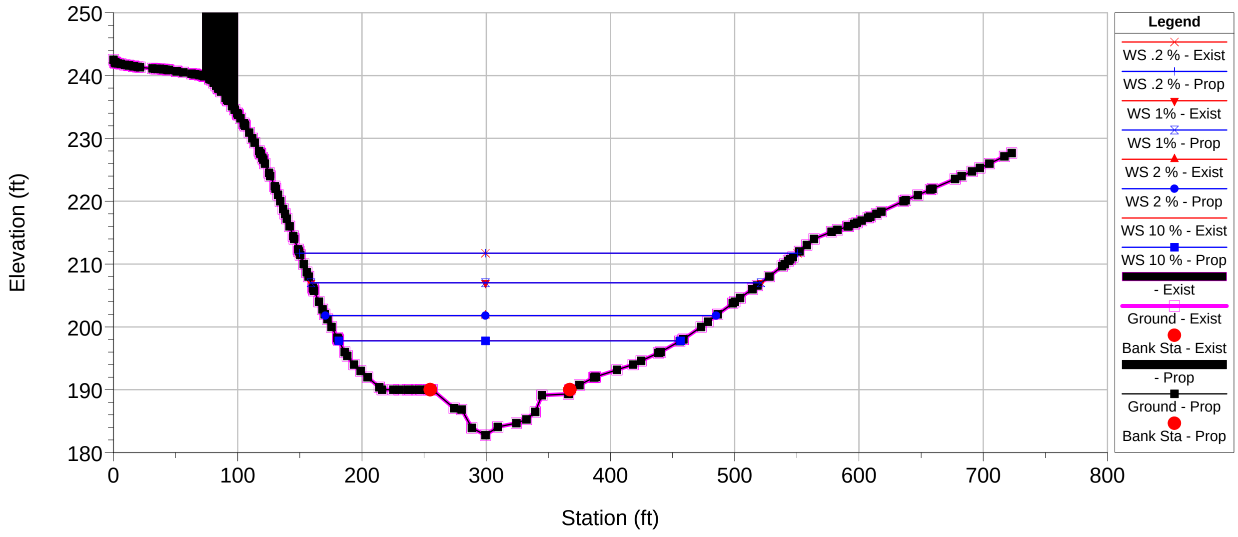

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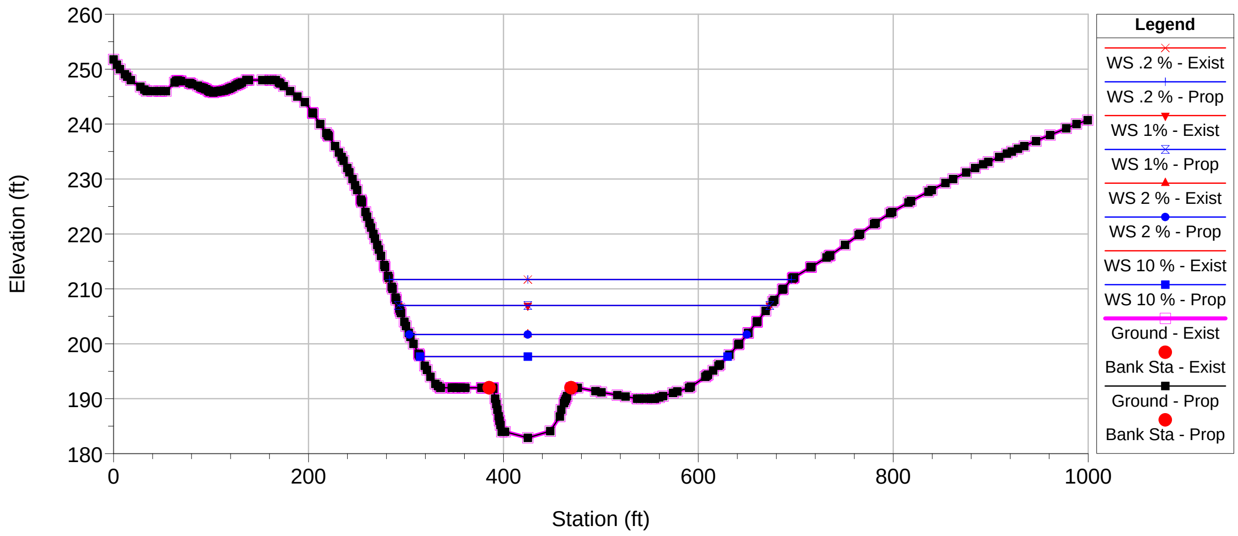

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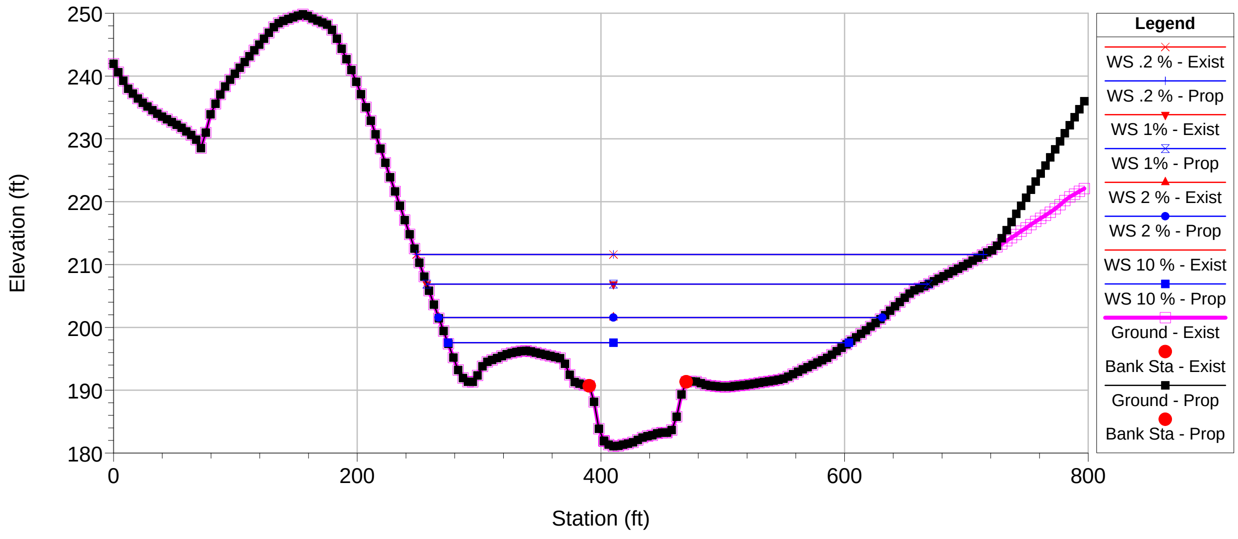

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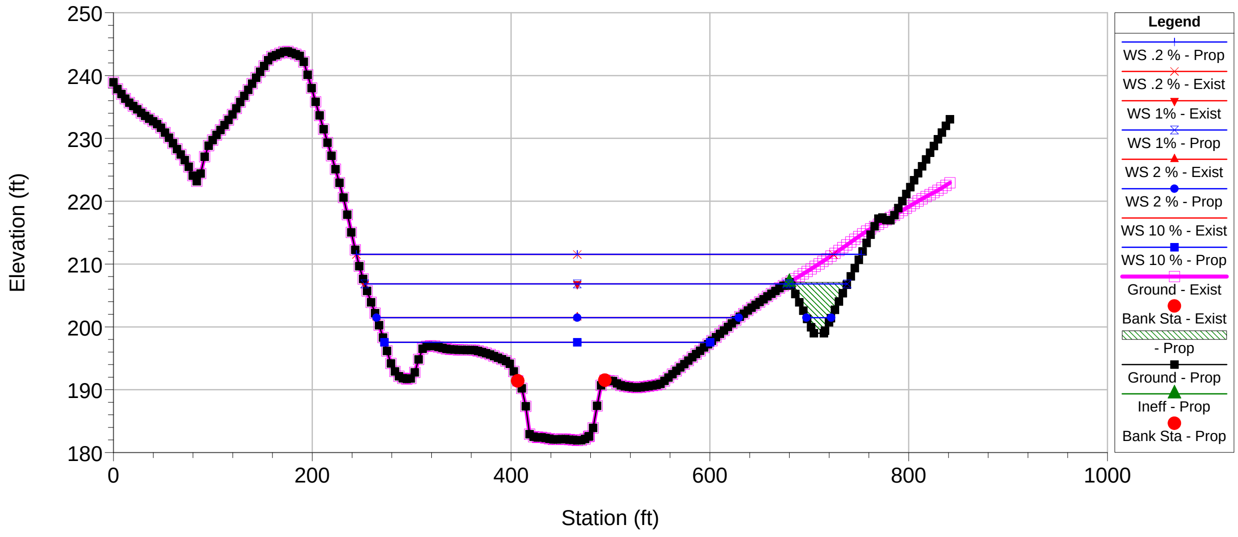

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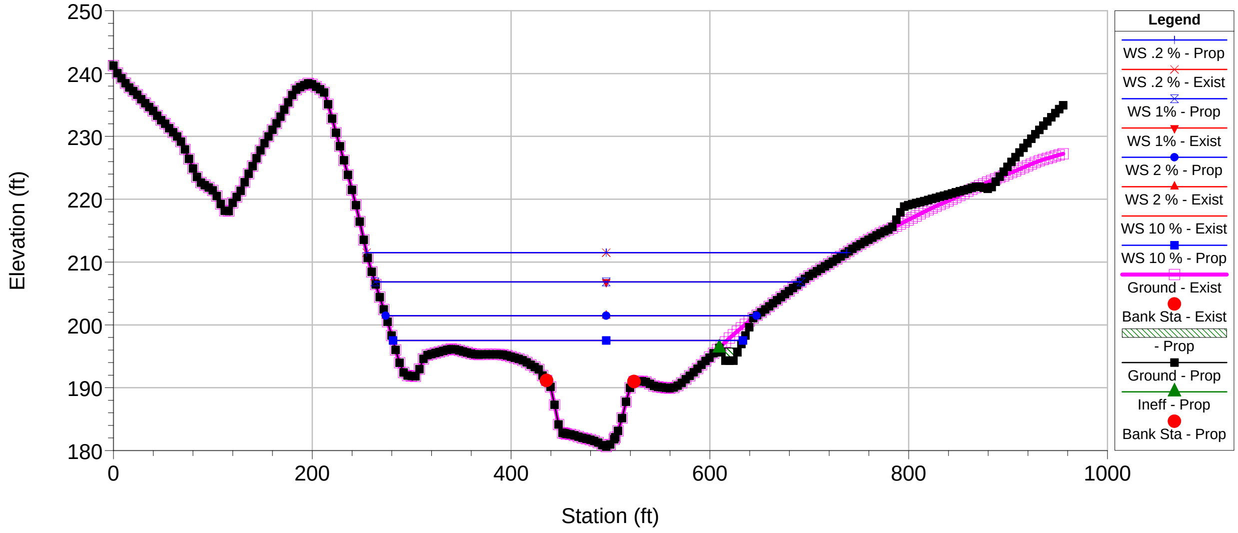

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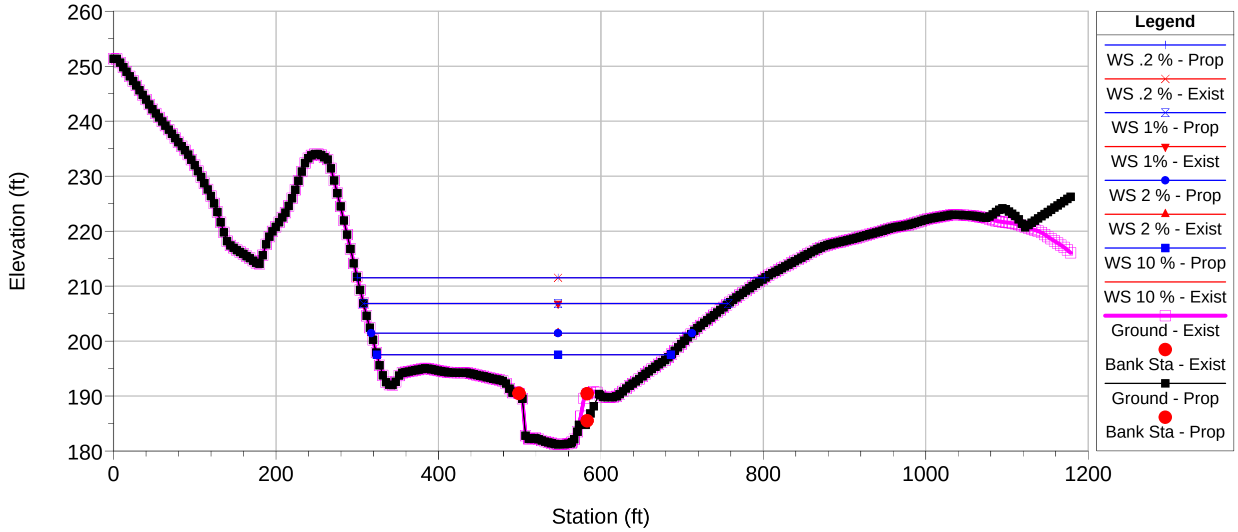

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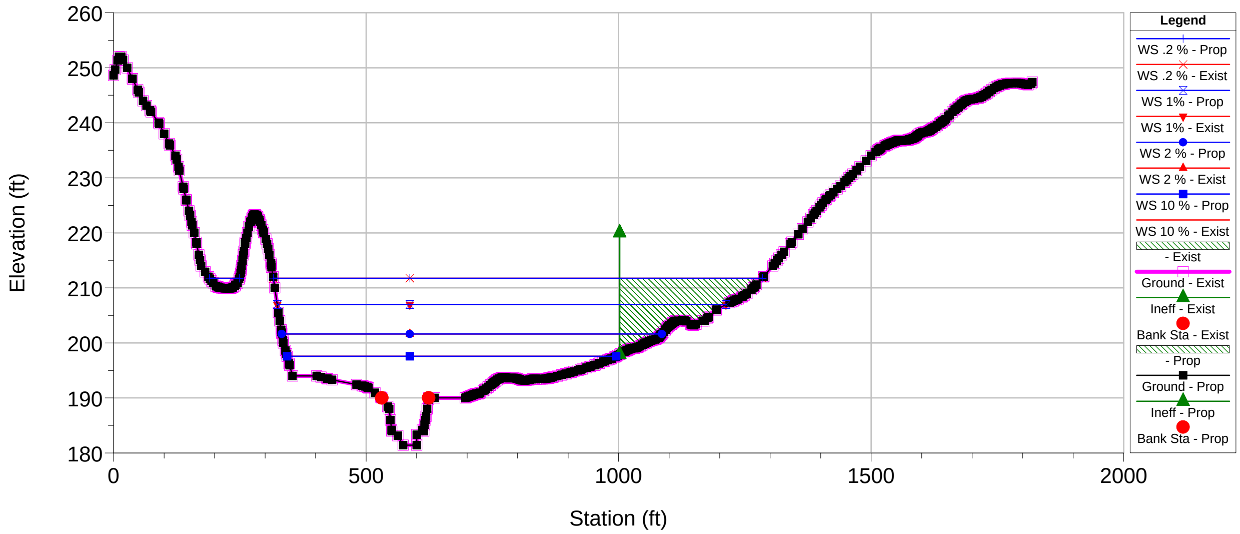

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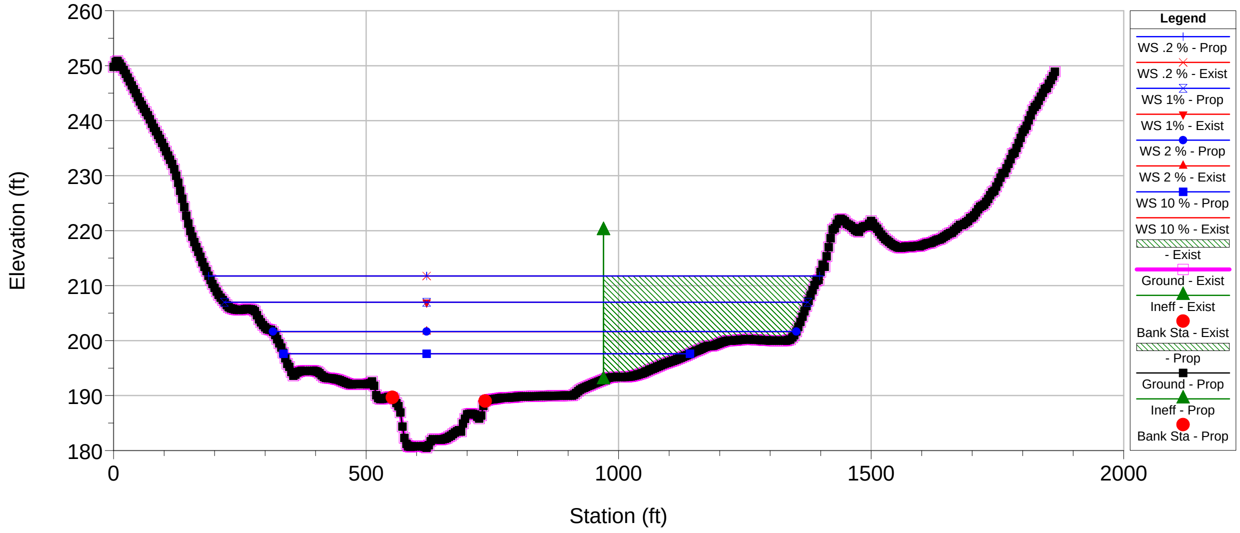

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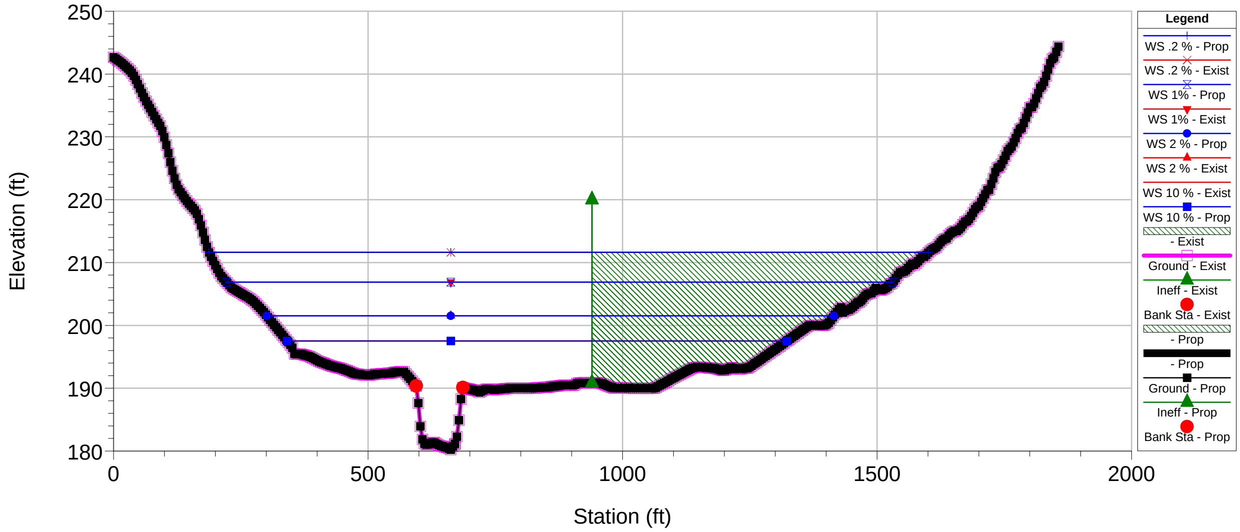

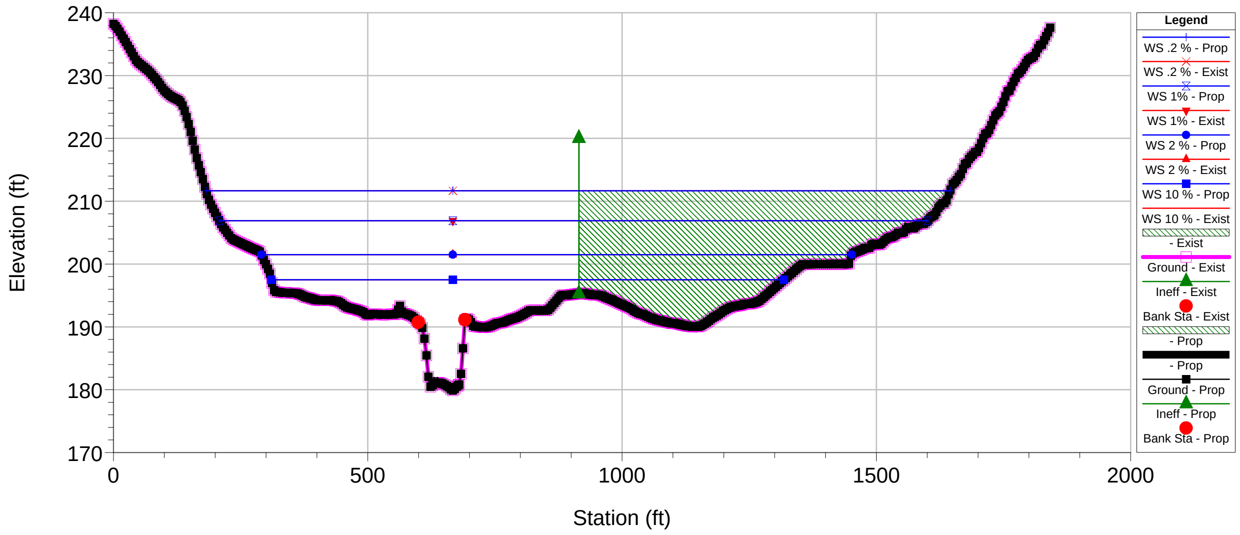

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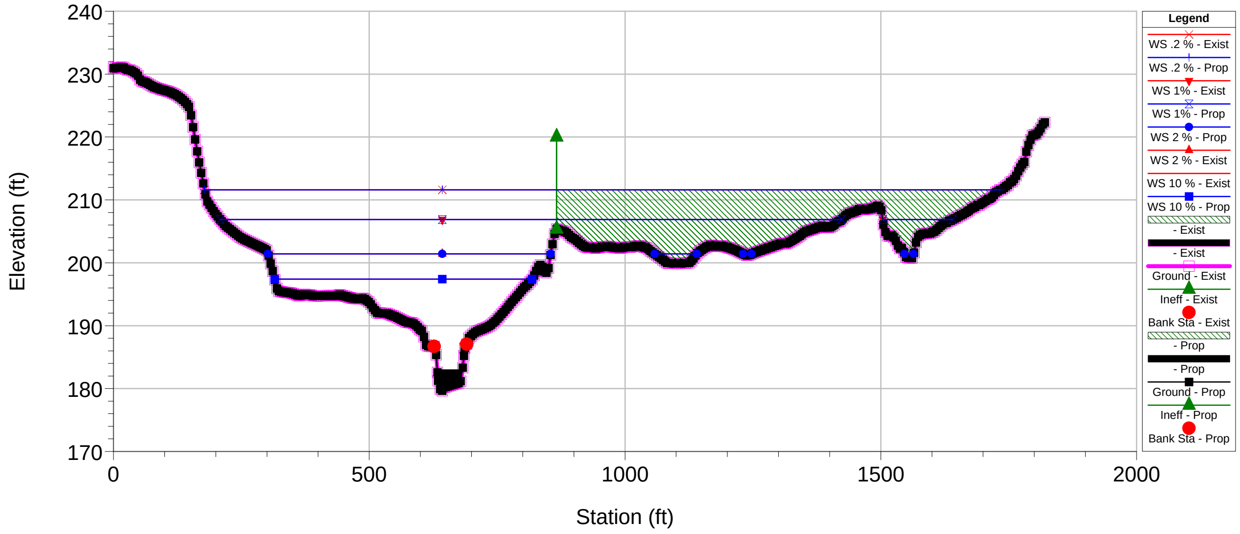

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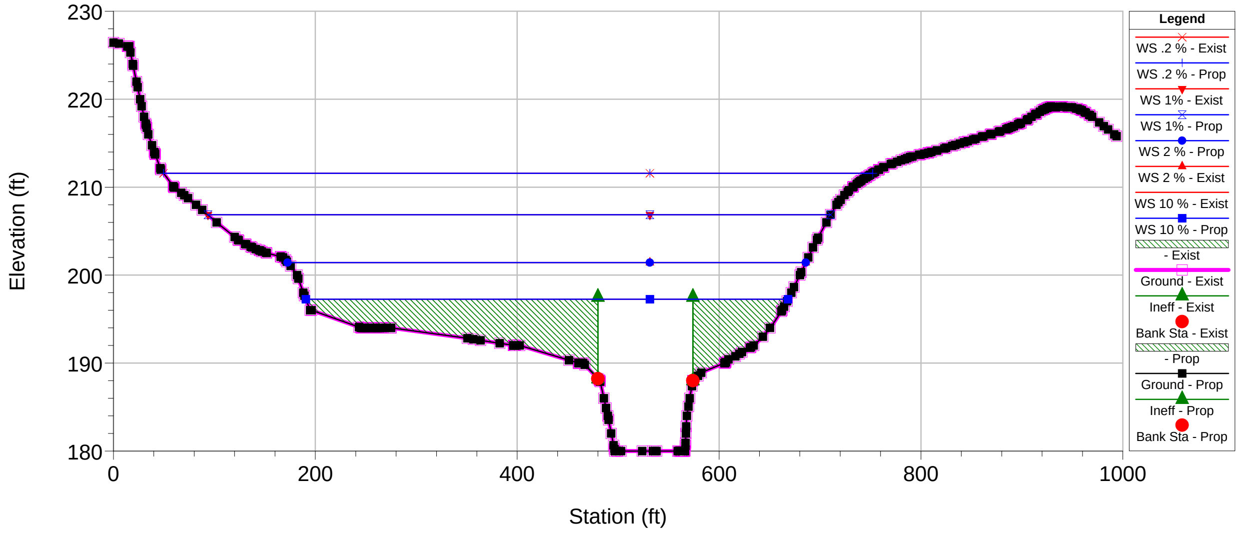

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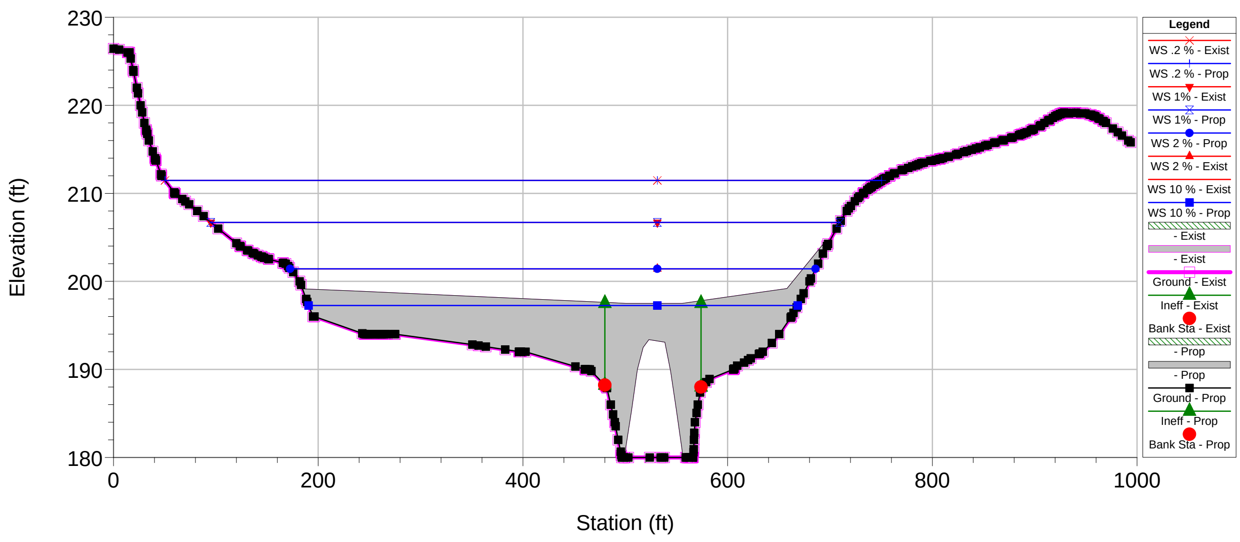

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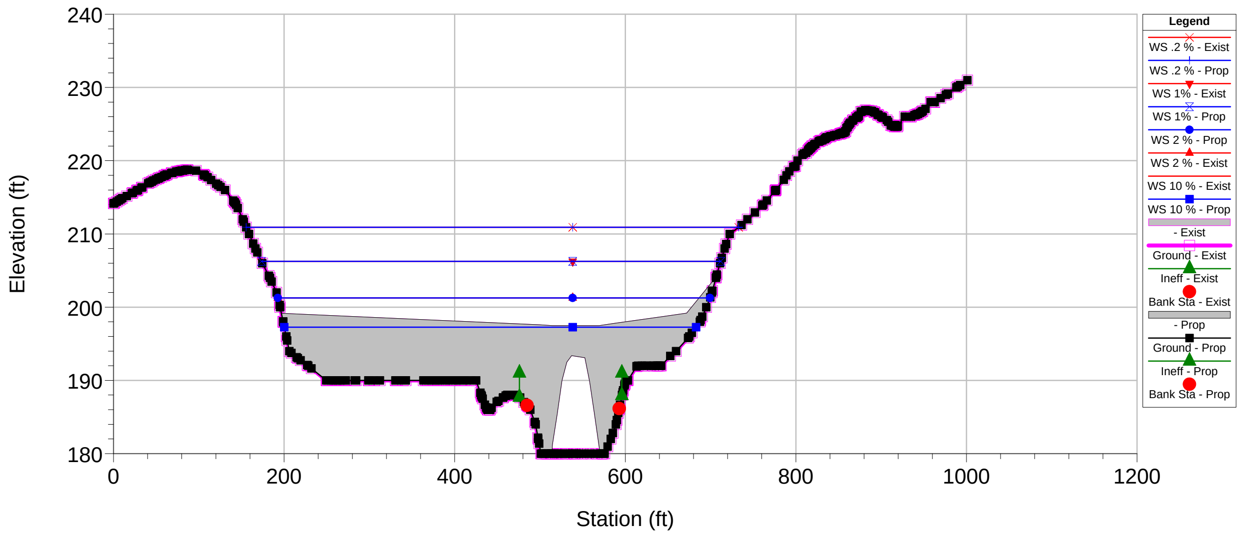
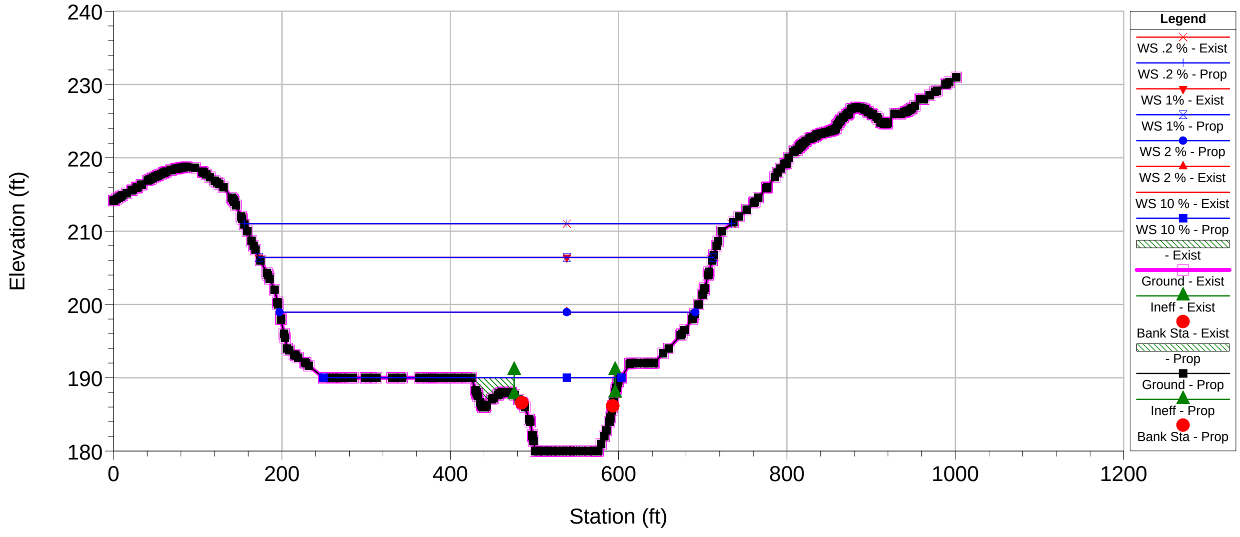


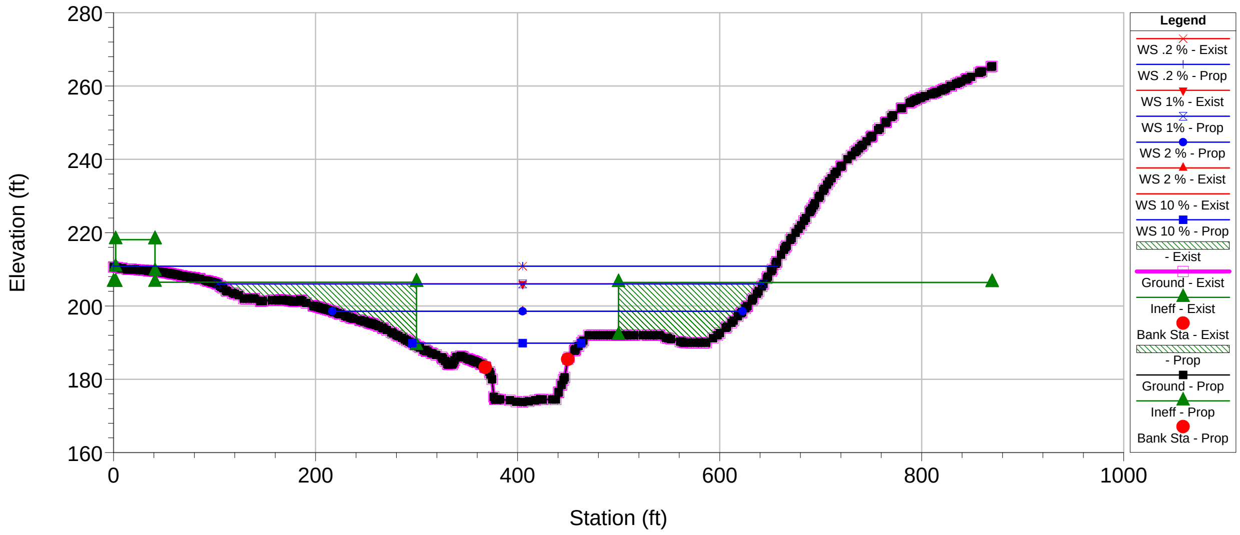
Winters Run Plan: 1) Prop 2) Exist

RS = 23066.57 DS Route 1



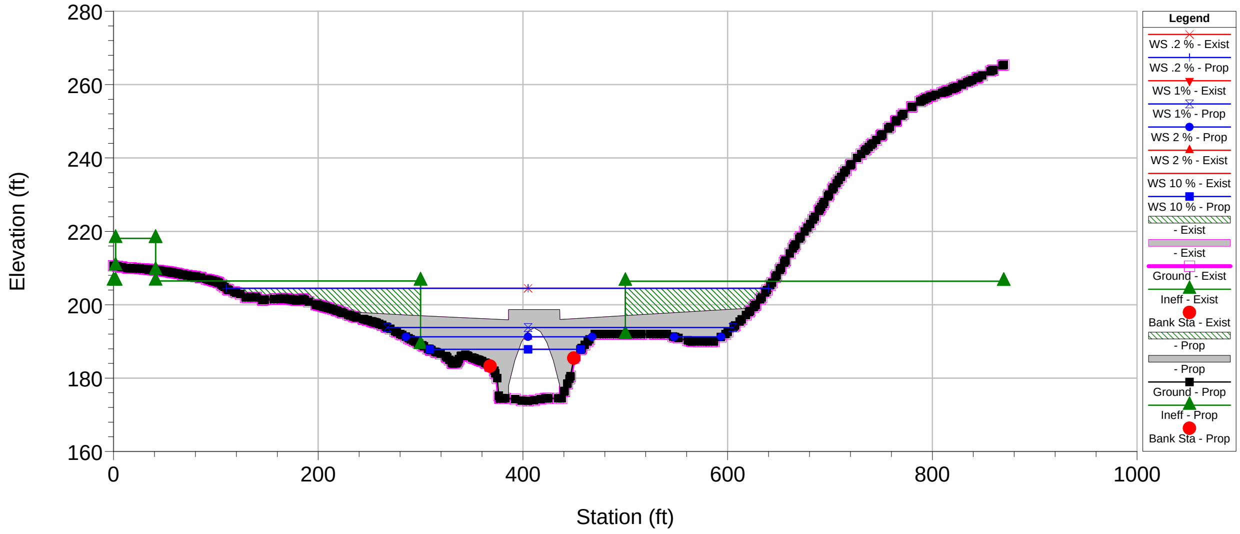
Winters Run Plan: 1) Prop 2) Exist

RS = 22716.82 Effective W - US Lake Fanny Road



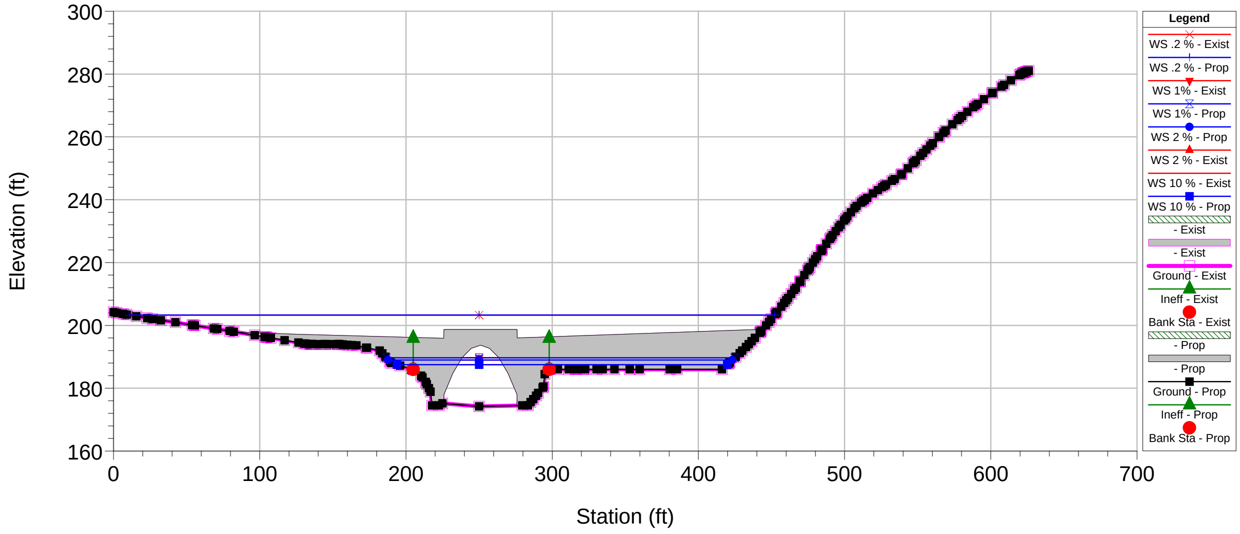
Winters Run Plan: 1) Prop 2) Exist

RS = 22641 BR Lake Fanny Road



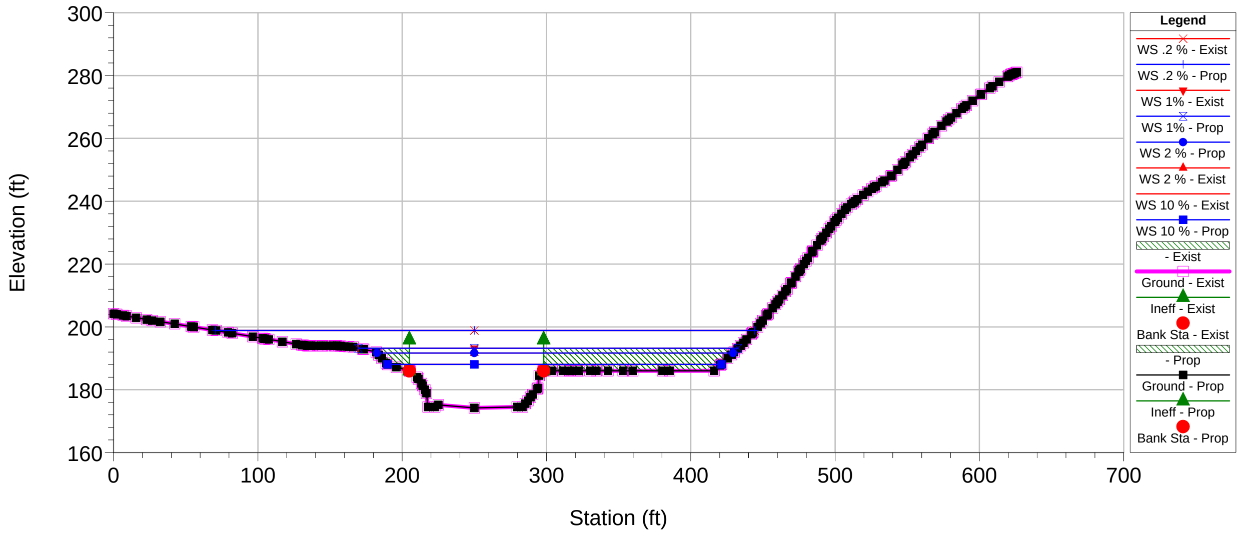
Winters Run Plan: 1) Prop 2) Exist

RS = 22641 BR Lake Fanny Road



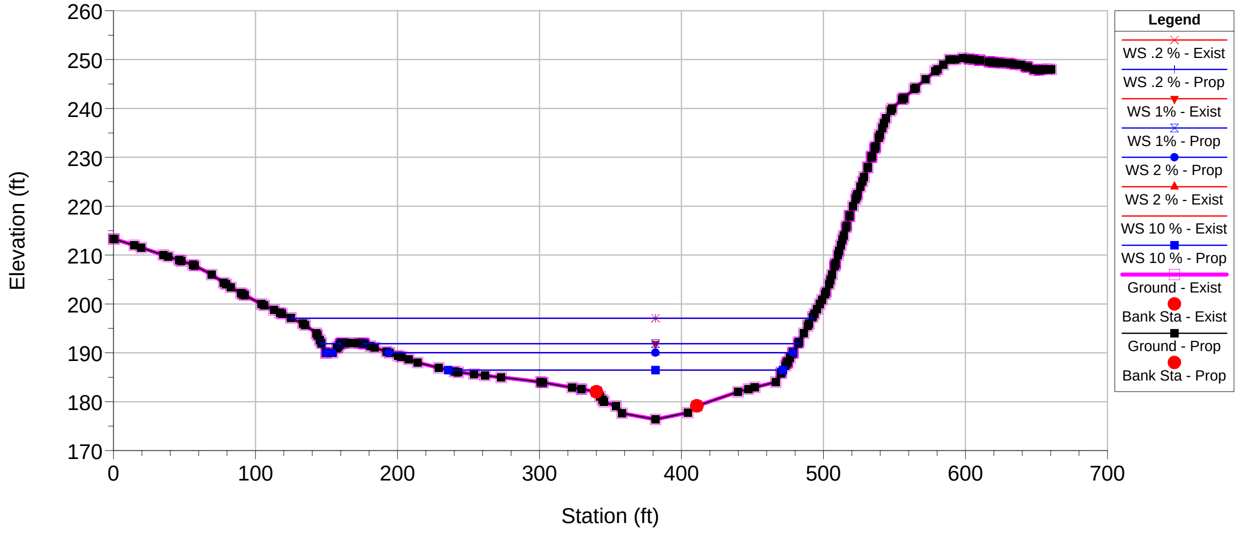
Winters Run Plan: 1) Prop 2) Exist

RS = 22575.76 DS lake Fanny Road



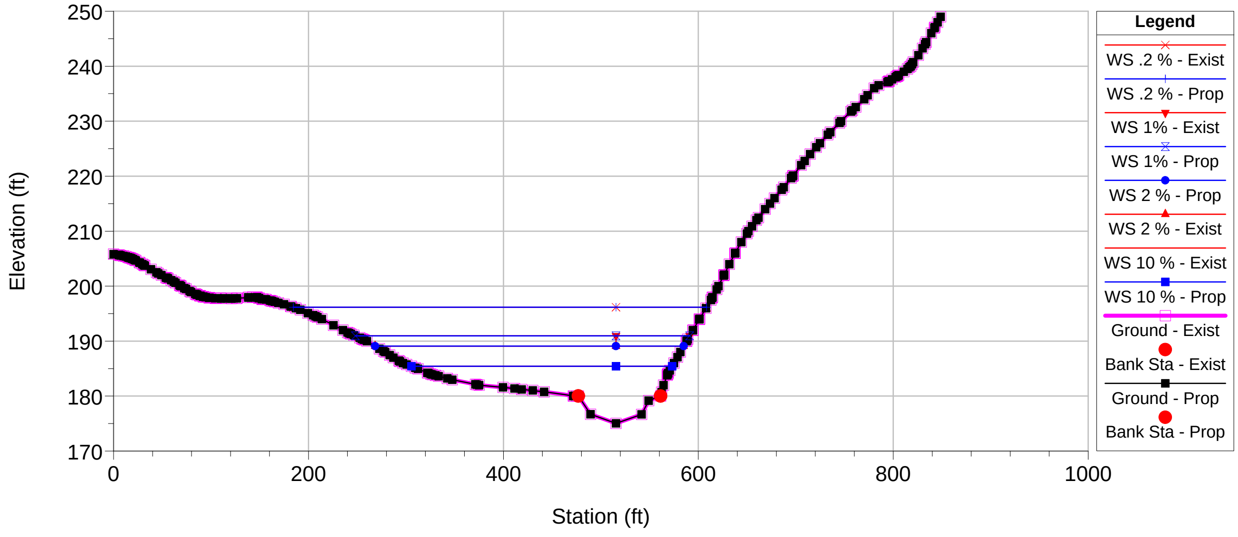
Winters Run Plan: 1) Prop 2) Exist

RS = 22183.62



Winters Run Plan: 1) Prop 2) Exist

RS = 21765.15



HEC-RAS River: Winters Run Reach: Step 2 Profile: 1%

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Step 2	59990.99	1%	FEMA	10300.00	321.19	335.479	331.45	335.86	0.001234	6.14	3212.59	616.26	0.30
Step 2	59990.99	1%	Temp	10300.00	321.19	335.479	331.45	335.86	0.001234	6.14	3212.59	616.26	0.30
Step 2	59990.99	1%	Exist	10300.00	321.19	335.479	331.45	335.86	0.001234	6.14	3212.59	616.26	0.30
Step 2	59990.99	1%	Prop	10300.00	321.19	335.479	331.45	335.86	0.001234	6.14	3212.59	616.26	0.30
Step 2	59607.84	1%	FEMA	10300.00	321.19	334.885		335.36	0.001393	6.53	2112.43	311.36	0.32
Step 2	59607.84	1%	Temp	10300.00	321.19	334.885		335.36	0.001393	6.53	2112.43	311.36	0.32
Step 2	59607.84	1%	Exist	10300.00	321.19	334.885		335.36	0.001393	6.53	2112.43	311.36	0.32
Step 2	59607.84	1%	Prop	10300.00	321.19	334.885		335.36	0.001393	6.53	2112.43	311.36	0.32
Step 2	59123.93	1%	FEMA	10300.00	319.02	333.979		334.63	0.001658	7.65	2385.02	269.89	0.36
Step 2	59123.93	1%	Temp	10300.00	319.02	333.979		334.63	0.001658	7.65	2385.02	269.89	0.36
Step 2	59123.93	1%	Exist	10300.00	319.02	333.979		334.63	0.001658	7.65	2385.02	269.89	0.36
Step 2	59123.93	1%	Prop	10300.00	319.02	333.979		334.63	0.001658	7.65	2385.02	269.89	0.36
Step 2	58676.57	1%	FEMA	10300.00	317.01	333.926		334.10	0.000527	4.36	3973.47	402.91	0.20
Step 2	58676.57	1%	Temp	10300.00	317.01	333.926		334.10	0.000527	4.36	3973.47	402.91	0.20
Step 2	58676.57	1%	Exist	10300.00	317.01	333.926		334.10	0.000527	4.36	3973.47	402.91	0.20
Step 2	58676.57	1%	Prop	10300.00	317.01	333.926		334.10	0.000527	4.36	3973.47	402.91	0.20
Step 2	58319.7	1%	FEMA	10300.00	315.29	332.536	325.40	333.55	0.001712	8.08	1281.97	446.88	0.37
Step 2	58319.7	1%	Temp	10300.00	315.29	332.536	325.40	333.55	0.001712	8.08	1281.97	446.88	0.37
Step 2	58319.7	1%	Exist	10300.00	315.29	332.536	325.40	333.55	0.001712	8.08	1281.97	446.88	0.37
Step 2	58319.7	1%	Prop	10300.00	315.29	332.536	325.40	333.55	0.001712	8.08	1281.97	446.88	0.37
Step 2	58262			Bridge									
Step 2	58206.81	1%	FEMA	10300.00	314.39	328.485	323.11	329.70	0.002488	8.89	1264.86	609.61	0.44
Step 2	58206.81	1%	Temp	10300.00	314.39	328.485	323.11	329.70	0.002488	8.89	1264.86	609.61	0.44
Step 2	58206.81	1%	Exist	10300.00	314.39	328.485	323.11	329.70	0.002488	8.89	1264.86	609.61	0.44
Step 2	58206.81	1%	Prop	10300.00	314.39	328.485	323.11	329.70	0.002488	8.89	1264.86	609.61	0.44
Step 2	57889.34	1%	FEMA	10300.00	313.39	328.241		328.82	0.001395	7.00	2478.27	290.22	0.34
Step 2	57889.34	1%	Temp	10300.00	313.39	328.241		328.82	0.001395	7.00	2478.27	290.22	0.34
Step 2	57889.34	1%	Exist	10300.00	313.39	328.241		328.82	0.001395	7.00	2478.27	290.22	0.34
Step 2	57889.34	1%	Prop	10300.00	313.39	328.241		328.82	0.001395	7.00	2478.27	290.22	0.34
Step 2	57651.57	1%	FEMA	10600.00	312.63	326.441		328.17	0.004259	11.86	1456.87	205.24	0.58
Step 2	57651.57	1%	Temp	10600.00	312.63	326.441		328.17	0.004259	11.86	1456.87	205.24	0.58
Step 2	57651.57	1%	Exist	10600.00	312.63	326.441		328.17	0.004259	11.86	1456.87	205.24	0.58
Step 2	57651.57	1%	Prop	10600.00	312.63	326.441		328.17	0.004259	11.86	1456.87	205.24	0.58
Step 2	57238.61	1%	FEMA	10600.00	311.33	325.224		326.52	0.003289	10.10	1578.28	192.37	0.50
Step 2	57238.61	1%	Temp	10600.00	311.33	325.224		326.52	0.003289	10.10	1578.28	192.37	0.50
Step 2	57238.61	1%	Exist	10600.00	311.33	325.224		326.52	0.003289	10.10	1578.28	192.37	0.50
Step 2	57238.61	1%	Prop	10600.00	311.33	325.224		326.52	0.003289	10.10	1578.28	192.37	0.50
Step 2	56754.95	1%	FEMA	10600.00	309.79	324.385		325.10	0.002070	8.40	1971.57	243.21	0.40
Step 2	56754.95	1%	Temp	10600.00	309.79	324.385		325.10	0.002070	8.40	1971.57	243.21	0.40
Step 2	56754.95	1%	Exist	10600.00	309.79	324.385		325.10	0.002070	8.40	1971.57	243.21	0.40
Step 2	56754.95	1%	Prop	10600.00	309.79	324.385		325.10	0.002070	8.40	1971.57	243.21	0.40
Step 2	56318.2	1%	FEMA	10600.00	308.33	322.067		323.73	0.004690	11.17	1467.50	253.92	0.58
Step 2	56318.2	1%	Temp	10600.00	308.33	322.067		323.73	0.004690	11.17	1467.50	253.92	0.58
Step 2	56318.2	1%	Exist	10600.00	308.33	322.067		323.73	0.004690	11.17	1467.50	253.92	0.58
Step 2	56318.2	1%	Prop	10600.00	308.33	322.067		323.73	0.004690	11.17	1467.50	253.92	0.58
Step 2	56004.67	1%	FEMA	10600.00	307.28	321.496		322.40	0.002758	8.97	2115.21	297.99	0.45
Step 2	56004.67	1%	Temp	10600.00	307.28	321.496		322.40	0.002758	8.97	2115.21	297.99	0.45
Step 2	56004.67	1%	Exist	10600.00	307.28	321.496		322.40	0.002758	8.97	2115.21	297.99	0.45
Step 2	56004.67	1%	Prop	10600.00	307.28	321.496		322.40	0.002758	8.97	2115.21	297.99	0.45
Step 2	55686.88	1%	FEMA	11000.00	306.22	321.080		321.63	0.001688	7.44	2817.05	335.19	0.36
Step 2	55686.88	1%	Temp	11000.00	306.22	321.080		321.63	0.001688	7.44	2817.05	335.19	0.36
Step 2	55686.88	1%	Exist	11000.00	306.22	321.080		321.63	0.001688	7.44	2817.05	335.19	0.36
Step 2	55686.88	1%	Prop	11000.00	306.22	321.080		321.63	0.001688	7.44	2817.05	335.19	0.36
Step 2	55452.56	1%	FEMA	11000.00	305.44	321.038		321.30	0.000757	5.13	2879.36	277.78	0.24
Step 2	55452.56	1%	Temp	11000.00	305.44	321.038		321.30	0.000757	5.13	2879.36	277.78	0.24
Step 2	55452.56	1%	Exist	11000.00	305.44	321.038		321.30	0.000757	5.13	2879.36	277.78	0.24
Step 2	55452.56	1%	Prop	11000.00	305.44	321.038		321.30	0.000757	5.13	2879.36	277.78	0.24
Step 2	55126.55	1%	FEMA	11000.00	304.34	320.445		321.00	0.001421	7.41	2285.25	215.38	0.34
Step 2	55126.55	1%	Temp	11000.00	304.34	320.445		321.00	0.001421	7.41	2285.25	215.38	0.34
Step 2	55126.55	1%	Exist	11000.00	304.34	320.445		321.00	0.001421	7.41	2285.25	215.38	0.34
Step 2	55126.55	1%	Prop	11000.00	304.34	320.445		321.00	0.001421	7.41	2285.25	215.38	0.34
Step 2	54724.65	1%	FEMA	11000.00	302.99	319.131		320.27	0.002135	9.01	1679.28	166.47	0.41
Step 2	54724.65	1%	Temp	11000.00	302.99	319.131		320.27	0.002135	9.01	1679.28	166.47	0.41
Step 2	54724.65	1%	Exist	11000.00	302.99	319.131		320.27	0.002135	9.01	1679.28	166.47	0.41
Step 2	54724.65	1%	Prop	11000.00	302.99	319.131		320.27	0.002135	9.01	1679.28	166.47	0.41
Step 2	54420.88	1%	FEMA	11000.00	302.40	318.452		319.58	0.002390	9.18	1780.54	188.93	0.43
Step 2	54420.88	1%	Temp	11000.00	302.40	318.452		319.58	0.002390	9.18	1780.54	188.93	0.43
Step 2	54420.88	1%	Exist	11000.00	302.40	318.452		319.58	0.002390	9.18	1780.54	188.93	0.43
Step 2	54420.88	1%	Prop	11000.00	302.40	318.452		319.58	0.002390	9.18	1780.54	188.93	0.43
Step 2	54048.25	1%	FEMA	11000.00	301.73	318.078		318.81	0.001358	7.39	1987.87	189.78	0.33
Step 2	54048.25	1%	Temp	11000.00	301.73	318.078		318.81	0.001358	7.39	1987.87	189.78	0.33

HEC-RAS River: Winters Run Reach: Step 2 Profile: 1% (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Step 2	54048.25	1%	Exist	11000.00	301.73	318.078		318.81	0.001358	7.39	1987.87	189.78	0.33
Step 2	54048.25	1%	Prop	11000.00	301.73	318.078		318.81	0.001358	7.39	1987.87	189.78	0.33
Step 2	53766.59	1%	FEMA	11000.00	301.12	317.325	312.94	318.28	0.002447	9.30	2123.84	324.62	0.44
Step 2	53766.59	1%	Temp	11000.00	301.12	317.325	312.94	318.28	0.002447	9.30	2123.84	324.62	0.44
Step 2	53766.59	1%	Exist	11000.00	301.12	317.325	312.94	318.28	0.002447	9.30	2123.84	324.62	0.44
Step 2	53766.59	1%	Prop	11000.00	301.12	317.325	312.94	318.28	0.002447	9.30	2123.84	324.62	0.44
Step 2	53472.8	1%	FEMA	11000.00	299.74	315.894		317.40	0.003329	10.87	1634.58	179.35	0.51
Step 2	53472.8	1%	Temp	11000.00	299.74	315.894		317.40	0.003329	10.87	1634.58	179.35	0.51
Step 2	53472.8	1%	Exist	11000.00	299.74	315.894		317.40	0.003329	10.87	1634.58	179.35	0.51
Step 2	53472.8	1%	Prop	11000.00	299.74	315.894		317.40	0.003329	10.87	1634.58	179.35	0.51
Step 2	53174.82	1%	FEMA	11000.00	299.26	315.002		316.42	0.003135	10.33	1610.74	177.72	0.49
Step 2	53174.82	1%	Temp	11000.00	299.26	315.002		316.42	0.003135	10.33	1610.74	177.72	0.49
Step 2	53174.82	1%	Exist	11000.00	299.26	315.002		316.42	0.003135	10.33	1610.74	177.72	0.49
Step 2	53174.82	1%	Prop	11000.00	299.26	315.002		316.42	0.003135	10.33	1610.74	177.72	0.49
Step 2	52879.26	1%	FEMA	11000.00	299.38	313.969		315.40	0.003857	10.85	1741.75	212.94	0.54
Step 2	52879.26	1%	Temp	11000.00	299.38	313.969		315.40	0.003857	10.85	1741.75	212.94	0.54
Step 2	52879.26	1%	Exist	11000.00	299.38	313.969		315.40	0.003857	10.85	1741.75	212.94	0.54
Step 2	52879.26	1%	Prop	11000.00	299.38	313.969		315.40	0.003857	10.85	1741.75	212.94	0.54
Step 2	52411.36	1%	FEMA	11200.00	298.46	313.329	308.35	313.96	0.001911	7.95	2910.13	450.20	0.39
Step 2	52411.36	1%	Temp	11200.00	298.46	313.329	308.35	313.96	0.001911	7.95	2910.13	450.20	0.39
Step 2	52411.36	1%	Exist	11200.00	298.46	313.329	308.35	313.96	0.001911	7.95	2910.13	450.20	0.39
Step 2	52411.36	1%	Prop	11200.00	298.46	313.329	308.35	313.96	0.001911	7.95	2910.13	450.20	0.39
Step 2	51950.89	1%	FEMA	11200.00	297.55	311.391		312.78	0.003831	10.83	1822.79	217.52	0.53
Step 2	51950.89	1%	Temp	11200.00	297.55	311.391		312.78	0.003831	10.83	1822.79	217.52	0.53
Step 2	51950.89	1%	Exist	11200.00	297.55	311.391		312.78	0.003831	10.83	1822.79	217.52	0.53
Step 2	51950.89	1%	Prop	11200.00	297.55	311.391		312.78	0.003831	10.83	1822.79	217.52	0.53
Step 2	51712.67	1%	FEMA	11200.00	297.09	309.853		311.69	0.005372	12.18	1552.37	207.33	0.61
Step 2	51712.67	1%	Temp	11200.00	297.09	309.853		311.69	0.005372	12.18	1552.37	207.33	0.61
Step 2	51712.67	1%	Exist	11200.00	297.09	309.853		311.69	0.005372	12.18	1552.37	207.33	0.61
Step 2	51712.67	1%	Prop	11200.00	297.09	309.853		311.69	0.005372	12.18	1552.37	207.33	0.61
Step 2	51325.77	1%	FEMA	11200.00	294.85	308.443		309.87	0.003895	10.53	1734.34	236.56	0.53
Step 2	51325.77	1%	Temp	11200.00	294.85	308.443		309.87	0.003895	10.53	1734.34	236.56	0.53
Step 2	51325.77	1%	Exist	11200.00	294.85	308.443		309.87	0.003895	10.53	1734.34	236.56	0.53
Step 2	51325.77	1%	Prop	11200.00	294.85	308.443		309.87	0.003895	10.53	1734.34	236.56	0.53
Step 2	51145.92	1%	FEMA	11200.00	293.47	308.078		309.22	0.002663	9.89	1888.24	213.10	0.46
Step 2	51145.92	1%	Temp	11200.00	293.47	308.078		309.22	0.002663	9.89	1888.24	213.10	0.46
Step 2	51145.92	1%	Exist	11200.00	293.47	308.078		309.22	0.002663	9.89	1888.24	213.10	0.46
Step 2	51145.92	1%	Prop	11200.00	293.47	308.078		309.22	0.002663	9.89	1888.24	213.10	0.46
Step 2	50992.82	1%	FEMA	11200.00	292.98	307.628		308.82	0.002727	9.97	2235.33	331.26	0.47
Step 2	50992.82	1%	Temp	11200.00	292.98	307.628		308.82	0.002727	9.97	2235.33	331.26	0.47
Step 2	50992.82	1%	Exist	11200.00	292.98	307.628		308.82	0.002727	9.97	2235.33	331.26	0.47
Step 2	50992.82	1%	Prop	11200.00	292.98	307.628		308.82	0.002727	9.97	2235.33	331.26	0.47
Step 2	50747.62	1%	FEMA	11200.00	292.20	305.141	304.13	307.69	0.006677	13.63	1266.80	218.60	0.69
Step 2	50747.62	1%	Temp	11200.00	292.20	305.141	304.13	307.69	0.006677	13.63	1266.80	218.60	0.69
Step 2	50747.62	1%	Exist	11200.00	292.20	305.141	304.13	307.69	0.006677	13.63	1266.80	218.60	0.69
Step 2	50747.62	1%	Prop	11200.00	292.20	305.141	304.13	307.69	0.006677	13.63	1266.80	218.60	0.69
Step 2	50287.4	1%	FEMA	11200.00	292.52	304.337		305.21	0.003118	8.53	2502.26	463.78	0.47
Step 2	50287.4	1%	Temp	11200.00	292.52	304.337		305.21	0.003118	8.53	2502.26	463.78	0.47
Step 2	50287.4	1%	Exist	11200.00	292.52	304.337		305.21	0.003118	8.53	2502.26	463.78	0.47
Step 2	50287.4	1%	Prop	11200.00	292.52	304.337		305.21	0.003118	8.53	2502.26	463.78	0.47
Step 2	49951.02	1%	FEMA	11200.00	290.85	304.012		304.42	0.001683	6.62	4121.60	696.61	0.35
Step 2	49951.02	1%	Temp	11200.00	290.85	304.012		304.42	0.001683	6.62	4121.60	696.61	0.35
Step 2	49951.02	1%	Exist	11200.00	290.85	304.012		304.42	0.001683	6.62	4121.60	696.61	0.35
Step 2	49951.02	1%	Prop	11200.00	290.85	304.012		304.42	0.001683	6.62	4121.60	696.61	0.35
Step 2	49613.97	1%	FEMA	11200.00	290.36	303.719		304.07	0.001294	5.93	4434.27	749.44	0.31
Step 2	49613.97	1%	Temp	11200.00	290.36	303.719		304.07	0.001294	5.93	4434.27	749.44	0.31
Step 2	49613.97	1%	Exist	11200.00	290.36	303.719		304.07	0.001294	5.93	4434.27	749.44	0.31
Step 2	49613.97	1%	Prop	11200.00	290.36	303.719		304.07	0.001294	5.93	4434.27	749.44	0.31
Step 2	49438.25	1%	FEMA	11200.00	289.80	303.314	300.35	303.80	0.001816	7.54	4146.37	736.39	0.37
Step 2	49438.25	1%	Temp	11200.00	289.80	303.314	300.35	303.80	0.001816	7.54	4146.37	736.39	0.37
Step 2	49438.25	1%	Exist	11200.00	289.80	303.314	300.35	303.80	0.001816	7.54	4146.37	736.39	0.37
Step 2	49438.25	1%	Prop	11200.00	289.80	303.314	300.35	303.80	0.001816	7.54	4146.37	736.39	0.37
Step 2	49298.45	1%	FEMA	11200.00	289.36	303.071		303.60	0.001862	7.69	3788.31	599.28	0.38
Step 2	49298.45	1%	Temp	11200.00	289.36	303.071		303.60	0.001862	7.69	3788.31	599.28	0.38
Step 2	49298.45	1%	Exist	11200.00	289.36	303.071		303.60	0.001862	7.69	3788.31	599.28	0.38
Step 2	49298.45	1%	Prop	11200.00	289.36	303.071		303.60	0.001862	7.69	3788.31	599.28	0.38
Step 2	49095.59	1%	FEMA	11200.00	288.69	302.666		303.29	0.002046	7.73	3162.78	483.18	0.39
Step 2	49095.59	1%	Temp	11200.00	288.69	302.666		303.29	0.002046	7.73	3162.78	483.18	0.39
Step 2	49095.59	1%	Exist	11200.00	288.69	302.666		303.29	0.002046	7.73	3162.78	483.18	0.39
Step 2	49095.59	1%	Prop	11200.00	288.69	302.666		303.29	0.002046	7.73	3162.78	483.18	0.39
Step 2	48751.7	1%	FEMA	11200.00	287.60	301.094		302.35	0.004028	10.60	2155.28	335.34	0.54

HEC-RAS River: Winters Run Reach: Step 2 Profile: 1% (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Step 2	48751.7	1%	Temp	11200.00	287.60	301.094		302.35	0.004028	10.60	2155.28	335.34	0.54
Step 2	48751.7	1%	Exist	11200.00	287.60	301.094		302.35	0.004028	10.60	2155.28	335.34	0.54
Step 2	48751.7	1%	Prop	11200.00	287.60	301.094		302.35	0.004028	10.60	2155.28	335.34	0.54
Step 2	48453.89	1%	FEMA	11200.00	286.64	300.985		301.46	0.001582	7.22	3383.08	370.78	0.35
Step 2	48453.89	1%	Temp	11200.00	286.64	300.985		301.46	0.001582	7.22	3383.08	370.78	0.35
Step 2	48453.89	1%	Exist	11200.00	286.64	300.985		301.46	0.001582	7.22	3383.08	370.78	0.35
Step 2	48453.89	1%	Prop	11200.00	286.64	300.985		301.46	0.001582	7.22	3383.08	370.78	0.35
Step 2	48003.08	1%	FEMA	11400.00	284.19	299.909		300.64	0.001824	8.38	2736.90	280.42	0.38
Step 2	48003.08	1%	Temp	11400.00	284.19	299.909		300.64	0.001824	8.38	2736.90	280.42	0.38
Step 2	48003.08	1%	Exist	11400.00	284.19	299.909		300.64	0.001824	8.38	2736.90	280.42	0.38
Step 2	48003.08	1%	Prop	11400.00	284.19	299.909		300.64	0.001824	8.38	2736.90	280.42	0.38
Step 2	47732.88	1%	FEMA	11400.00	283.32	298.387		299.90	0.003534	10.56	1590.18	191.17	0.52
Step 2	47732.88	1%	Temp	11400.00	283.32	298.387		299.90	0.003534	10.56	1590.18	191.17	0.52
Step 2	47732.88	1%	Exist	11400.00	283.32	298.387		299.90	0.003534	10.56	1590.18	191.17	0.52
Step 2	47732.88	1%	Prop	11400.00	283.32	298.387		299.90	0.003534	10.56	1590.18	191.17	0.52
Step 2	47501.97	1%	FEMA	11400.00	282.99	297.979		299.06	0.002781	9.21	2145.58	310.60	0.46
Step 2	47501.97	1%	Temp	11400.00	282.99	297.979		299.06	0.002781	9.21	2145.58	310.60	0.46
Step 2	47501.97	1%	Exist	11400.00	282.99	297.979		299.06	0.002781	9.21	2145.58	310.60	0.46
Step 2	47501.97	1%	Prop	11400.00	282.99	297.979		299.06	0.002781	9.21	2145.58	310.60	0.46
Step 2	47190.29	1%	FEMA	11400.00	282.59	297.228		298.15	0.002805	9.00	2530.34	411.51	0.45
Step 2	47190.29	1%	Temp	11400.00	282.59	297.228		298.15	0.002805	9.00	2530.34	411.51	0.45
Step 2	47190.29	1%	Exist	11400.00	282.59	297.228		298.15	0.002805	9.00	2530.34	411.51	0.45
Step 2	47190.29	1%	Prop	11400.00	282.59	297.228		298.15	0.002805	9.00	2530.34	411.51	0.45
Step 2	46811.26	1%	FEMA	11400.00	279.99	296.151		297.20	0.002204	9.39	2225.89	243.14	0.43
Step 2	46811.26	1%	Temp	11400.00	279.99	296.151		297.20	0.002204	9.39	2225.89	243.14	0.43
Step 2	46811.26	1%	Exist	11400.00	279.99	296.151		297.20	0.002204	9.39	2225.89	243.14	0.43
Step 2	46811.26	1%	Prop	11400.00	279.99	296.151		297.20	0.002204	9.39	2225.89	243.14	0.43
Step 2	46419.41	1%	FEMA	11400.00	279.94	295.493		296.36	0.001952	7.95	2230.55	320.08	0.39
Step 2	46419.41	1%	Temp	11400.00	279.94	295.493		296.36	0.001952	7.95	2230.55	320.08	0.39
Step 2	46419.41	1%	Exist	11400.00	279.94	295.493		296.36	0.001952	7.95	2230.55	320.08	0.39
Step 2	46419.41	1%	Prop	11400.00	279.94	295.493		296.36	0.001952	7.95	2230.55	320.08	0.39
Step 2	46141.52	1%	FEMA	11400.00	279.52	294.668		295.73	0.002513	8.85	2024.02	301.53	0.43
Step 2	46141.52	1%	Temp	11400.00	279.52	294.668		295.73	0.002513	8.85	2024.02	301.53	0.43
Step 2	46141.52	1%	Exist	11400.00	279.52	294.668		295.73	0.002513	8.85	2024.02	301.53	0.43
Step 2	46141.52	1%	Prop	11400.00	279.52	294.668		295.73	0.002513	8.85	2024.02	301.53	0.43
Step 2	45794.66	1%	FEMA	11400.00	278.51	293.903	289.29	294.93	0.002285	9.17	2393.30	339.44	0.43
Step 2	45794.66	1%	Temp	11400.00	278.51	293.903	289.29	294.93	0.002285	9.17	2393.30	339.44	0.43
Step 2	45794.66	1%	Exist	11400.00	278.51	293.903	289.29	294.93	0.002285	9.17	2393.30	339.44	0.43
Step 2	45794.66	1%	Prop	11400.00	278.51	293.903	289.29	294.93	0.002285	9.17	2393.30	339.44	0.43
Step 2	45341.54	1%	FEMA	12400.00	277.18	292.957		293.95	0.002244	8.84	2401.74	306.01	0.42
Step 2	45341.54	1%	Temp	12400.00	277.18	292.957		293.95	0.002244	8.84	2401.74	306.01	0.42
Step 2	45341.54	1%	Exist	12400.00	277.18	292.957		293.95	0.002244	8.84	2401.74	306.01	0.42
Step 2	45341.54	1%	Prop	12400.00	277.18	292.957		293.95	0.002244	8.84	2401.74	306.01	0.42
Step 2	44970.82	1%	FEMA	12400.00	276.09	291.363		292.89	0.003397	10.83	1883.67	240.79	0.52
Step 2	44970.82	1%	Temp	12400.00	276.09	291.363		292.89	0.003397	10.83	1883.67	240.79	0.52
Step 2	44970.82	1%	Exist	12400.00	276.09	291.363		292.89	0.003397	10.83	1883.67	240.79	0.52
Step 2	44970.82	1%	Prop	12400.00	276.09	291.363		292.89	0.003397	10.83	1883.67	240.79	0.52
Step 2	44713.84	1%	FEMA	12400.00	275.33	290.988		292.01	0.002443	9.24	2226.96	276.18	0.44
Step 2	44713.84	1%	Temp	12400.00	275.33	290.988		292.01	0.002443	9.24	2226.96	276.18	0.44
Step 2	44713.84	1%	Exist	12400.00	275.33	290.988		292.01	0.002443	9.24	2226.96	276.18	0.44
Step 2	44713.84	1%	Prop	12400.00	275.33	290.988		292.01	0.002443	9.24	2226.96	276.18	0.44
Step 2	44444.14	1%	FEMA	12400.00	274.54	288.934		291.04	0.005202	12.34	1480.16	203.97	0.62
Step 2	44444.14	1%	Temp	12400.00	274.54	288.934		291.04	0.005202	12.34	1480.16	203.97	0.62
Step 2	44444.14	1%	Exist	12400.00	274.54	288.934		291.04	0.005202	12.34	1480.16	203.97	0.62
Step 2	44444.14	1%	Prop	12400.00	274.54	288.934		291.04	0.005202	12.34	1480.16	203.97	0.62
Step 2	44183.21	1%	FEMA	12400.00	273.78	287.972		289.66	0.004453	11.34	1758.66	260.80	0.57
Step 2	44183.21	1%	Temp	12400.00	273.78	287.972		289.66	0.004453	11.34	1758.66	260.80	0.57
Step 2	44183.21	1%	Exist	12400.00	273.78	287.972		289.66	0.004453	11.34	1758.66	260.80	0.57
Step 2	44183.21	1%	Prop	12400.00	273.78	287.972		289.66	0.004453	11.34	1758.66	260.80	0.57
Step 2	43916.01	1%	FEMA	13300.00	273.01	287.283		288.60	0.002997	9.51	1766.02	202.75	0.48
Step 2	43916.01	1%	Temp	13300.00	273.01	287.283		288.60	0.002997	9.51	1766.02	202.75	0.48
Step 2	43916.01	1%	Exist	13300.00	273.01	287.283		288.60	0.002997	9.51	1766.02	202.75	0.48
Step 2	43916.01	1%	Prop	13300.00	273.01	287.283		288.60	0.002997	9.51	1766.02	202.75	0.48
Step 2	43582.02	1%	FEMA	13300.00	272.02	285.749		287.35	0.004732	11.30	2004.90	289.84	0.59
Step 2	43582.02	1%	Temp	13300.00	272.02	285.749		287.35	0.004732	11.30	2004.90	289.84	0.59
Step 2	43582.02	1%	Exist	13300.00	272.02	285.749		287.35	0.004732	11.30	2004.90	289.84	0.59
Step 2	43582.02	1%	Prop	13300.00	272.02	285.749		287.35	0.004732	11.30	2004.90	289.84	0.59
Step 2	43303.92	1%	FEMA	13300.00	271.20	284.728		286.05	0.004316	10.58	2116.73	304.86	0.56
Step 2	43303.92	1%	Temp	13300.00	271.20	284.728		286.05	0.004316	10.58	2116.73	304.86	0.56
Step 2	43303.92	1%	Exist	13300.00	271.20	284.728		286.05	0.004316	10.58	2116.73	304.86	0.56
Step 2	43303.92	1%	Prop	13300.00	271.20	284.728		286.05	0.004316	10.58	2116.73	304.86	0.56

HEC-RAS River: Winters Run Reach: Step 2 Profile: 1% (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Step 2	42957.81	1%	FEMA	13300.00	270.19	283.530		284.74	0.004021	10.26	1833.40	299.39	0.53
Step 2	42957.81	1%	Temp	13300.00	270.19	283.530		284.74	0.004021	10.26	1833.40	299.39	0.53
Step 2	42957.81	1%	Exist	13300.00	270.19	283.530		284.74	0.004021	10.26	1833.40	299.39	0.53
Step 2	42957.81	1%	Prop	13300.00	270.19	283.530		284.74	0.004021	10.26	1833.40	299.39	0.53
Step 2	42235.91	1%	FEMA	13300.00	266.57	282.988		283.29	0.000871	5.37	3677.34	425.47	0.26
Step 2	42235.91	1%	Temp	13300.00	266.57	282.988		283.29	0.000871	5.37	3677.34	425.47	0.26
Step 2	42235.91	1%	Exist	13300.00	266.57	282.988		283.29	0.000871	5.37	3677.34	425.47	0.26
Step 2	42235.91	1%	Prop	13300.00	266.57	282.988		283.29	0.000871	5.37	3677.34	425.47	0.26
Step 2	41999.72	1%	FEMA	13300.00	265.71	282.630		283.01	0.001169	6.38	4987.22	657.38	0.30
Step 2	41999.72	1%	Temp	13300.00	265.71	282.630		283.01	0.001169	6.38	4987.22	657.38	0.30
Step 2	41999.72	1%	Exist	13300.00	265.71	282.630		283.01	0.001169	6.38	4987.22	657.38	0.30
Step 2	41999.72	1%	Prop	13300.00	265.71	282.630		283.01	0.001169	6.38	4987.22	657.38	0.30
Step 2	41598.61	1%	FEMA	13300.00	263.56	280.589		282.17	0.002998	10.49	1732.29	202.44	0.49
Step 2	41598.61	1%	Temp	13300.00	263.56	280.589		282.17	0.002998	10.49	1732.29	202.44	0.49
Step 2	41598.61	1%	Exist	13300.00	263.56	280.589		282.17	0.002998	10.49	1732.29	202.44	0.49
Step 2	41598.61	1%	Prop	13300.00	263.56	280.589		282.17	0.002998	10.49	1732.29	202.44	0.49
Step 2	41313.82	1%	FEMA	13300.00	263.02	278.865		281.03	0.004925	12.37	1500.50	195.02	0.61
Step 2	41313.82	1%	Temp	13300.00	263.02	278.865		281.03	0.004925	12.37	1500.50	195.02	0.61
Step 2	41313.82	1%	Exist	13300.00	263.02	278.865		281.03	0.004925	12.37	1500.50	195.02	0.61
Step 2	41313.82	1%	Prop	13300.00	263.02	278.865		281.03	0.004925	12.37	1500.50	195.02	0.61
Step 2	40924.63	1%	FEMA	13300.00	261.02	277.377		279.25	0.003926	11.44	1566.95	185.13	0.55
Step 2	40924.63	1%	Temp	13300.00	261.02	277.377		279.25	0.003926	11.44	1566.95	185.13	0.55
Step 2	40924.63	1%	Exist	13300.00	261.02	277.377		279.25	0.003926	11.44	1566.95	185.13	0.55
Step 2	40924.63	1%	Prop	13300.00	261.02	277.377		279.25	0.003926	11.44	1566.95	185.13	0.55
Step 2	40544	1%	FEMA	13300.00	261.13	276.396		277.79	0.003135	9.78	1711.02	192.53	0.49
Step 2	40544	1%	Temp	13300.00	261.13	276.396		277.79	0.003135	9.78	1711.02	192.53	0.49
Step 2	40544	1%	Exist	13300.00	261.13	276.396		277.79	0.003135	9.78	1711.02	192.53	0.49
Step 2	40544	1%	Prop	13300.00	261.13	276.396		277.79	0.003135	9.78	1711.02	192.53	0.49
Step 2	40341.57	1%	FEMA	13300.00	260.69	273.842	272.77	276.68	0.008049	13.89	1216.90	192.47	0.76
Step 2	40341.57	1%	Temp	13300.00	260.69	273.842	272.77	276.68	0.008049	13.89	1216.90	192.47	0.76
Step 2	40341.57	1%	Exist	13300.00	260.69	273.842	272.77	276.68	0.008049	13.89	1216.90	192.47	0.76
Step 2	40341.57	1%	Prop	13300.00	260.69	273.842	272.77	276.68	0.008049	13.89	1216.90	192.47	0.76
Step 2	40103.12	1%	FEMA	13300.00	259.70	273.162		275.07	0.004112	11.37	1576.03	297.04	0.61
Step 2	40103.12	1%	Temp	13300.00	259.70	273.162		275.07	0.004112	11.37	1576.03	297.04	0.61
Step 2	40103.12	1%	Exist	13300.00	259.70	273.162		275.07	0.004112	11.37	1576.03	297.04	0.61
Step 2	40103.12	1%	Prop	13300.00	259.70	273.162		275.07	0.004112	11.37	1576.03	297.04	0.61
Step 2	39705.5	1%	FEMA	13300.00	257.77	271.273		273.37	0.004358	12.01	1481.79	222.07	0.63
Step 2	39705.5	1%	Temp	13300.00	257.77	271.273		273.37	0.004358	12.01	1481.79	222.07	0.63
Step 2	39705.5	1%	Exist	13300.00	257.77	271.273		273.37	0.004358	12.01	1481.79	222.07	0.63
Step 2	39705.5	1%	Prop	13300.00	257.77	271.273		273.37	0.004358	12.01	1481.79	222.07	0.63
Step 2	39429.45	1%	FEMA	13300.00	255.80	268.774	267.69	271.76	0.007499	15.62	1520.22	208.92	0.82
Step 2	39429.45	1%	Temp	13300.00	255.80	268.774	267.69	271.76	0.007499	15.62	1520.22	208.92	0.82
Step 2	39429.45	1%	Exist	13300.00	255.80	268.774	267.69	271.76	0.007499	15.62	1520.22	208.92	0.82
Step 2	39429.45	1%	Prop	13300.00	255.80	268.774	267.69	271.76	0.007499	15.62	1520.22	208.92	0.82
Step 2	39183.36	1%	FEMA	13300.00	255.09	269.623	262.31	270.07	0.000725	5.40	2603.58	341.18	0.27
Step 2	39183.36	1%	Temp	13300.00	255.09	269.623	262.31	270.07	0.000725	5.40	2603.58	341.18	0.27
Step 2	39183.36	1%	Exist	13300.00	255.09	269.623	262.31	270.07	0.000725	5.40	2603.58	341.18	0.27
Step 2	39183.36	1%	Prop	13300.00	255.09	269.623	262.31	270.07	0.000725	5.40	2603.58	341.18	0.27
Step 2	39070			Bridge									
Step 2	39044.97	1%	FEMA	13300.00	256.00	268.722	263.30	269.55	0.001564	7.31	1824.47	241.46	0.38
Step 2	39044.97	1%	Temp	13300.00	256.00	268.722	263.30	269.55	0.001564	7.31	1824.47	241.46	0.38
Step 2	39044.97	1%	Exist	13300.00	256.00	268.722	263.30	269.55	0.001564	7.31	1824.47	241.46	0.38
Step 2	39044.97	1%	Prop	13300.00	256.00	268.722	263.30	269.55	0.001564	7.31	1824.47	241.46	0.38
Step 2	38693.73	1%	FEMA	13400.00	251.54	264.872	263.53	267.90	0.006315	15.05	1380.49	187.87	0.77
Step 2	38693.73	1%	Temp	13400.00	251.54	264.872	263.53	267.90	0.006315	15.05	1380.49	187.87	0.77
Step 2	38693.73	1%	Exist	13400.00	251.54	264.872	263.53	267.90	0.006315	15.05	1380.49	187.87	0.77
Step 2	38693.73	1%	Prop	13400.00	251.54	264.872	263.53	267.90	0.006315	15.05	1380.49	187.87	0.77
Step 2	38521.9	1%	FEMA	13400.00	250.59	264.560		266.80	0.004127	12.70	1497.54	175.45	0.63
Step 2	38521.9	1%	Temp	13400.00	250.59	264.560		266.80	0.004127	12.70	1497.54	175.45	0.63
Step 2	38521.9	1%	Exist	13400.00	250.59	264.560		266.80	0.004127	12.70	1497.54	175.45	0.63
Step 2	38521.9	1%	Prop	13400.00	250.59	264.560		266.80	0.004127	12.70	1497.54	175.45	0.63
Step 2	38268.25	1%	FEMA	13400.00	249.04	263.952		265.78	0.003080	11.26	1583.67	174.87	0.55
Step 2	38268.25	1%	Temp	13400.00	249.04	263.952		265.78	0.003080	11.26	1583.67	174.87	0.55
Step 2	38268.25	1%	Exist	13400.00	249.04	263.952		265.78	0.003080	11.26	1583.67	174.87	0.55
Step 2	38268.25	1%	Prop	13400.00	249.04	263.952		265.78	0.003080	11.26	1583.67	174.87	0.55
Step 2	38026.75	1%	FEMA	13400.00	247.28	262.403	259.99	264.83	0.004402	13.38	1526.04	175.61	0.65
Step 2	38026.75	1%	Temp	13400.00	247.28	262.403	259.99	264.83	0.004402	13.38	1526.04	175.61	0.65
Step 2	38026.75	1%	Exist	13400.00	247.28	262.403	259.99	264.83	0.004402	13.38	1526.04	175.61	0.65
Step 2	38026.75	1%	Prop	13400.00	247.28	262.403	259.99	264.83	0.004402	13.38	1526.04	175.61	0.65
Step 2	37846.66	1%	FEMA	13400.00	247.20	259.485	259.49	263.56	0.009327	16.81	1085.55	165.25	0.91
Step 2	37846.66	1%	Temp	13400.00	247.20	259.485	259.49	263.56	0.009327	16.81	1085.55	165.25	0.91

HEC-RAS River: Winters Run Reach: Step 2 Profile: 1% (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Step 2	37846.66	1%	Exist	13400.00	247.20	259.485	259.49	263.56	0.009327	16.81	1085.55	165.25	0.91
Step 2	37846.66	1%	Prop	13400.00	247.20	259.485	259.49	263.56	0.009327	16.81	1085.55	165.25	0.91
Step 2	37609.1	1%	FEMA	13400.00	246.27	259.058		260.00	0.003196	9.84	2175.10	399.94	0.54
Step 2	37609.1	1%	Temp	13400.00	246.27	259.058		260.00	0.003196	9.84	2175.10	399.94	0.54
Step 2	37609.1	1%	Exist	13400.00	246.27	259.058		260.00	0.003196	9.84	2175.10	399.94	0.54
Step 2	37609.1	1%	Prop	13400.00	246.27	259.058		260.00	0.003196	9.84	2175.10	399.94	0.54
Step 2	37243.48	1%	FEMA	13400.00	245.56	258.549		259.04	0.001681	7.84	3227.35	576.09	0.40
Step 2	37243.48	1%	Temp	13400.00	245.56	258.549		259.04	0.001681	7.84	3227.35	576.09	0.40
Step 2	37243.48	1%	Exist	13400.00	245.56	258.549		259.04	0.001681	7.84	3227.35	576.09	0.40
Step 2	37243.48	1%	Prop	13400.00	245.56	258.549		259.04	0.001681	7.84	3227.35	576.09	0.40
Step 2	36979.22	1%	FEMA	15200.00	245.15	258.298		258.63	0.001322	6.21	3739.77	702.38	0.34
Step 2	36979.22	1%	Temp	15200.00	245.15	258.298		258.63	0.001322	6.21	3739.77	702.38	0.34
Step 2	36979.22	1%	Exist	15200.00	245.15	258.298		258.63	0.001322	6.21	3739.77	702.38	0.34
Step 2	36979.22	1%	Prop	15200.00	245.15	258.298		258.63	0.001322	6.21	3739.77	702.38	0.34
Step 2	36760.16	1%	FEMA	15200.00	244.93	258.038		258.39	0.001120	6.52	3749.88	602.87	0.33
Step 2	36760.16	1%	Temp	15200.00	244.93	258.038		258.39	0.001120	6.52	3749.88	602.87	0.33
Step 2	36760.16	1%	Exist	15200.00	244.93	258.038		258.39	0.001120	6.52	3749.88	602.87	0.33
Step 2	36760.16	1%	Prop	15200.00	244.93	258.038		258.39	0.001120	6.52	3749.88	602.87	0.33
Step 2	36371.19	1%	FEMA	15200.00	242.27	257.649	251.42	258.04	0.000800	5.92	3351.93	361.96	0.28
Step 2	36371.19	1%	Temp	15200.00	242.27	257.649	251.42	258.04	0.000800	5.92	3351.93	361.96	0.28
Step 2	36371.19	1%	Exist	15200.00	242.27	257.649	251.42	258.04	0.000800	5.92	3351.93	361.96	0.28
Step 2	36371.19	1%	Prop	15200.00	242.27	257.649	251.42	258.04	0.000800	5.92	3351.93	361.96	0.28
Step 2	35826.58	1%	FEMA	15200.00	238.99	256.691	252.04	257.40	0.001359	8.15	2945.08	434.95	0.37
Step 2	35826.58	1%	Temp	15200.00	238.99	256.691	252.04	257.40	0.001359	8.15	2945.08	434.95	0.37
Step 2	35826.58	1%	Exist	15200.00	238.99	256.691	252.04	257.40	0.001359	8.15	2945.08	434.95	0.37
Step 2	35826.58	1%	Prop	15200.00	238.99	256.691	252.04	257.40	0.001359	8.15	2945.08	434.95	0.37
Step 2	35760			Bridge									
Step 2	35757.46	1%	FEMA	15200.00	237.64	252.990	252.99	255.74	0.004355	14.45	1501.05	296.35	0.73
Step 2	35757.46	1%	Temp	15200.00	237.64	252.990	252.99	255.74	0.004355	14.45	1501.05	296.35	0.73
Step 2	35757.46	1%	Exist	15200.00	237.64	252.990	252.99	255.74	0.004355	14.45	1501.05	296.35	0.73
Step 2	35757.46	1%	Prop	15200.00	237.64	252.990	252.99	255.74	0.004355	14.45	1501.05	296.35	0.73
Step 2	35492.88	1%	FEMA	15200.00	236.45	251.924	250.84	253.99	0.003335	12.83	1661.63	263.80	0.64
Step 2	35492.88	1%	Temp	15200.00	236.45	251.924	250.84	253.99	0.003335	12.83	1661.63	263.80	0.64
Step 2	35492.88	1%	Exist	15200.00	236.45	251.924	250.84	253.99	0.003335	12.83	1661.63	263.80	0.64
Step 2	35492.88	1%	Prop	15200.00	236.45	251.924	250.84	253.99	0.003335	12.83	1661.63	263.80	0.64
Step 2	35060.04	1%	FEMA	15200.00	236.19	248.873	248.87	252.08	0.005292	15.28	1279.12	220.60	0.79
Step 2	35060.04	1%	Temp	15200.00	236.19	248.873	248.87	252.08	0.005292	15.28	1279.12	220.60	0.79
Step 2	35060.04	1%	Exist	15200.00	236.19	248.873	248.87	252.08	0.005292	15.28	1279.12	220.60	0.79
Step 2	35060.04	1%	Prop	15200.00	236.19	248.873	248.87	252.08	0.005292	15.28	1279.12	220.60	0.79
Step 2	34633.1	1%	FEMA	15200.00	232.98	246.030	245.26	248.98	0.004487	14.47	1324.36	209.57	0.74
Step 2	34633.1	1%	Temp	15200.00	232.98	246.030	245.26	248.98	0.004487	14.47	1324.36	209.57	0.74
Step 2	34633.1	1%	Exist	15200.00	232.98	246.030	245.26	248.98	0.004487	14.47	1324.36	209.57	0.74
Step 2	34633.1	1%	Prop	15200.00	232.98	246.030	245.26	248.98	0.004487	14.47	1324.36	209.57	0.74
Step 2	34347.91	1%	FEMA	15200.00	230.69	245.299	242.51	247.75	0.003329	12.90	1319.78	294.64	0.63
Step 2	34347.91	1%	Temp	15200.00	230.69	245.299	242.51	247.75	0.003329	12.90	1319.78	294.64	0.63
Step 2	34347.91	1%	Exist	15200.00	230.69	245.299	242.51	247.75	0.003329	12.90	1319.78	294.64	0.63
Step 2	34347.91	1%	Prop	15200.00	230.69	245.299	242.51	247.75	0.003329	12.90	1319.78	294.64	0.63
Step 2	33913.79	1%	FEMA	15200.00	228.25	243.121	241.83	246.04	0.004457	14.61	1617.15	218.35	0.73
Step 2	33913.79	1%	Temp	15200.00	228.25	243.121	241.83	246.04	0.004457	14.61	1617.15	218.35	0.73
Step 2	33913.79	1%	Exist	15200.00	228.25	243.121	241.83	246.04	0.004457	14.61	1617.15	218.35	0.73
Step 2	33913.79	1%	Prop	15200.00	228.25	243.121	241.83	246.04	0.004457	14.61	1617.15	218.35	0.73
Step 2	33648.09	1%	FEMA	15200.00	226.75	242.902		244.90	0.002474	12.23	2098.11	236.88	0.55
Step 2	33648.09	1%	Temp	15200.00	226.75	242.902		244.90	0.002474	12.23	2098.11	236.88	0.55
Step 2	33648.09	1%	Exist	15200.00	226.75	242.902		244.90	0.002474	12.23	2098.11	236.88	0.55
Step 2	33648.09	1%	Prop	15200.00	226.75	242.902		244.90	0.002474	12.23	2098.11	236.88	0.55
Step 2	33440.67	1%	FEMA	15200.00	225.59	242.612		244.36	0.002018	11.32	2144.02	219.64	0.50
Step 2	33440.67	1%	Temp	15200.00	225.59	242.612		244.36	0.002018	11.32	2144.02	219.64	0.50
Step 2	33440.67	1%	Exist	15200.00	225.59	242.612		244.36	0.002018	11.32	2144.02	219.64	0.50
Step 2	33440.67	1%	Prop	15200.00	225.59	242.612		244.36	0.002018	11.32	2144.02	219.64	0.50
Step 2	33105.82	1%	FEMA	15200.00	224.19	238.422	238.42	242.96	0.006835	18.15	1352.76	188.59	0.90
Step 2	33105.82	1%	Temp	15200.00	224.19	238.422	238.42	242.96	0.006835	18.15	1352.76	188.59	0.90
Step 2	33105.82	1%	Exist	15200.00	224.19	238.422	238.42	242.96	0.006835	18.15	1352.76	188.59	0.90
Step 2	33105.82	1%	Prop	15200.00	224.19	238.422	238.42	242.96	0.006835	18.15	1352.76	188.59	0.90
Step 2	32880.86	1%	FEMA	15200.00	222.94	235.076	235.08	238.81	0.006565	16.26	1276.25	207.69	0.87
Step 2	32880.86	1%	Temp	15200.00	222.94	235.076	235.08	238.81	0.006565	16.26	1276.25	207.69	0.87
Step 2	32880.86	1%	Exist	15200.00	222.94	235.076	235.08	238.81	0.006565	16.26	1276.25	207.69	0.87
Step 2	32880.86	1%	Prop	15200.00	222.94	235.076	235.08	238.81	0.006565	16.26	1276.25	207.69	0.87
Step 2	32589.3	1%	FEMA	15200.00	221.47	234.267	233.59	236.45	0.004365	13.14	1917.28	357.81	0.72
Step 2	32589.3	1%	Temp	15200.00	221.47	234.267	233.59	236.45	0.004365	13.14	1917.28	357.81	0.72
Step 2	32589.3	1%	Exist	15200.00	221.47	234.267	233.59	236.45	0.004365	13.14	1917.28	357.81	0.72
Step 2	32589.3	1%	Prop	15200.00	221.47	234.267	233.59	236.45	0.004365	13.14	1917.28	357.81	0.72

HEC-RAS   River: Winters Run   Reach: Step 2   Profile: 1% (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Step 2	32364.43	1%	FEMA	15200.00	219.54	232.210	232.21	235.24	0.005751	15.53	1985.52	386.50	0.83
Step 2	32364.43	1%	Temp	15200.00	219.54	232.210	232.21	235.24	0.005751	15.53	1985.52	386.50	0.83
Step 2	32364.43	1%	Exist	15200.00	219.54	232.210	232.21	235.24	0.005751	15.53	1985.52	386.50	0.83
Step 2	32364.43	1%	Prop	15200.00	219.54	232.210	232.21	235.24	0.005751	15.53	1985.52	386.50	0.83
Step 2	32052.73	1%	FEMA	15200.00	217.36	229.014	228.69	232.18	0.006557	14.58	1353.36	363.88	0.85
Step 2	32052.73	1%	Temp	15200.00	217.36	229.014	228.69	232.18	0.006557	14.58	1353.36	363.88	0.85
Step 2	32052.73	1%	Exist	15200.00	217.36	229.014	228.69	232.18	0.006557	14.58	1353.36	363.88	0.85
Step 2	32052.73	1%	Prop	15200.00	217.36	229.014	228.69	232.18	0.006557	14.58	1353.36	363.88	0.85
Step 2	31732.23	1%	FEMA	15200.00	214.48	228.708		230.17	0.003600	10.11	2194.87	404.62	0.52
Step 2	31732.23	1%	Temp	15200.00	214.48	228.708		230.17	0.003600	10.11	2194.87	404.62	0.52
Step 2	31732.23	1%	Exist	15200.00	214.48	228.708		230.17	0.003600	10.11	2194.87	404.62	0.52
Step 2	31732.23	1%	Prop	15200.00	214.48	228.708		230.17	0.003600	10.11	2194.87	404.62	0.52
Step 2	31446.08	1%	FEMA	16500.00	213.56	228.340		229.36	0.001730	9.50	2637.97	415.49	0.47
Step 2	31446.08	1%	Temp	16500.00	213.56	228.340		229.36	0.001730	9.50	2637.97	415.49	0.47
Step 2	31446.08	1%	Exist	16500.00	213.56	228.340		229.36	0.001730	9.50	2637.97	415.49	0.47
Step 2	31446.08	1%	Prop	16500.00	213.56	228.340		229.36	0.001730	9.50	2637.97	415.49	0.47
Step 2	31143.84	1%	FEMA	16500.00	212.06	227.086		228.70	0.002366	11.41	2767.91	428.44	0.54
Step 2	31143.84	1%	Temp	16500.00	212.06	227.086		228.70	0.002366	11.41	2767.91	428.44	0.54
Step 2	31143.84	1%	Exist	16500.00	212.06	227.086		228.70	0.002366	11.41	2767.91	428.44	0.54
Step 2	31143.84	1%	Prop	16500.00	212.06	227.086		228.70	0.002366	11.41	2767.91	428.44	0.54
Step 2	30807.38	1%	FEMA	16500.00	212.26	223.945	223.94	227.32	0.006616	15.77	1786.05	331.34	0.87
Step 2	30807.38	1%	Temp	16500.00	212.26	223.945	223.94	227.32	0.006616	15.77	1786.05	331.34	0.87
Step 2	30807.38	1%	Exist	16500.00	212.26	223.945	223.94	227.32	0.006616	15.77	1786.05	331.34	0.87
Step 2	30807.38	1%	Prop	16500.00	212.26	223.945	223.94	227.32	0.006616	15.77	1786.05	331.34	0.87
Step 2	30379.15	1%	FEMA	16500.00	209.15	221.151	221.15	224.38	0.006296	15.51	1898.38	370.17	0.85
Step 2	30379.15	1%	Temp	16500.00	209.15	221.151	221.15	224.38	0.006296	15.51	1898.38	370.17	0.85
Step 2	30379.15	1%	Exist	16500.00	209.15	221.151	221.15	224.38	0.006296	15.51	1898.38	370.17	0.85
Step 2	30379.15	1%	Prop	16500.00	209.15	221.151	221.15	224.38	0.006296	15.51	1898.38	370.17	0.85
Step 2	29920.18	1%	FEMA	16500.00	206.57	218.087	217.88	219.76	0.004524	12.27	2643.44	681.71	0.71
Step 2	29920.18	1%	Temp	16500.00	206.57	218.087	217.88	219.76	0.004524	12.27	2643.44	681.71	0.71
Step 2	29920.18	1%	Exist	16500.00	206.57	218.087	217.88	219.76	0.004524	12.27	2643.44	681.71	0.71
Step 2	29920.18	1%	Prop	16500.00	206.57	218.087	217.88	219.76	0.004524	12.27	2643.44	681.71	0.71
Step 2	29461.16	1%	FEMA	16500.00	204.69	216.817	215.78	217.84	0.003833	10.74	3223.13	660.42	0.65
Step 2	29461.16	1%	Temp	16500.00	204.69	216.817	215.78	217.84	0.003833	10.74	3223.13	660.42	0.65
Step 2	29461.16	1%	Exist	16500.00	204.69	216.817	215.78	217.84	0.003833	10.74	3223.13	660.42	0.65
Step 2	29461.16	1%	Prop	16500.00	204.69	216.817	215.78	217.84	0.003833	10.74	3223.13	660.42	0.65
Step 2	29405.71	1%	FEMA	16500.00	204.19	216.694	213.97	217.59	0.002370	9.50	3678.47	869.49	0.52
Step 2	29405.71	1%	Temp	16500.00	204.19	216.694	213.97	217.59	0.002370	9.50	3678.47	869.49	0.52
Step 2	29405.71	1%	Exist	16500.00	204.19	216.694	213.97	217.59	0.002370	9.50	3678.47	869.49	0.52
Step 2	29405.71	1%	Prop	16500.00	204.19	216.694	213.97	217.59	0.002370	9.50	3678.47	869.49	0.52
Step 2	29036.83	1%	FEMA	17700.00	202.92	215.563	213.81	216.36	0.003699	10.06	2897.01	596.33	0.53
Step 2	29036.83	1%	Temp	17700.00	202.92	215.563	213.81	216.36	0.003699	10.06	2897.01	596.33	0.53
Step 2	29036.83	1%	Exist	17700.00	202.92	215.563	213.81	216.36	0.003699	10.06	2897.01	596.33	0.53
Step 2	29036.83	1%	Prop	17700.00	202.92	215.563	213.81	216.36	0.003699	10.06	2897.01	596.33	0.53
Step 2	28818.5	1%	FEMA	17700.00	201.42	215.391	212.33	215.86	0.001127	7.66	4593.53	899.47	0.38
Step 2	28818.5	1%	Temp	17700.00	201.42	215.391	212.33	215.86	0.001127	7.66	4593.53	899.47	0.38
Step 2	28818.5	1%	Exist	17700.00	201.42	215.391	212.33	215.86	0.001127	7.66	4593.53	899.47	0.38
Step 2	28818.5	1%	Prop	17700.00	201.42	215.391	212.33	215.86	0.001127	7.66	4593.53	899.47	0.38
Step 2	28532.16	1%	FEMA	17700.00	201.17	212.812	212.81	215.11	0.005206	14.52	2195.20	503.28	0.79
Step 2	28532.16	1%	Temp	17700.00	201.17	212.812	212.81	215.11	0.005206	14.52	2195.20	503.28	0.79
Step 2	28532.16	1%	Exist	17700.00	201.17	212.812	212.81	215.11	0.005206	14.52	2195.20	503.28	0.79
Step 2	28532.16	1%	Prop	17700.00	201.17	212.812	212.81	215.11	0.005206	14.52	2195.20	503.28	0.79
Step 2	28203.66	1%	FEMA	17700.00	200.04	210.359		211.52	0.004331	12.03	2883.95	749.54	0.70
Step 2	28203.66	1%	Temp	17700.00	200.04	210.374		211.52	0.004286	11.98	2895.67	749.79	0.70
Step 2	28203.66	1%	Exist	17700.00	200.04	210.371		211.52	0.004294	11.99	2893.57	749.75	0.70
Step 2	28203.66	1%	Prop	17700.00	200.04	210.371		211.52	0.004294	11.99	2893.54	749.75	0.70
Step 2	27730.86	1%	FEMA	17700.00	198.42	209.371	208.36	209.97	0.002332	8.80	4338.64	1131.54	0.52
Step 2	27730.86	1%	Temp	17700.00	198.42	209.443	208.36	210.01	0.002219	8.63	4420.41	1132.05	0.51
Step 2	27730.86	1%	Exist	17700.00	198.42	209.431	208.36	210.01	0.002237	8.66	4406.92	1131.97	0.51
Step 2	27730.86	1%	Prop	17700.00	198.42	209.431	208.36	210.01	0.002237	8.66	4406.75	1131.97	0.51
Step 2	27319.62	1%	FEMA	17700.00	196.99	209.457		209.53	0.000291	3.47	9166.95	1531.64	0.19
Step 2	27319.62	1%	Temp	17700.00	196.99	209.521		209.59	0.000282	3.43	9265.84	1536.04	0.19
Step 2	27319.62	1%	Exist	17700.00	196.99	209.511		209.58	0.000283	3.43	9249.41	1535.31	0.19
Step 2	27319.62	1%	Prop	17700.00	196.99	209.511		209.58	0.000283	3.43	9249.22	1535.30	0.19
Step 2	26954.57	1%	FEMA	17700.00	194.06	209.407		209.44	0.000102	2.32	14198.13	1689.04	0.11
Step 2	26954.57	1%	Temp	17700.00	194.06	209.473		209.50	0.000100	2.30	14309.14	1691.61	0.11
Step 2	26954.57	1%	Exist	17700.00	194.06	209.462		209.49	0.000101	2.30	14290.71	1691.19	0.11
Step 2	26954.57	1%	Prop	17700.00	194.06	209.462		209.49	0.000101	2.30	14290.51	1691.18	0.11
Step 2	26717.64	1%	FEMA	17700.00	191.79	209.362		209.41	0.000141	3.15	15470.08	1550.19	0.14
Step 2	26717.64	1%	Temp	17700.00	191.79	209.428		209.47	0.000138	3.13	15573.16	1551.45	0.14
Step 2	26717.64	1%	Exist	17700.00	191.79	209.417		209.46	0.000138	3.13	15556.07	1551.24	0.14

HEC-RAS River: Winters Run Reach: Step 2 Profile: 1% (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Step 2	26717.64	1%	Prop	17700.00	191.79	209.417		209.46	0.000138	3.13	15555.85	1551.24	0.14
Step 2	26347.09	1%	FEMA	17700.00	191.83	209.324	200.30	209.37	0.000099	2.70	16435.89	1474.94	0.12
Step 2	26347.09	1%	Temp	17700.00	191.83	209.391	200.30	209.44	0.000098	2.68	16534.86	1475.63	0.12
Step 2	26347.09	1%	Exist	17700.00	191.83	209.380	200.30	209.43	0.000098	2.68	16518.42	1475.51	0.12
Step 2	26347.09	1%	Prop	17700.00	191.83	209.380	200.30	209.43	0.000098	2.68	16518.21	1475.51	0.12
Step 2	25943.95	1%	FEMA	17700.00	189.69	209.164	198.79	209.30	0.000183	3.82	8523.35	1550.16	0.16
Step 2	25943.95	1%	Temp	17700.00	189.69	209.233	198.79	209.37	0.000180	3.80	8568.17	1551.77	0.16
Step 2	25943.95	1%	Exist	17700.00	189.69	209.221	198.79	209.35	0.000180	3.80	8560.73	1551.50	0.16
Step 2	25943.95	1%	Prop	17700.00	189.69	209.221	198.79	209.35	0.000180	3.80	8560.64	1551.50	0.16
Step 2	25807			Bridge									
Step 2	25712.36	1%	FEMA	17700.00	189.69	207.494	199.73	207.83	0.000443	5.61	4932.23	1612.26	0.25
Step 2	25712.36	1%	Temp	17700.00	189.69	207.587	199.73	207.92	0.000433	5.57	4969.54	1614.61	0.24
Step 2	25712.36	1%	Exist	17700.00	189.69	207.572	199.73	207.91	0.000434	5.58	4963.37	1614.22	0.24
Step 2	25712.36	1%	Prop	17700.00	189.69	207.571	199.73	207.91	0.000434	5.58	4963.29	1614.21	0.24
Step 2	25288.21	1%	FEMA	17700.00	186.19	207.412		207.64	0.000335	5.32	7037.36	780.51	0.22
Step 2	25288.21	1%	Temp	17700.00	186.19	207.508		207.74	0.000328	5.28	7087.52	781.25	0.21
Step 2	25288.21	1%	Exist	17700.00	186.19	207.492		207.72	0.000329	5.29	7079.22	781.12	0.21
Step 2	25288.21	1%	Prop	17700.00	186.19	207.492		207.72	0.000329	5.29	7079.10	781.12	0.21
Step 2	24922.38	1%	FEMA	17700.00	185.28	207.226		207.53	0.000284	5.12	6256.10	475.97	0.20
Step 2	24922.38	1%	Temp	17700.00	185.28	207.324		207.62	0.000279	5.09	6302.94	477.02	0.20
Step 2	24922.38	1%	Exist	17700.00	185.28	207.308		207.60	0.000280	5.10	6295.19	476.85	0.20
Step 2	24922.38	1%	Prop	17700.00	185.28	207.308		207.60	0.000280	5.10	6295.08	476.85	0.20
Step 2	24673.85	1%	FEMA	17700.00	184.67	207.023		207.43	0.000410	6.10	5247.10	399.31	0.24
Step 2	24673.85	1%	Temp	17700.00	184.67	207.125		207.53	0.000401	6.06	5288.05	400.21	0.24
Step 2	24673.85	1%	Exist	17700.00	184.67	207.108		207.51	0.000403	6.06	5281.27	400.06	0.24
Step 2	24673.85	1%	Prop	17700.00	184.67	207.108		207.51	0.000403	6.06	5281.18	400.06	0.24
Step 2	24310.02	1%	FEMA	17700.00	182.77	206.921		207.30	0.000318	5.64	5012.10	361.41	0.22
Step 2	24310.02	1%	Temp	17700.00	182.77	207.025		207.40	0.000314	5.59	5050.01	362.33	0.22
Step 2	24310.02	1%	Exist	17700.00	182.77	207.008		207.38	0.000312	5.61	5043.60	362.17	0.22
Step 2	24310.02	1%	Prop	17700.00	182.77	207.007		207.38	0.000312	5.61	5043.52	362.17	0.22
Step 2	23954.15	1%	FEMA	17700.00	182.89	206.882		207.17	0.000285	5.34	5540.76	380.61	0.20
Step 2	23954.15	1%	Temp	17700.00	182.89	206.987		207.27	0.000280	5.30	5580.71	381.28	0.20
Step 2	23954.15	1%	Exist	17700.00	182.89	206.970		207.25	0.000281	5.30	5574.37	381.18	0.20
Step 2	23954.15	1%	Prop	17700.00	182.89	206.970		207.25	0.000281	5.30	5574.28	381.18	0.20
Step 2	23815.18	1%	Temp	17700.00	181.09	206.919		207.22	0.000273	5.47	5640.30	411.94	0.20
Step 2	23815.18	1%	Exist	17700.00	181.09	206.902		207.21	0.000273	5.48	5633.36	411.74	0.20
Step 2	23815.18	1%	Prop	17700.00	181.09	206.902		207.21	0.000273	5.48	5633.27	411.73	0.20
Step 2	23744.4	1%	Temp	17700.00	181.93	206.866		207.20	0.000289	5.58	5542.35	481.95	0.21
Step 2	23744.4	1%	Exist	17700.00	181.93	206.849		207.18	0.000290	5.58	5535.14	424.21	0.21
Step 2	23744.4	1%	Prop	17700.00	181.93	206.848		207.18	0.000290	5.58	5535.03	481.60	0.21
Step 2	23685.14	1%	Temp	17700.00	180.64	206.915		207.16	0.000217	4.90	6388.67	452.98	0.18
Step 2	23685.14	1%	Exist	17700.00	180.64	206.829		207.17	0.000284	5.60	5697.42	428.63	0.21
Step 2	23685.14	1%	Prop	17700.00	180.64	206.837		207.16	0.000277	5.53	5753.42	428.71	0.20
Step 2	23628.97	1%	Temp	17700.00	181.20	206.840		207.14	0.000249	5.37	6214.78	449.27	0.19
Step 2	23628.97	1%	Exist	17700.00	181.20	206.837		207.14	0.000266	5.42	6139.36	449.24	0.20
Step 2	23628.97	1%	Prop	17700.00	181.20	206.841		207.14	0.000249	5.37	6215.62	449.29	0.19
Step 2	23542.47	1%	FEMA	17700.00	181.44	206.935	194.94	207.04	0.000120	3.60	10003.14	887.93	0.13
Step 2	23542.47	1%	Temp	17700.00	181.44	206.963	194.94	207.06	0.000119	3.59	10021.93	888.54	0.13
Step 2	23542.47	1%	Exist	17700.00	181.44	206.963	194.94	207.06	0.000119	3.59	10021.93	888.54	0.13
Step 2	23542.47	1%	Prop	17700.00	181.44	206.965	194.94	207.07	0.000119	3.59	10023.21	888.58	0.13
Step 2	23470.53	1%	Temp	17700.00	180.53	206.975	190.74	207.04	0.000054	2.52	11617.18	1155.35	0.09
Step 2	23470.53	1%	Exist	17700.00	180.53	206.975	190.74	207.04	0.000054	2.52	11617.18	1155.35	0.09
Step 2	23470.53	1%	Prop	17700.00	180.53	206.977	190.74	207.04	0.000054	2.52	11618.59	1155.37	0.09
Step 2	23384.9	1%	Temp	17700.00	180.24	206.894	193.84	207.03	0.000132	3.97	10443.96	1309.23	0.14
Step 2	23384.9	1%	Exist	17700.00	180.24	206.894	193.84	207.03	0.000132	3.97	10443.96	1309.23	0.14
Step 2	23384.9	1%	Prop	17700.00	180.24	206.895	193.84	207.03	0.000133	3.98	10432.99	1309.25	0.14
Step 2	23319.22	1%	Temp	17700.00	179.89	206.906	194.64	207.01	0.000108	3.50	9796.52	1392.70	0.13
Step 2	23319.22	1%	Exist	17700.00	179.89	206.906	194.64	207.01	0.000108	3.50	9796.52	1392.70	0.13
Step 2	23319.22	1%	Prop	17700.00	179.89	206.910	194.73	207.01	0.000111	3.45	9790.16	1392.76	0.12
Step 2	23243	1%	Temp	17700.00	183.00	206.861	196.37	207.00	0.000160	4.27	8372.58	1351.11	0.16
Step 2	23243	1%	Exist	17700.00	183.00	206.861	196.37	207.00	0.000160	4.27	8372.58	1351.11	0.16
Step 2	23243	1%	Prop	17700.00	183.00	206.861	196.37	207.00	0.000160	4.27	8372.58	1351.11	0.16
Step 2	23188.9	1%	FEMA	17700.00	180.00	206.859	191.55	206.99	0.000110	3.72	8471.65	616.88	0.13
Step 2	23188.9	1%	Temp	17700.00	180.00	206.859	191.55	206.99	0.000110	3.72	8471.65	616.88	0.13
Step 2	23188.9	1%	Exist	17700.00	180.00	206.859	191.55	206.99	0.000110	3.72	8471.65	616.88	0.13
Step 2	23188.9	1%	Prop	17700.00	180.00	206.859	191.55	206.99	0.000110	3.72	8471.65	616.88	0.13
Step 2	23123			Bridge									
Step 2	23066.57	1%	FEMA	17700.00	180.00	206.405	191.23	206.62	0.000151	4.43	8938.18	539.37	0.15

HEC-RAS   River: Winters Run   Reach: Step 2   Profile: 1% (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Step 2	23066.57	1%	Temp	17700.00	180.00	206.405	191.23	206.62	0.000151	4.43	8938.18	539.37	0.15
Step 2	23066.57	1%	Exist	17700.00	180.00	206.405	191.23	206.62	0.000151	4.43	8938.18	539.37	0.15
Step 2	23066.57	1%	Prop	17700.00	180.00	206.405	191.23	206.62	0.000151	4.43	8938.18	539.37	0.15
Step 2	22716.82	1%	FEMA	17700.00	173.79	206.002	187.30	206.48	0.000243	6.00	4611.84	540.48	0.19
Step 2	22716.82	1%	Temp	17700.00	173.79	206.002	187.30	206.48	0.000243	6.00	4611.84	540.48	0.19
Step 2	22716.82	1%	Exist	17700.00	173.79	206.002	187.30	206.48	0.000243	6.00	4611.84	540.48	0.19
Step 2	22716.82	1%	Prop	17700.00	173.79	206.002	187.30	206.48	0.000243	6.00	4611.84	540.48	0.19
Step 2	22641			Bridge									
Step 2	22575.76	1%	FEMA	17700.00	174.19	193.223	186.82	195.22	0.002505	11.33	1562.79	263.00	0.49
Step 2	22575.76	1%	Temp	17700.00	174.19	193.223	186.82	195.22	0.002505	11.33	1562.79	263.00	0.49
Step 2	22575.76	1%	Exist	17700.00	174.19	193.223	186.82	195.22	0.002505	11.33	1562.79	263.00	0.49
Step 2	22575.76	1%	Prop	17700.00	174.19	193.223	186.82	195.22	0.002505	11.33	1562.79	263.00	0.49
Step 2	22183.62	1%	FEMA	17700.00	176.40	191.869		193.98	0.003890	13.36	2593.15	318.92	0.63
Step 2	22183.62	1%	Temp	17700.00	176.40	191.869		193.98	0.003890	13.36	2593.15	318.92	0.63
Step 2	22183.62	1%	Exist	17700.00	176.40	191.869		193.98	0.003890	13.36	2593.15	318.92	0.63
Step 2	22183.62	1%	Prop	17700.00	176.40	191.869		193.98	0.003890	13.36	2593.15	318.92	0.63
Step 2	21765.15	1%	FEMA	17700.00	175.03	190.944		192.44	0.002742	11.25	3014.02	342.97	0.53
Step 2	21765.15	1%	Temp	17700.00	175.03	190.944		192.44	0.002742	11.25	3014.02	342.97	0.53
Step 2	21765.15	1%	Exist	17700.00	175.03	190.944		192.44	0.002742	11.25	3014.02	342.97	0.53
Step 2	21765.15	1%	Prop	17700.00	175.03	190.944		192.44	0.002742	11.25	3014.02	342.97	0.53
Step 2	21385.58	1%	FEMA	17700.00	173.78	189.912		191.36	0.002841	11.59	3342.08	393.98	0.53
Step 2	21385.58	1%	Temp	17700.00	173.78	189.912		191.36	0.002841	11.59	3342.08	393.98	0.53
Step 2	21385.58	1%	Exist	17700.00	173.78	189.912		191.36	0.002841	11.59	3342.08	393.98	0.53
Step 2	21385.58	1%	Prop	17700.00	173.78	189.912		191.36	0.002841	11.59	3342.08	393.98	0.53
Step 2	20947.18	1%	FEMA	17700.00	172.35	185.019	185.02	189.06	0.009410	17.57	1626.31	221.16	0.93
Step 2	20947.18	1%	Temp	17700.00	172.35	185.019	185.02	189.06	0.009410	17.57	1626.31	221.16	0.93
Step 2	20947.18	1%	Exist	17700.00	172.35	185.019	185.02	189.06	0.009410	17.57	1626.31	221.16	0.93
Step 2	20947.18	1%	Prop	17700.00	172.35	185.019	185.02	189.06	0.009410	17.57	1626.31	221.16	0.93
Step 2	20597.38	1%	FEMA	17700.00	171.19	184.020		186.05	0.003997	11.56	1714.26	195.32	0.61
Step 2	20597.38	1%	Temp	17700.00	171.19	184.020		186.05	0.003997	11.56	1714.26	195.32	0.61
Step 2	20597.38	1%	Exist	17700.00	171.19	184.020		186.05	0.003997	11.56	1714.26	195.32	0.61
Step 2	20597.38	1%	Prop	17700.00	171.19	184.020		186.05	0.003997	11.56	1714.26	195.32	0.61
Step 2	20324.68	1%	FEMA	17700.00	166.32	181.936		184.76	0.004934	13.82	1567.25	171.02	0.68
Step 2	20324.68	1%	Temp	17700.00	166.32	181.936		184.76	0.004934	13.82	1567.25	171.02	0.68
Step 2	20324.68	1%	Exist	17700.00	166.32	181.936		184.76	0.004934	13.82	1567.25	171.02	0.68
Step 2	20324.68	1%	Prop	17700.00	166.32	181.936		184.76	0.004934	13.82	1567.25	171.02	0.68
Step 2	19987.46	1%	FEMA	17700.00	165.34	180.222	177.77	183.12	0.004807	13.93	1595.58	211.60	0.68
Step 2	19987.46	1%	Temp	17700.00	165.34	180.222	177.77	183.12	0.004807	13.93	1595.58	211.60	0.68
Step 2	19987.46	1%	Exist	17700.00	165.34	180.222	177.77	183.12	0.004807	13.93	1595.58	211.60	0.68
Step 2	19987.46	1%	Prop	17700.00	165.34	180.222	177.77	183.12	0.004807	13.93	1595.58	211.60	0.68
Step 2	19571.85	1%	FEMA	17700.00	163.22	178.579		181.24	0.004033	13.39	1653.29	175.52	0.63
Step 2	19571.85	1%	Temp	17700.00	163.22	178.579		181.24	0.004033	13.39	1653.29	175.52	0.63
Step 2	19571.85	1%	Exist	17700.00	163.22	178.579		181.24	0.004033	13.39	1653.29	175.52	0.63
Step 2	19571.85	1%	Prop	17700.00	163.22	178.579		181.24	0.004033	13.39	1653.29	175.52	0.63
Step 2	19210.74	1%	FEMA	17700.00	161.57	177.851		179.81	0.002845	11.78	2121.41	217.81	0.54
Step 2	19210.74	1%	Temp	17700.00	161.57	177.851		179.81	0.002845	11.78	2121.41	217.81	0.54
Step 2	19210.74	1%	Exist	17700.00	161.57	177.851		179.81	0.002845	11.78	2121.41	217.81	0.54
Step 2	19210.74	1%	Prop	17700.00	161.57	177.851		179.81	0.002845	11.78	2121.41	217.81	0.54
Step 2	18760.41	1%	FEMA	17700.00	159.52	177.247		178.64	0.001790	9.87	2561.62	278.57	0.43
Step 2	18760.41	1%	Temp	17700.00	159.52	177.247		178.64	0.001790	9.87	2561.62	278.57	0.43
Step 2	18760.41	1%	Exist	17700.00	159.52	177.247		178.64	0.001790	9.87	2561.62	278.57	0.43
Step 2	18760.41	1%	Prop	17700.00	159.52	177.247		178.64	0.001790	9.87	2561.62	278.57	0.43
Step 2	18508.27	1%	FEMA	17700.00	159.58	176.751		178.16	0.001983	10.06	2608.64	279.44	0.45
Step 2	18508.27	1%	Temp	17700.00	159.58	176.751		178.16	0.001983	10.06	2608.64	279.44	0.45
Step 2	18508.27	1%	Exist	17700.00	159.58	176.751		178.16	0.001983	10.06	2608.64	279.44	0.45
Step 2	18508.27	1%	Prop	17700.00	159.58	176.751		178.16	0.001983	10.06	2608.64	279.44	0.45
Step 2	18249.71	1%	FEMA	17900.00	159.39	176.762		177.58	0.001275	7.85	3279.89	312.28	0.36
Step 2	18249.71	1%	Temp	17900.00	159.39	176.762		177.58	0.001275	7.85	3279.89	312.28	0.36
Step 2	18249.71	1%	Exist	17900.00	159.39	176.762		177.58	0.001275	7.85	3279.89	312.28	0.36
Step 2	18249.71	1%	Prop	17900.00	159.39	176.762		177.58	0.001275	7.85	3279.89	312.28	0.36
Step 2	17797.83	1%	FEMA	17900.00	158.27	175.249		176.70	0.002734	10.50	2579.15	245.17	0.47
Step 2	17797.83	1%	Temp	17900.00	158.27	175.249		176.70	0.002734	10.50	2579.15	245.17	0.47
Step 2	17797.83	1%	Exist	17900.00	158.27	175.249		176.70	0.002734	10.50	2579.15	245.17	0.47
Step 2	17797.83	1%	Prop	17900.00	158.27	175.249		176.70	0.002734	10.50	2579.15	245.17	0.47
Step 2	17395.32	1%	FEMA	17900.00	157.27	174.334		175.61	0.002459	9.94	2769.98	257.47	0.44
Step 2	17395.32	1%	Temp	17900.00	157.27	174.334		175.61	0.002459	9.94	2769.98	257.47	0.44
Step 2	17395.32	1%	Exist	17900.00	157.27	174.334		175.61	0.002459	9.94	2769.98	257.47	0.44
Step 2	17395.32	1%	Prop	17900.00	157.27	174.334		175.61	0.002459	9.94	2769.98	257.47	0.44
Step 2	17045.65	1%	FEMA	17900.00	156.41	172.406		174.46	0.003932	12.01	2091.21	259.28	0.55
Step 2	17045.65	1%	Temp	17900.00	156.41	172.406		174.46	0.003932	12.01	2091.21	259.28	0.55
Step 2	17045.65	1%	Exist	17900.00	156.41	172.406		174.46	0.003932	12.01	2091.21	259.28	0.55

HEC-RAS River: Winters Run Reach: Step 2 Profile: 1% (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Step 2	17045.65	1%	Prop	17900.00	156.41	172.406		174.46	0.003932	12.01	2091.21	259.28	0.55
Step 2	16745.88	1%	FEMA	17900.00	155.66	172.234		173.26	0.002316	9.31	3637.11	443.43	0.43
Step 2	16745.88	1%	Temp	17900.00	155.66	172.234		173.26	0.002316	9.31	3637.11	443.43	0.43
Step 2	16745.88	1%	Exist	17900.00	155.66	172.234		173.26	0.002316	9.31	3637.11	443.43	0.43
Step 2	16745.88	1%	Prop	17900.00	155.66	172.234		173.26	0.002316	9.31	3637.11	443.43	0.43
Step 2	16457.42	1%	FEMA	17900.00	154.94	171.042		172.42	0.003463	11.07	3363.65	465.05	0.51
Step 2	16457.42	1%	Temp	17900.00	154.94	171.042		172.42	0.003463	11.07	3363.65	465.05	0.51
Step 2	16457.42	1%	Exist	17900.00	154.94	171.042		172.42	0.003463	11.07	3363.65	465.05	0.51
Step 2	16457.42	1%	Prop	17900.00	154.94	171.042		172.42	0.003463	11.07	3363.65	465.05	0.51
Step 2	16033.69	1%	FEMA	17900.00	153.89	170.974		171.38	0.001050	6.37	5878.17	628.04	0.29
Step 2	16033.69	1%	Temp	17900.00	153.89	170.974		171.38	0.001050	6.37	5878.17	628.04	0.29
Step 2	16033.69	1%	Exist	17900.00	153.89	170.974		171.38	0.001050	6.37	5878.17	628.04	0.29
Step 2	16033.69	1%	Prop	17900.00	153.89	170.974		171.38	0.001050	6.37	5878.17	628.04	0.29
Step 2	15588.66	1%	FEMA	17900.00	152.07	170.037		170.83	0.001426	7.84	3498.02	305.51	0.34
Step 2	15588.66	1%	Temp	17900.00	152.07	170.037		170.83	0.001426	7.84	3498.02	305.51	0.34
Step 2	15588.66	1%	Exist	17900.00	152.07	170.037		170.83	0.001426	7.84	3498.02	305.51	0.34
Step 2	15588.66	1%	Prop	17900.00	152.07	170.037		170.83	0.001426	7.84	3498.02	305.51	0.34
Step 2	15176.39	1%	FEMA	17900.00	151.38	167.618		169.76	0.004343	12.60	2192.33	258.26	0.58
Step 2	15176.39	1%	Temp	17900.00	151.38	167.618		169.76	0.004343	12.60	2192.33	258.26	0.58
Step 2	15176.39	1%	Exist	17900.00	151.38	167.618		169.76	0.004343	12.60	2192.33	258.26	0.58
Step 2	15176.39	1%	Prop	17900.00	151.38	167.618		169.76	0.004343	12.60	2192.33	258.26	0.58
Step 2	14680.04	1%	FEMA	17900.00	151.38	166.793		167.87	0.002560	9.26	2519.16	285.02	0.45
Step 2	14680.04	1%	Temp	17900.00	151.38	166.793		167.87	0.002560	9.26	2519.16	285.02	0.45
Step 2	14680.04	1%	Exist	17900.00	151.38	166.793		167.87	0.002560	9.26	2519.16	285.02	0.45
Step 2	14680.04	1%	Prop	17900.00	151.38	166.793		167.87	0.002560	9.26	2519.16	285.02	0.45
Step 2	14315.87	1%	FEMA	17900.00	149.88	165.609		166.95	0.002708	9.81	2172.45	219.20	0.46
Step 2	14315.87	1%	Temp	17900.00	149.88	165.609		166.95	0.002708	9.81	2172.45	219.20	0.46
Step 2	14315.87	1%	Exist	17900.00	149.88	165.609		166.95	0.002708	9.81	2172.45	219.20	0.46
Step 2	14315.87	1%	Prop	17900.00	149.88	165.609		166.95	0.002708	9.81	2172.45	219.20	0.46
Step 2	13957.62	1%	FEMA	17900.00	147.55	164.572		166.00	0.002702	10.22	2666.65	323.60	0.47
Step 2	13957.62	1%	Temp	17900.00	147.55	164.572		166.00	0.002702	10.22	2666.65	323.60	0.47
Step 2	13957.62	1%	Exist	17900.00	147.55	164.572		166.00	0.002702	10.22	2666.65	323.60	0.47
Step 2	13957.62	1%	Prop	17900.00	147.55	164.572		166.00	0.002702	10.22	2666.65	323.60	0.47
Step 2	13600.28	1%	FEMA	17900.00	145.93	163.000		164.91	0.003414	11.49	2115.48	253.61	0.52
Step 2	13600.28	1%	Temp	17900.00	145.93	163.000		164.91	0.003414	11.49	2115.48	253.61	0.52
Step 2	13600.28	1%	Exist	17900.00	145.93	163.000		164.91	0.003414	11.49	2115.48	253.61	0.52
Step 2	13600.28	1%	Prop	17900.00	145.93	163.000		164.91	0.003414	11.49	2115.48	253.61	0.52
Step 2	13441.14	1%	FEMA	17900.00	145.31	162.072		164.29	0.004160	12.35	1673.72	161.85	0.57
Step 2	13441.14	1%	Temp	17900.00	145.31	162.072		164.29	0.004160	12.35	1673.72	161.85	0.57
Step 2	13441.14	1%	Exist	17900.00	145.31	162.072		164.29	0.004160	12.35	1673.72	161.85	0.57
Step 2	13441.14	1%	Prop	17900.00	145.31	162.072		164.29	0.004160	12.35	1673.72	161.85	0.57
Step 2	13108.55	1%	FEMA	17900.00	144.46	160.000		162.66	0.005500	14.06	1586.80	173.43	0.66
Step 2	13108.55	1%	Temp	17900.00	144.46	160.000		162.66	0.005500	14.06	1586.80	173.43	0.66
Step 2	13108.55	1%	Exist	17900.00	144.46	160.000		162.66	0.005500	14.06	1586.80	173.43	0.66
Step 2	13108.55	1%	Prop	17900.00	144.46	160.000		162.66	0.005500	14.06	1586.80	173.43	0.66
Step 2	12720.68	1%	FEMA	17900.00	141.62	160.770		161.27	0.001011	6.69	3612.28	382.36	0.29
Step 2	12720.68	1%	Temp	17900.00	141.62	160.770		161.27	0.001011	6.69	3612.28	382.36	0.29
Step 2	12720.68	1%	Exist	17900.00	141.62	160.770		161.27	0.001011	6.69	3612.28	382.36	0.29
Step 2	12720.68	1%	Prop	17900.00	141.62	160.770		161.27	0.001011	6.69	3612.28	382.36	0.29
Step 2	12358.88	1%	FEMA	17900.00	139.89	160.376		160.90	0.001022	6.99	3625.33	338.88	0.29
Step 2	12358.88	1%	Temp	17900.00	139.89	160.376		160.90	0.001022	6.99	3625.33	338.88	0.29
Step 2	12358.88	1%	Exist	17900.00	139.89	160.376		160.90	0.001022	6.99	3625.33	338.88	0.29
Step 2	12358.88	1%	Prop	17900.00	139.89	160.376		160.90	0.001022	6.99	3625.33	338.88	0.29
Step 2	12064.04	1%	FEMA	17900.00	137.69	158.924	154.55	160.28	0.002174	10.50	2409.37	258.74	0.42
Step 2	12064.04	1%	Temp	17900.00	137.69	158.924	154.55	160.28	0.002174	10.50	2409.37	258.74	0.42
Step 2	12064.04	1%	Exist	17900.00	137.69	158.924	154.55	160.28	0.002174	10.50	2409.37	258.74	0.42
Step 2	12064.04	1%	Prop	17900.00	137.69	158.924	154.55	160.28	0.002174	10.50	2409.37	258.74	0.42
Step 2	12020			Bridge									
Step 2	11998.71	1%	FEMA	17900.00	137.69	155.705	154.59	159.03	0.005855	15.33	1527.56	238.56	0.68
Step 2	11998.71	1%	Temp	17900.00	137.69	155.705	154.59	159.03	0.005855	15.33	1527.56	238.56	0.68
Step 2	11998.71	1%	Exist	17900.00	137.69	155.705	154.59	159.03	0.005855	15.33	1527.56	238.56	0.68
Step 2	11998.71	1%	Prop	17900.00	137.69	155.705	154.59	159.03	0.005855	15.33	1527.56	238.56	0.68
Step 2	11716.53	1%	FEMA	17900.00	135.69	155.674		156.95	0.002615	10.28	2508.52	325.29	0.44
Step 2	11716.53	1%	Temp	17900.00	135.69	155.674		156.95	0.002615	10.28	2508.52	325.29	0.44
Step 2	11716.53	1%	Exist	17900.00	135.69	155.674		156.95	0.002615	10.28	2508.52	325.29	0.44
Step 2	11716.53	1%	Prop	17900.00	135.69	155.674		156.95	0.002615	10.28	2508.52	325.29	0.44
Step 2	11482.87	1%	FEMA	17900.00	135.54	155.539	150.99	156.31	0.001737	8.38	3190.51	389.21	0.37
Step 2	11482.87	1%	Temp	17900.00	135.54	155.539	150.99	156.31	0.001737	8.38	3190.51	389.21	0.37
Step 2	11482.87	1%	Exist	17900.00	135.54	155.539	150.99	156.31	0.001737	8.38	3190.51	389.21	0.37
Step 2	11482.87	1%	Prop	17900.00	135.54	155.539	150.99	156.31	0.001737	8.38	3190.51	389.21	0.37

HEC-RAS River: Winters Run Reach: Step 2 Profile: 1% (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Step 2	11207.63	1%	FEMA	17900.00	134.64	155.486		155.88	0.000934	6.30	4298.16	452.35	0.27
Step 2	11207.63	1%	Temp	17900.00	134.64	155.486		155.88	0.000934	6.30	4298.16	452.35	0.27
Step 2	11207.63	1%	Exist	17900.00	134.64	155.486		155.88	0.000934	6.30	4298.16	452.35	0.27
Step 2	11207.63	1%	Prop	17900.00	134.64	155.486		155.88	0.000934	6.30	4298.16	452.35	0.27
Step 2	10753.45	1%	FEMA	17900.00	134.15	153.265		155.07	0.003561	11.56	2346.32	275.01	0.53
Step 2	10753.45	1%	Temp	17900.00	134.15	153.265		155.07	0.003561	11.56	2346.32	275.01	0.53
Step 2	10753.45	1%	Exist	17900.00	134.15	153.265		155.07	0.003561	11.56	2346.32	275.01	0.53
Step 2	10753.45	1%	Prop	17900.00	134.15	153.265		155.07	0.003561	11.56	2346.32	275.01	0.53
Step 2	10390.88	1%	FEMA	17900.00	133.27	151.989		153.58	0.004533	10.68	2104.25	203.69	0.49
Step 2	10390.88	1%	Temp	17900.00	133.27	151.989		153.58	0.004533	10.68	2104.25	203.69	0.49
Step 2	10390.88	1%	Exist	17900.00	133.27	151.989		153.58	0.004533	10.68	2104.25	203.69	0.49
Step 2	10390.88	1%	Prop	17900.00	133.27	151.989		153.58	0.004533	10.68	2104.25	203.69	0.49
Step 2	10119.41	1%	FEMA	17900.00	132.50	151.540		152.56	0.002358	10.03	3568.05	414.02	0.43
Step 2	10119.41	1%	Temp	17900.00	132.50	151.540		152.56	0.002358	10.03	3568.05	414.02	0.43
Step 2	10119.41	1%	Exist	17900.00	132.50	151.540		152.56	0.002358	10.03	3568.05	414.02	0.43
Step 2	10119.41	1%	Prop	17900.00	132.50	151.540		152.56	0.002358	10.03	3568.05	414.02	0.43
Step 2	9603.496	1%	FEMA	17900.00	130.88	150.229		151.47	0.001851	9.61	2776.63	241.74	0.40
Step 2	9603.496	1%	Temp	17900.00	130.88	150.229		151.47	0.001851	9.61	2776.63	241.74	0.40
Step 2	9603.496	1%	Exist	17900.00	130.88	150.229		151.47	0.001851	9.61	2776.63	241.74	0.40
Step 2	9603.496	1%	Prop	17900.00	130.88	150.229		151.47	0.001851	9.61	2776.63	241.74	0.40
Step 2	9154.891	1%	FEMA	17900.00	128.61	149.698		150.72	0.001345	8.61	2969.63	229.95	0.34
Step 2	9154.891	1%	Temp	17900.00	128.61	149.698		150.72	0.001345	8.61	2969.63	229.95	0.34
Step 2	9154.891	1%	Exist	17900.00	128.61	149.698		150.72	0.001345	8.61	2969.63	229.95	0.34
Step 2	9154.891	1%	Prop	17900.00	128.61	149.698		150.72	0.001345	8.61	2969.63	229.95	0.34
Step 2	8903.543	1%	FEMA	17900.00	128.89	148.934	140.88	150.25	0.001787	10.11	2791.65	237.26	0.40
Step 2	8903.543	1%	Temp	17900.00	128.89	148.934	140.88	150.25	0.001787	10.11	2791.65	237.26	0.40
Step 2	8903.543	1%	Exist	17900.00	128.89	148.934	140.88	150.25	0.001787	10.11	2791.65	237.26	0.40
Step 2	8903.543	1%	Prop	17900.00	128.89	148.934	140.88	150.25	0.001787	10.11	2791.65	237.26	0.40
Step 2	8851			Bridge									
Step 2	8807.032	1%	FEMA	17900.00	128.99	142.622	142.62	146.71	0.008943	16.98	1527.62	254.08	0.82
Step 2	8807.032	1%	Temp	17900.00	128.99	142.622	142.62	146.71	0.008943	16.98	1527.62	254.08	0.82
Step 2	8807.032	1%	Exist	17900.00	128.99	142.622	142.62	146.71	0.008943	16.98	1527.62	254.08	0.82
Step 2	8807.032	1%	Prop	17900.00	128.99	142.622	142.62	146.71	0.008943	16.98	1527.62	254.08	0.82
Step 2	8644.402	1%	FEMA	17900.00	127.86	140.843	140.02	144.52	0.008867	15.97	1427.35	183.09	0.81
Step 2	8644.402	1%	Temp	17900.00	127.86	140.843	140.02	144.52	0.008867	15.97	1427.35	183.09	0.81
Step 2	8644.402	1%	Exist	17900.00	127.86	140.843	140.02	144.52	0.008867	15.97	1427.35	183.09	0.81
Step 2	8644.402	1%	Prop	17900.00	127.86	140.843	140.02	144.52	0.008867	15.97	1427.35	183.09	0.81
Step 2	8247.414	1%	FEMA	17900.00	124.11	138.190	136.79	141.17	0.007143	14.22	1605.33	255.35	0.72
Step 2	8247.414	1%	Temp	17900.00	124.11	138.190	136.79	141.17	0.007143	14.22	1605.33	255.35	0.72
Step 2	8247.414	1%	Exist	17900.00	124.11	138.190	136.79	141.17	0.007143	14.22	1605.33	255.35	0.72
Step 2	8247.414	1%	Prop	17900.00	124.11	138.190	136.79	141.17	0.007143	14.22	1605.33	255.35	0.72
Step 2	7758.166	1%	FEMA	17900.00	121.69	135.965		138.05	0.004866	12.02	1888.27	240.10	0.60
Step 2	7758.166	1%	Temp	17900.00	121.69	135.965		138.05	0.004866	12.02	1888.27	240.10	0.60
Step 2	7758.166	1%	Exist	17900.00	121.69	135.965		138.05	0.004866	12.02	1888.27	240.10	0.60
Step 2	7758.166	1%	Prop	17900.00	121.69	135.965		138.05	0.004866	12.02	1888.27	240.10	0.60
Step 2	7329.719	1%	FEMA	17900.00	120.64	134.035		135.93	0.004781	11.24	1835.86	219.59	0.59
Step 2	7329.719	1%	Temp	17900.00	120.64	134.035		135.93	0.004781	11.24	1835.86	219.59	0.59
Step 2	7329.719	1%	Exist	17900.00	120.64	134.035		135.93	0.004781	11.24	1835.86	219.59	0.59
Step 2	7329.719	1%	Prop	17900.00	120.64	134.035		135.93	0.004781	11.24	1835.86	219.59	0.59
Step 2	6897.939	1%	FEMA	17900.00	117.11	132.923		134.23	0.002710	9.29	2157.35	213.60	0.45
Step 2	6897.939	1%	Temp	17900.00	117.11	132.923		134.23	0.002710	9.29	2157.35	213.60	0.45
Step 2	6897.939	1%	Exist	17900.00	117.11	132.923		134.23	0.002710	9.29	2157.35	213.60	0.45
Step 2	6897.939	1%	Prop	17900.00	117.11	132.923		134.23	0.002710	9.29	2157.35	213.60	0.45
Step 2	6332.211	1%	FEMA	17900.00	115.19	132.302		133.07	0.001240	7.31	2807.55	234.53	0.32
Step 2	6332.211	1%	Temp	17900.00	115.19	132.302		133.07	0.001240	7.31	2807.55	234.53	0.32
Step 2	6332.211	1%	Exist	17900.00	115.19	132.302		133.07	0.001240	7.31	2807.55	234.53	0.32
Step 2	6332.211	1%	Prop	17900.00	115.19	132.302		133.07	0.001240	7.31	2807.55	234.53	0.32
Step 2	5992.891	1%	FEMA	17900.00	114.37	131.299		132.43	0.002748	9.42	2444.98	278.33	0.45
Step 2	5992.891	1%	Temp	17900.00	114.37	131.299		132.43	0.002748	9.42	2444.98	278.33	0.45
Step 2	5992.891	1%	Exist	17900.00	114.37	131.299		132.43	0.002748	9.42	2444.98	278.33	0.45
Step 2	5992.891	1%	Prop	17900.00	114.37	131.299		132.43	0.002748	9.42	2444.98	278.33	0.45
Step 2	5581.458	1%	FEMA	17900.00	113.35	129.133		130.98	0.004107	11.56	1891.11	229.18	0.55
Step 2	5581.458	1%	Temp	17900.00	113.35	129.133		130.98	0.004107	11.56	1891.11	229.18	0.55
Step 2	5581.458	1%	Exist	17900.00	113.35	129.133		130.98	0.004107	11.56	1891.11	229.18	0.55
Step 2	5581.458	1%	Prop	17900.00	113.35	129.133		130.98	0.004107	11.56	1891.11	229.18	0.55
Step 2	5165.408	1%	FEMA	17900.00	112.09	125.932	125.14	128.70	0.006996	13.98	1575.21	253.34	0.70
Step 2	5165.408	1%	Temp	17900.00	112.09	125.932	125.14	128.70	0.006996	13.98	1575.21	253.34	0.70
Step 2	5165.408	1%	Exist	17900.00	112.09	125.932	125.14	128.70	0.006996	13.98	1575.21	253.34	0.70
Step 2	5165.408	1%	Prop	17900.00	112.09	125.932	125.14	128.70	0.006996	13.98	1575.21	253.34	0.70
Step 2	4739.718	1%	FEMA	17900.00	111.29	125.310		126.54	0.002588	9.01	2179.14	298.34	0.43
Step 2	4739.718	1%	Temp	17900.00	111.29	125.310		126.54	0.002588	9.01	2179.14	298.34	0.43

HEC-RAS River: Winters Run Reach: Step 2 Profile: 1% (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Step 2	4739.718	1%	Exist	17900.00	111.29	125.310		126.54	0.002588	9.01	2179.14	298.34	0.43
Step 2	4739.718	1%	Prop	17900.00	111.29	125.310		126.54	0.002588	9.01	2179.14	298.34	0.43
Step 2	3937.103	1%	FEMA	17900.00	109.28	123.982		124.58	0.001906	7.41	4180.24	1026.07	0.37
Step 2	3937.103	1%	Temp	17900.00	109.28	123.982		124.58	0.001906	7.41	4180.24	1026.07	0.37
Step 2	3937.103	1%	Exist	17900.00	109.28	123.982		124.58	0.001906	7.41	4180.24	1026.07	0.37
Step 2	3937.103	1%	Prop	17900.00	109.28	123.982		124.58	0.001906	7.41	4180.24	1026.07	0.37
Step 2	3497.456	1%	FEMA	17900.00	106.84	121.132	117.45	123.19	0.004919	11.63	1743.88	412.03	0.59
Step 2	3497.456	1%	Temp	17900.00	106.84	121.132	117.45	123.19	0.004919	11.63	1743.88	412.03	0.59
Step 2	3497.456	1%	Exist	17900.00	106.84	121.132	117.45	123.19	0.004919	11.63	1743.88	412.03	0.59
Step 2	3497.456	1%	Prop	17900.00	106.84	121.132	117.45	123.19	0.004919	11.63	1743.88	412.03	0.59
Step 2	2714.094	1%	FEMA	17900.00	105.34	121.684		121.88	0.000360	3.57	5216.33	477.15	0.17
Step 2	2714.094	1%	Temp	17900.00	105.34	121.684		121.88	0.000360	3.57	5216.33	477.15	0.17
Step 2	2714.094	1%	Exist	17900.00	105.34	121.684		121.88	0.000360	3.57	5216.33	477.15	0.17
Step 2	2714.094	1%	Prop	17900.00	105.34	121.684		121.88	0.000360	3.57	5216.33	477.15	0.17
Step 2	2382.713	1%	FEMA	17900.00	104.52	121.578		121.76	0.000334	3.44	5203.38	384.95	0.16
Step 2	2382.713	1%	Temp	17900.00	104.52	121.578		121.76	0.000334	3.44	5203.38	384.95	0.16
Step 2	2382.713	1%	Exist	17900.00	104.52	121.578		121.76	0.000334	3.44	5203.38	384.95	0.16
Step 2	2382.713	1%	Prop	17900.00	104.52	121.578		121.76	0.000334	3.44	5203.38	384.95	0.16
Step 2	2012.109	1%	FEMA	17900.00	103.61	121.447		121.64	0.000306	3.55	5055.62	335.38	0.16
Step 2	2012.109	1%	Temp	17900.00	103.61	121.447		121.64	0.000306	3.55	5055.62	335.38	0.16
Step 2	2012.109	1%	Exist	17900.00	103.61	121.447		121.64	0.000306	3.55	5055.62	335.38	0.16
Step 2	2012.109	1%	Prop	17900.00	103.61	121.447		121.64	0.000306	3.55	5055.62	335.38	0.16
Step 2	1755.161	1%	FEMA	17900.00	102.99	121.363		121.57	0.000283	3.62	4959.17	287.58	0.15
Step 2	1755.161	1%	Temp	17900.00	102.99	121.363		121.57	0.000283	3.62	4959.17	287.58	0.15
Step 2	1755.161	1%	Exist	17900.00	102.99	121.363		121.57	0.000283	3.62	4959.17	287.58	0.15
Step 2	1755.161	1%	Prop	17900.00	102.99	121.363		121.57	0.000283	3.62	4959.17	287.58	0.15
Step 2	1451.106	1%	FEMA	17900.00	102.24	121.334		121.48	0.000203	3.03	6022.16	407.28	0.13
Step 2	1451.106	1%	Temp	17900.00	102.24	121.334		121.48	0.000203	3.03	6022.16	407.28	0.13
Step 2	1451.106	1%	Exist	17900.00	102.24	121.334		121.48	0.000203	3.03	6022.16	407.28	0.13
Step 2	1451.106	1%	Prop	17900.00	102.24	121.334		121.48	0.000203	3.03	6022.16	407.28	0.13
Step 2	1099.64	1%	FEMA	17900.00	101.38	121.282		121.41	0.000159	2.84	6340.64	364.40	0.12
Step 2	1099.64	1%	Temp	17900.00	101.38	121.282		121.41	0.000159	2.84	6340.64	364.40	0.12
Step 2	1099.64	1%	Exist	17900.00	101.38	121.282		121.41	0.000159	2.84	6340.64	364.40	0.12
Step 2	1099.64	1%	Prop	17900.00	101.38	121.282		121.41	0.000159	2.84	6340.64	364.40	0.12
Step 2	841.9819	1%	FEMA	17900.00	100.75	121.256		121.37	0.000129	2.68	6781.39	386.41	0.11
Step 2	841.9819	1%	Temp	17900.00	100.75	121.256		121.37	0.000129	2.68	6781.39	386.41	0.11
Step 2	841.9819	1%	Exist	17900.00	100.75	121.256		121.37	0.000129	2.68	6781.39	386.41	0.11
Step 2	841.9819	1%	Prop	17900.00	100.75	121.256		121.37	0.000129	2.68	6781.39	386.41	0.11
Step 2	513.1667	1%	FEMA	17900.00	99.94	121.227		121.32	0.000107	2.50	7175.78	353.42	0.10
Step 2	513.1667	1%	Temp	17900.00	99.94	121.227		121.32	0.000107	2.50	7175.78	353.42	0.10
Step 2	513.1667	1%	Exist	17900.00	99.94	121.227		121.32	0.000107	2.50	7175.78	353.42	0.10
Step 2	513.1667	1%	Prop	17900.00	99.94	121.227		121.32	0.000107	2.50	7175.78	353.42	0.10
Step 2	290.7667	1%	FEMA	17900.00	99.40	121.204		121.30	0.000107	2.49	7204.08	343.01	0.09
Step 2	290.7667	1%	Temp	17900.00	99.40	121.204		121.30	0.000107	2.49	7204.08	343.01	0.09
Step 2	290.7667	1%	Exist	17900.00	99.40	121.204		121.30	0.000107	2.49	7204.08	343.01	0.09
Step 2	290.7667	1%	Prop	17900.00	99.40	121.204		121.30	0.000107	2.49	7204.08	343.01	0.09
Step 2	2.010118	1%	FEMA	17900.00	98.69	121.190	103.10	121.27	0.000079	2.24	8024.32	374.44	0.08
Step 2	2.010118	1%	Temp	17900.00	98.69	121.190	103.10	121.27	0.000079	2.24	8024.32	374.44	0.08
Step 2	2.010118	1%	Exist	17900.00	98.69	121.190	103.10	121.27	0.000079	2.24	8024.32	374.44	0.08
Step 2	2.010118	1%	Prop	17900.00	98.69	121.190	103.10	121.27	0.000079	2.24	8024.32	374.44	0.08

Chapter 3

3.1 Wetlands & Waterways Identification & Delineation Report

3.2 Stream Assessment Report

3.3 Threatened & Endangered Species Coordination
    3.3.1 Maryland DNR Coordination

    3.3.2 USFWS Coordination

    3.3.3 Phase I Bog Turtle Habitat Survey Report

3.4 Maryland Historic Trust Coordination

3.1

Wetlands & Waterways Identification & Delineation Report

WETLAND IDENTIFICATION AND DELINEATION REPORT

Bel Air Impoundment Project
Bel Air, Harford County, Maryland

Prepared for:
Maryland American Water Company

Prepared by:

November 2015

WETLAND IDENTIFICATION AND DELINEATION REPORT

Bel Air Impoundment Project

Bel Air, Harford County, Maryland

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Prepared by:

Gannett Fleming

November 2015

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APPENDIX D – PROJECT ENVIRONMENTAL REVIEW LETTERS

1.0 Project Description

Maryland American Water Company (MAWC) is proposing to construct an off-stream raw water storage reservoir to serve the Town of Bel Air. The proposed project requires a raw water intake structure on Winters Run and associated pipeline crossings on Winters Run to connect the existing Winters Run Water Treatment Plant (WTP). Construction for this project is proposed in an upland field currently used as agricultural land. The connecting infrastructure between the impoundment and the plant will need to cross Winters Run and its floodplain.

The existing Bel Air water system is supplied primarily from the existing Winters Run Water Treatment Plant (2.0 MGD nominal capacity) that treats water from Winters Run. The Winters Run withdrawal is permitted by the Maryland Department of the Environment (MDE) at 1.4 MGD, annual average. The MAWC water system is also supplemented by water supply wells. Finally, MACW has an agreement with Harford County for a 0.5 MGD supply through an existing metered interconnection.

When stream flow drops below the minimum pass-by flow stipulated by MDE, water cannot be withdrawn by the water treatment plant. During such times historically, the Harford County has allowed the MAWC system to take water in excess of the agreement amount to meet system demands. The County is now facing projected long-term supply shortfalls and has alerted MAWC that they can no longer commit to supplemental supply. As a result, the MAWC identified and evaluated a number of options for a supplemental supply.

In working with Harford County and MDE to evaluate supply alternatives, the County identified a County-owned parcel adjacent to Winters Run, upstream of the Winters Run Water Treatment Plant that could potentially be used for construction of an off-stream storage reservoir. The reservoir would be purchased by MAWC and used to supply the WTP when withdrawal from the stream is restricted or prohibited. The reservoir would be refilled from the stream when flows are sufficient to meet both the supply needs and the refill rates.

2.0 Purpose

The purpose of this report is to present the results of the wetlands and waterways investigation performed within the proposed project study area. This report was prepared in part to satisfy the regulatory requirements of the U.S. Army Corps of Engineers (USACE) under the purview of Section 404 of the Clean Water Act and the Maryland Department of the Environment (MDE) under Environment Article Title 5, Subtitle 5-901through 5-911; Annotated Code of Maryland; Code of Maryland Regulations (COMAR) 26.23.

3.0 Study Area Description

The project study area was approximately 82.18 acres in size and is an agricultural field located southwest of Winters Run between Route 1/Bel Air Bypass and Baltimore Pike. The project study area encompasses the existing water treatment plant and is bordered to the north-northeast by Winters Run, to the south by an unnamed tributary (UNT) to Winters Run, to the southeast by current construction of an apartment building complex and its access road, and to the northwest by Route 1/Bel Air Bypass. The stream features are bordered by emergent wetlands and beech-maple forests.

3.1 Topography

According to the U.S. Geological Survey (USGS) 7.5 minute topographic quadrangle maps (Bel Air and Jarrettsville, MD), the elevation of the project site is approximately between 180 and 320 feet above mean sea level (amsl). The project study area's highest elevation is approximately 320 feet amsl in the southwest corner of the agricultural field. The project study area's lowest elevation is approximately 180 feet amsl at Winters Run. A Project Location and Study Area Map is provided as **Figure 1**. An excerpt from the USGS Topographic Quadrangle Maps is provided as **Figure 2**.

3.2 Soils

According to the U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) Soil Survey for Harford County, the soil series within the project study area includes the following listed below in Table 1. An excerpt from the soil survey is provided below as **Figure 3.**

Table 1 Mapped Soils of the Project Study Area

Map Unit Symbol	Map Unit Name
Av	Alluvial land
Cu	Codorus silt loam
DcB	Delanco silt loam, 3 to 8 percent slopes
GcC2	Glenelg loam, 8 to 15 percent slopes, moderately eroded
EsC2	Elsinboro loam, 5 to 10 percent slopes, moderately eroded
Hb	Hatboro silt loam
LeB2	Legore silt loam, 3 to 8 percent slopes, moderately eroded
LeC2	Legore silt loam, 8 to 15 percent slopes, moderately eroded
LeD2	Legore silt loam, 15 to 25 percent slopes, moderately eroded
LgC3	Legore silty clay loam, 8 to 15 percent slopes, severely eroded
LgD3	Legore silty clay loam 15 to 25 percent slopes, severely eroded
LfE	Legore very stony silt loam, 25 to 45 percent slopes
MdE	Manor very stony loam, 25 to 45 percent slopes
MgC	Manor and Glenelg very stony loams, 3 to 15 percent slopes
MgD	Manor and Glenelg very stony loams, 15 to 25 percent slopes
MfE	Manor soils, 25 to 45 percent slopes
MsC2	Montalto silt loam, 8 to 15 percent slopes, moderately eroded
NeB2	Neshaminy silt loam, 3 to 8 percent slopes, moderately eroded
NeC2	Neshaminy silt loam, 8 to 15 percent slopes, moderately eroded

According to the USDA NRCS Web Soil Survey (October 2015), the following soils are listed as soils with a hydric rating for Harford County, Maryland: Av-Alluvial land, Cu-Codorus silt loam, and Hb-Hatboro silt loam.

3.3 Geology

The proposed project is located in the Piedmont Plateau Province of Maryland (MGS, 2000). According to the Maryland Geological Survey, the site is underlain with hypersthene gabbro with subordinate amounts of olivine gabbro, norite, anorthositic gabbro, and pyroxenite from the Early Paleozic to Late Precambrian Period (MGS, 1968).

3.4 Surface Waters

Winters Run and the UNT to Winters Run are both identified as perennial streams by the U.S. Geological Survey (USGS) (**Figure 2**). Four ephemeral, two intermittent, and one other perennial streams were also identified as water features within the project study area.

Maryland classifies surface water bodies according to use classes which describe the suite of specific designated uses or goals for that water body. The use classes assigned to Maryland's surface waters as promulgated in COMAR Section 26.08.02.08 lists Winters Run and its unnamed tributary as Recreational Trout Waters and Public Water Supply (IV-P). The Maryland Department of Natural Resources (MDNR) does not stock Winters Run or its unnamed tributary, nor does it list these streams as a wild trout waters.

3.5 National Wetlands Inventory

The National Wetlands Inventory (NWI) online mapping tool identified Winters Run as a riverine, lower perennial, unconsolidated bottom, permanently flooded (R2UBH) feature. No other NWI features were mapped the project study area. The NWI map for the site is provided as **Figure 4**.

3.6 Project Environmental Review

The project study area was submitted for environmental review to the MDNR Wildlife and Heritage Service and the USFWS Chesapeake Bay Field Office (CBFO) on August 27, 2014 to identify potential species of concern within the project study area, and aid in initiating jurisdictional agency coordination to avoid potential environmental impacts.

No records of rare, threatened or endangered species were identified within the study area boundaries by USFWS CBFO or MDNR Wildlife and Heritage Service. No further coordination is required with either agency unless project plans change or additional information on the distribution of listed or proposed species becomes available.

One wetland delineated within the project study area was determined to have potential bog turtle (*Glyptemys muhlenbergii*) habitat through a Phase I Bog Turtle Habitat survey performed by a Recognized, Qualified Bog Turtle Surveyor. Therefore, further coordination with the MDNR and USFWS may be required if impacts to this wetland is proposed. The project environmental review letters and responses are provided as **Appendix D.**

Legend

- Project Study Area
- Streams

Figure 1
Project Location and Study Area Map

Bel Air Impoundment Project

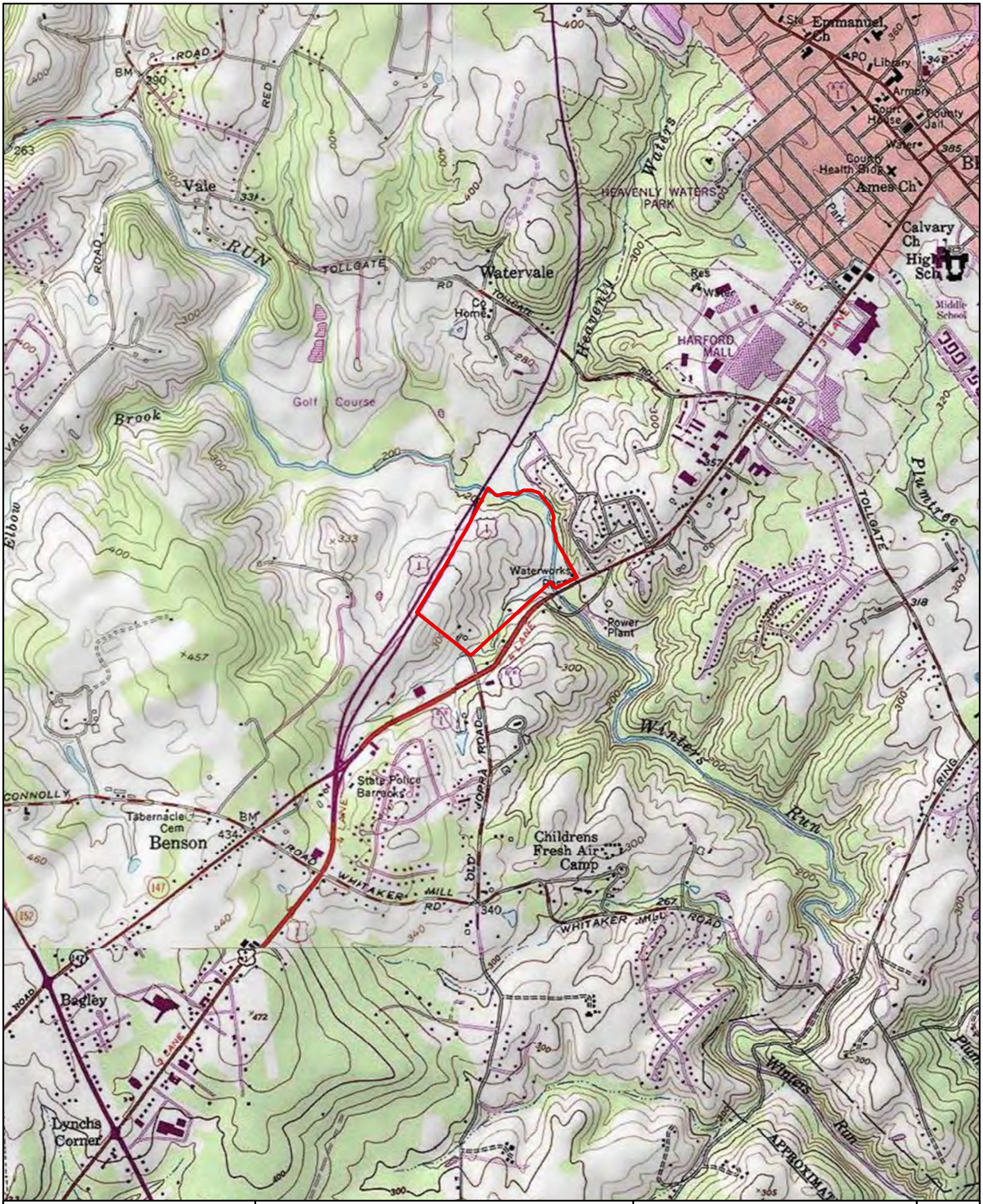
MARYLAND AMERICAN WATER
Town of Bel Air, Harford County, Maryland

Feet
400 200 0 400

Gannett Fleming

N

Source: Aerial imagery basemapping provided by ESRI ArcGIS Online webservices.



Legend

▭ Project Study Area

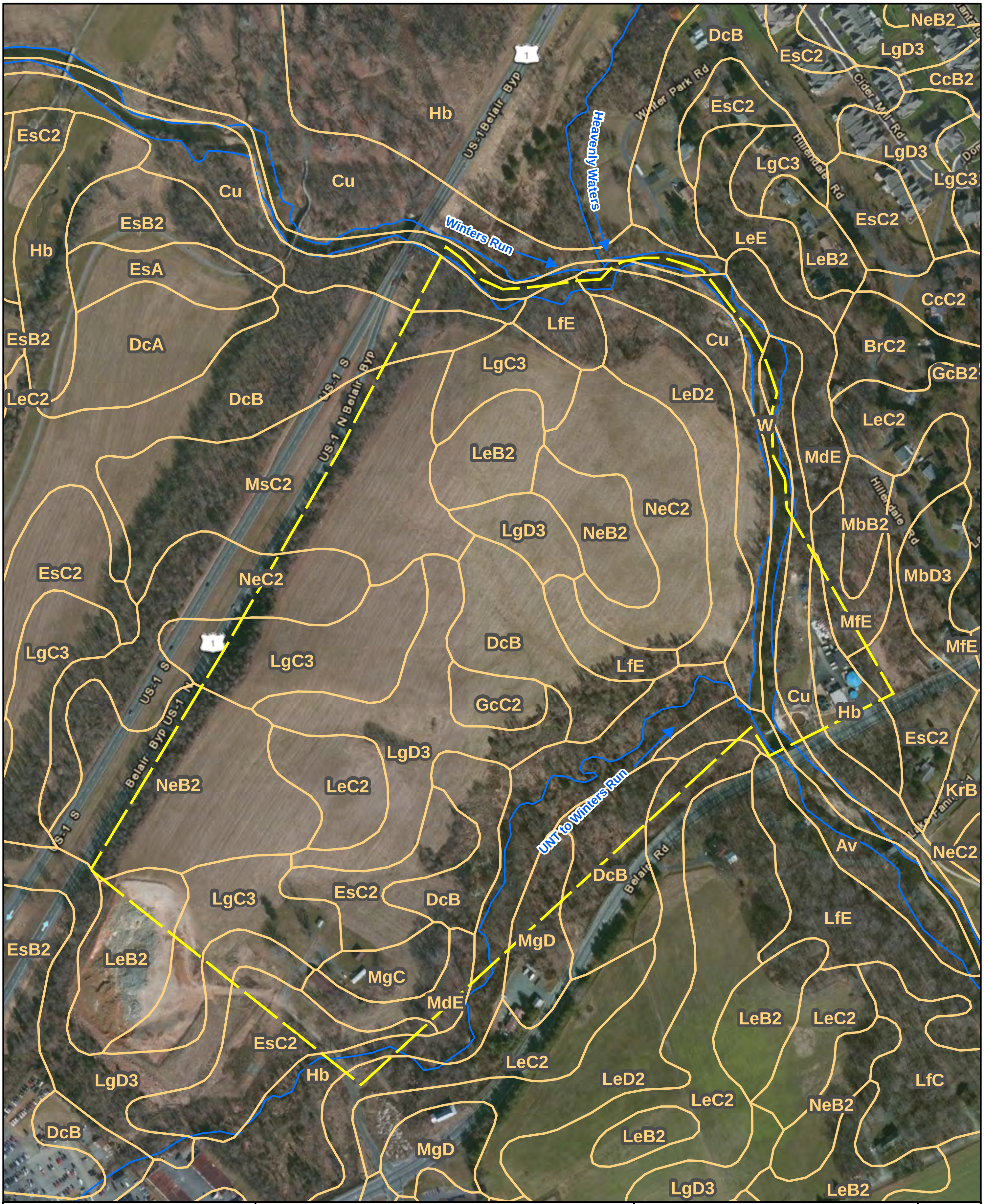
Figure 2
USGS Topographic Map
Bel Air, MD and Jarrettsville, MD Quads
Bel Air Impoundment Project
MARYLAND AMERICAN WATER
Town of Bel Air, Harford County, Maryland

Feet
2,000 1,000 0 2,000

Gannett Fleming

Source: USGS topographic basemapping provided by ESRI ArcGIS Online webservices.

N



Legend

▭ Project Study Area

— Streams

▭ Harford County Soils

Figure 3
Soil Survey Map

Bel Air Impoundment Project

MARYLAND AMERICAN WATER
Town of Bel Air, Harford County, Maryland

Feet
400 200 0 400

Gannett Fleming

N

Source: Aerial imagery basemapping provided by ESRI ArcGIS Online webservices. Harford County Soils data provided by USDA NRCS Web Soil Survey.

Legend

▭ Project Study Area
— Streams

NWI Wetlands

🟩 Freshwater Forested/Shrub Wetland
🟦 Riverine

Figure 4
National Wetlands Inventory Map

Bel Air Impoundment Project

MARYLAND AMERICAN WATER
Town of Bel Air, Harford County, Maryland

Feet
400 200 0 400

Gannett Fleming

N

Source: Aerial imagery basemapping provided by ESRI ArcGIS Online webservices. National Wetlands Inventory data provided by USFWS.

4.0 Methods

The 82.18-acre study area was investigated for palustrine wetland indicators of vegetative composition, soil development, and hydrology. The investigation was conducted in accordance with the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region Version 2.0* (U.S. Army Corps of Engineers, 2012). Wetland field data forms were completed to document wetland or non-wetland data points. If present, wetlands within and directly adjacent to the study area were delineated so that their presence could be shown on project mapping to aid in impact avoidance and/or minimization during engineering design.

Soils were characterized by evaluating the upper horizons of the soil profile. Soil pits were dug using a “sharpshooter” spade with a 14-inch blade. Soil horizons were evaluated using normal field protocols for determining texture and nomenclature. The *Munsell Soil Color Charts* (Kollmorgen Instruments Corporation, 1994) were used to determine the colors of horizons and redoximorphic features. Soil observations of reducing conditions were determined in the field using presence/absence determinations of redoximorphic concretions and oxidized rhizospheres, and identifying low chroma matrices.

Vegetation was identified using *A Field Guide to Trees and Shrubs* (Petrides, 1986), *Newcomb's Wildflower Guide* (Newcomb 1977), and *Grasses: An Identification Guide* (Brown, 1979). Plant species were assigned an indicator status [i.e., Upland (UPL), Facultative Upland (FACU), Facultative (FAC), Facultative Wetland (FACW), or Obligate Wetland (OBL)] based on the *National Wetland Plant List* (USACE, 2014) for the Eastern Mountain and Piedmont Region.

Data point locations were investigated for primary and secondary wetland hydrology indicators. If present, wetland boundaries were marked using pink wetland flagging marked with the wetland id (e.g. W1) and the flag number (e.g. 1, 2, 3, etc.). Wetland boundary data points were located using a Trimble GeoXH 6000 Global Positioning System (GPS). The Trimble GeoXH 6000 is capable of attaining sub-meter accuracy. The GPS data were then transferred onto relevant site mapping using the U.S. State Plane Maryland coordinate system. Wetlands and waterways were identified on site base mapping to show their proximity to the proposed construction area.

Classifications were assigned to each wetland following the Cowardin et al methods (1979). Color photographs were taken of all relevant features to document site conditions during the time of the investigations.

Wetland function and value assessments were performed at each wetland location (if present) using the methods outlined in *The Highway Methodology Workbook Supplement, Wetland Functions and Values A Descriptive Approach*, USACE New England District (NEDEP-360-1-30a 1995). Wetland functions were evaluated and recorded using the standard wetland function-value evaluation form. Classifications were assigned to each wetland following the Cowardin et al methods (1979). Color photographs were taken of all relevant features to document site conditions during the time of the investigations.

Waterways were identified through a review of available mapping and field investigations. Topographic and engineering maps were reviewed for the presence of streams within the project study area. Field investigations for waterways were performed in conjunction with the wetland field investigation and included the field verification of mapped watercourses and the identification and delineation of streams, springs, and seeps that were not shown on existing engineering plans. Waterways were identified by the presence of bed and banks and/or ordinary high water marks. The flow regime of each identified waterway was characterized based upon field indicators of hydrologic, floral, and faunal character at the time of the investigation. Waterways with banks less than 10 feet wide had centerlines delineated using pink wetland flagging marked with the stream id (e.g. S1) and the flag number (e.g. 1, 2, 3, etc.). Waterways with top of bank widths greater than 10 feet had both banks delineated. All identified waterways were photographed and located using GPS.

5.0 Results

The study area was field investigated for palustrine wetland indicators of vegetative composition, soil development, and hydrologic characteristics on September 29-30, 2015. Weather conditions were warm with a high temperature of 79.6^{o}F. Preliminary precipitation data indicated no rainfall for the region over two weeks prior to the investigation (Weather Underground, 2015), however 1.6 inches of rain fell between the afternoon of September 29 to the morning of September 30 during the investigation. The closest weather station to the site was located at N 39 ° 33 ' 14 ", W 76 ° 22 ' 39 ", approximately 2.6 miles north of the project site. The dominant land-use within the study area was agricultural, upland forest, and light industrial (water treatment plant). **Table 2** is a summary of dominant vegetation observed within the project study area.

Table 2
Dominant Vegetation

Scientific Name	Common Name	Indicator Status
Trees		
Acer rubrum	red maple	FAC
Acer saccharum	sugar maple	FACU
Catalpa speciosa	northern catalpa	FAC
Fagus grandifolia	American beech	FACU
Juglans nigra	black walnut	UPL
Liriodendron tulipifera	tulip poplar	FACU
Platanus occidentalis	American sycamore	FACW
Prunus serotina	black cherry	FACU
Shrubs		
Lindera benzoin	spicebush	FAC
Rosa multiflora	multiflora rose	FACU

Table 3…
Dominant Vegetation

Herbs		
Impatiens capensis	spotted touch-me-not	FACW
Lactuca serriola	prickly lettuce	FAC
Microstegium vimineum	Japanese stilt grass	FAC
Persicaria sagittata	arrow-leaf tearthumb	OBL
Phalaris arundinacea	reed canary grass	FACW
Phytolacca americana	American pokeweed	FACU
Solidago spp.	goldenrods	NA
Typha latifolia	broad-leaf cattail	OBL
Vines		
Lonicera japonica	Japanese honeysuckle	FAC
Vitis sp.	grape	NA

The USGS-mapped Winters Run (WR) and UNT to Winters Run (S8) were confirmed and delineated within the project study area. An additional perennial watercourse (S3), two intermittent (S4-S5) and four ephemeral (S1-S2, S6-S7) watercourses with defined bed and banks were identified and delineated within the project study area. Two palustrine wetlands were identified and delineated within the project study area: one palustrine emergent (W1, PEM) wetland along the north-northwest property and study area boundary behind the water treatment plant and one palustrine emergent (W2, PEM) wetland along the UNT to Winters Run along the southeast edge of the study area. See **Appendix A** for the location and boundaries of the following delineated features. See **Appendix B** for representative photographs of the project study area, including the wetlands and waterways. Wetland Determination Data Forms are provided in **Appendix C**.

5.1 Wetlands

Wetland 1 (W1)
Cowardin Classification: PEM
Area (acres): 0.161

Wetland 1 is a PEM wetland located along the north-northwest property and study area boundary behind the water treatment plant. The wetland receives hydrology as drainage from the surrounding upland forested slopes and is a toe-slope linear depression in the Winters Run floodplain. Dominant wetland vegetation within this wetland consisted of multiflora rose (*Rosa multiflora* – FACU) and Japanese stilt grass (*Microstegium vimineum* – FAC).

Primary hydrologic indicators within this wetland area consisted of water-stained leaves (B9) and oxidized rhizospheres (C3). Secondary hydrologic indicators included sparsely vegetated concave surface (B8), geomorphic position (D2), and microtopographic relief (D4).

A soil test pit was advanced to approximately 20 inches below the ground surface. The upper two inches of the soil profile displayed a 10YR 4/2 color in the matrix with 10% 7.5YR 4/6 redox concentrations and 5% 7.5YR 3/4 pore linings with a silty-sand texture. The depth between two to 10 inches had a 10YR 5/2 color in the matrix with 20% 10YR 5/6 redox concentrations and 5% 10YR 4/6 pore linings with a sand texture. The remaining soil profile had a 10YR 5/1 matrix color with 15% 7.5YR 4/6 redox concentrations and 5% 7/5YR 4/4 pore linings with a silty-sand texture. The soil was indicative of wetland soils with low chroma colors and redox features.

Wetland 2 (W2)
Cowardin Classification: PEM
Area (acres): 1.872

Wetland 2 is a PEM wetland located downslope of an agricultural field and within the floodplain of the UNT to Winters Run. The wetland receives hydrology from a spring house and several springs located on the upslope edge of the wetland, as well as drainage from the surrounding agricultural field. Dominant vegetation within this wetland consisted of arrow-leaf tearthumb (*Perciscaria sagittata* – OBL), reed canary grass (*Phalaris arundinacea* – FACW), and broad-leaf cat-tail (*Typha latifolia* – OBL).

Primary hydrologic indicators within this wetland area consisted of a high water table (A2), saturation (A3), iron deposits (B5), hydrogen sulfide odor (C1), and oxidized rhizospheres (C3). Secondary hydrologic indicators included geomorphic position (D2) and microtopographic relief (D4).

A soil test pit was advanced to approximately 20 inches below the ground surface. The upper four inches of soil displayed a 10YR 4/1 matrix color with 3% 10YR 4/6 redox concentrations located in the pore linings of living roots. The depth of four to eight inches displayed a 10YR 5/2 matrix color with 5% 10YR 4/6 redox concentrations. The texture for the first 10 inches was a sandy-silt. The remaining 10 inches of the soil profile showed a 10YR 4/2 matrix color with 3% 10YR 4/4 redox concentrations with a silt loam texture. The soil was indicative of wetland soils with low chroma colors and redox features.

5.2 Waterways

Nine waterways were delineated within the project study area. Four ephemeral, two intermittent, and three perennial waterways boundaries were mapped and are presented in **Appendix A**. Photographs were taken of the streams and are provided in **Appendix B.**

Stream 1 (S1) is an ephemeral watercourse between Wetland 1 and Winters Run and was dry at the time of survey. Stream 1 had an approximate width, from bank to bank, ranging from 1 to 3 feet. Its substrate was composed of exposed soil, roots, fine woody debris, and leaf litter. The stream banks were approximately 1 foot high on either side.

Stream 2 (S2) is an ephemeral watercourse that drains overland flow from the agricultural field to Wetland 2. Stream 2 had a top of bank width of 1 foot and wetted width of less than 1 foot.
The bank depth was approximately 1 foot on either bank and water depth was less than 1 inch. The substrate consisted of vegetation, cobble, roots, and exposed soil.

Stream 3 (S3) is a perennial watercourse that begins at a spring house adjacent to Wetland 2 and drains into the wetland where it loses channel definition, then re-channelizes near the UNT to

Winters Run (S8). Stream 3 had a top of bank width that ranged from 2 to five feet and wetted width of 1 to 3 feet. The bank height was less than 1 foot on either bank and water depth was approximately 2 inches. The substrate consisted of cobble, silts, leaf litter, and fine woody debris.

Stream 4 (S4) is an intermittent watercourse that drains Wetland 2 to the UNT to Winters Run (S8). Stream 4 had a top of bank width of 1foot and wetted width of less than 1 foot. The bank height on either bank was less than 1 foot and water depth was less than 2 inches. The substrate consisted of silts, leaf litter, and fine woody debris.

Stream 5 (S5) is an intermittent watercourse that also drains Wetland 2 to the UNT to Winters Run (S8). Stream 5 had a top of bank width and wetted width of 2 feet. The bank height on either bank was 1 foot and water depth ranged from 2 to 6 inches. The substrate was composed of vegetation, silts, cobble, and fine roots.

Stream 6 (S6) is an ephemeral watercourse that drains overland flow from the agricultural field to the UNT to Winters Run. Stream 6 had a top of bank width of 1 foot and had no flow at the time of survey. The bank height was less than 1 foot on either bank. The substrate consisted of leaf litter and exposed soil.

Stream 7 (S7) is an ephemeral watercourse that drains overland flow from the agricultural field to the UNT to Winters Run. Stream 7 had a top of bank width ranging from 1 to 2 feet and was not flowing at the time of survey. The bank height was 1 foot on either bank. The substrate consisted of leaf litter and exposed soil.

Stream 8 (S8) is a USGS-mapped, unnamed perennial watercourse that flows into Winters Run. Stream 8 had top of bank and wetted widths ranging from 12 to 18 feet. The bank height ranged from 3 to 6 feet on either bank and water depths ranged from one to 24 inches. The substrate consisted of cobble, gravel, sands, silts, and some boulders.

Winters Run (WR) is a USGS-mapped, perennial watercourse that flows to the southeast across the northern project study area boundary. Winters Run had a top of bank width that ranged from 50 to 120 feet. The wetted width ranged from 50 to 120 feet. Banks were approximately 3 to 6 feet in height and water depths ranged from 18 to 36+inches. The substrate consisted of cobble, gravel, sands, silts, and some boulders.

6.0 Summary

Field investigations conducted by Gannett Fleming on September 29-30, 2015, identified and delineated wetlands and waterways in conjunction with the Bel Air Reservoir Project. Winters Run (WR) and its unnamed tributary (S8) were confirmed in the field. Additionally, one other perennial stream, two intermittent streams, and four ephemeral streams were identified and delineated within the project study area. Two palustrine emergent wetlands, were identified and delineated within the project study area.

- Wetland 1 (W1): PEM, 0.161 ac.
- Wetland 2 (W2): PEM, 1.872 ac.
- Stream 1 (S1): Ephemeral Waterway, 80 linear feet
- Stream 2 (S2): Ephemeral Waterway, 40 linear feet
- Stream 3 (S3): Perennial Waterway, 80 linear feet
- Stream 4 (S4): Intermittent Waterway, 20 linear feet
- Stream 5 (S5): Intermittent Waterway, 35 linear feet
- Stream 6 (S6): Ephemeral Waterway, 15 linear feet
- Stream 7 (S7): Ephemeral Waterway, 60 linear feet
- Stream 8 (S8): Perennial Waterway, UNT to Winters Run, 3,400 linear feet
- Winters Run (WR): Perennial Waterway, 2,500 linear feet

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APPENDIX A
WETLANDS AND WATERWAYS MAPPING

Legend

- 🟨 Project Study Area
- 🟧 Existing Reforestation Area
- ▨ Delineated Wetlands
- Mapped Waterways
- ⊗ Springhouse
- Delineated Streams

Appendix A
Wetlands and Waterways Mapping Overview Map
Bel Air Impoundment Project
MARYLAND AMERICAN WATER
Town of Bel Air, Harford County, Maryland

Feet

400 200 0 400

Gannett Fleming

N

Source: Aerial imagery basemapping provided by ESRI ArcGIS Online webservices.

Legend

🟨 Project Study Area
Mapped Waterways
🟧 Existing Reforestation Area
⊗ Springhouse
▨ Delineated Wetlands
Delineated Streams
○ Delineation Point
⊕ Data Plot

Appendix A
Wetlands and Waterways Mapping
Map 1 of 2

Bel Air Impoundment Project

MARYLAND AMERICAN WATER
Town of Bel Air, Harford County, Maryland

Feet
100 50 0 100

Gannett Fleming

N

Source: Aerial imagery basemapping provided by ESRI ArcGIS Online webservices.

Legend

- ▭ Project Study Area
- ▭ Existing Reforestation Area
- ▨ Delineated Wetlands
- ○ Delineation Point
- — Mapped Waterways
- ⊗ Springhouse
- — Delineated Streams
- ⊕ Data Plot

Appendix A
Wetlands and Waterways Mapping
Map 2 of 2

Bel Air Impoundment Project

MARYLAND AMERICAN WATER
Town of Bel Air, Harford County, Maryland

Feet
100 50 0 100

Gannett Fleming

N

Source: Aerial imagery basemapping provided by ESRI ArcGIS Online webservices.

APPENDIX B
SITE PHOTOGRAPHS

Legend

- Project Study Area
- Mapped Waterways
- Existing Reforestation Area
- Springhouse
- Delineated Wetlands
- Delineated Streams
- Photo Locations

Appendix B
Site Photographs
Photo Location Map
Bel Air Impoundment Project

MARYLAND AMERICAN WATER
Town of Bel Air, Harford County, Maryland

Feet
300 150 0 300

Gannett Fleming

Source: Aerial imagery basemapping provided by ESRI ArcGIS Online webservices.

Photo 1 (09-29-2015)
Wetland 1 (W1) is a palustrine emergent (PEM) wetland located on the eastern bank floodplain of Winters Run. View is close-up of wetland plot.

Photo 2 (09-29-2015)
Wetland 1 (W1) extends off the project study area for a short distance before connecting to Winters Run. View is northwest from wetland plot.

Photo 3 (09-29-2015)
Wetland 1 is a toe-of-slope drainage swale that is partially an unvegetated, concave surface. View is southeast from wetland plot.

Photo 4 (09-29-2015)
Upland plot for the project study area is on the floodplain of Winters Run. View is southwest near Wetland 1 boundary and start of Stream 1.

Photo 5 (09-29-2015)
Stream 1 (S1) is an ephemeral watercourse located between Wetland 1 and Winters Run. View is north and upstream from Flag S1-1.

Photo 6 (09-29-2015)
Upstream view of Stream 1 from flag S1-4 looking northeast.

Photo 7 (09-29-2015)
Downstream view of Stream 1 at flag S1-4 looking south at junction with Winters Run.

Photo 8 (09-30-2015)
Wetland 2 (W2) is a PEM wetland dominated by tearthumb, reed canary grass, and cattail. View is northeast at the wetland plot.

Photo 9 (09-30-2015)
Wetland 2 overview from flag W2-11 and left bank of UNT to Winters Run (S8). View is looking west.

Photo 10 (09-30-2015)
Upstream view of Stream 2, ephemeral stream originating at spring. View is west from flag S2-1.

Photo 11 (09-30-2015)
Downstream view of Stream 2. View is east from flag S2-1.

Photo 12 (09-30-2015)
Upstream view of Stream 3, perennial stream originating at springhouse. View is east from flag S3-4.

Photo 13 (09-30-2015)
Downstream view of Stream 3 before diffusing into Wetland 2. View is east from flag S3-4.

Photo 14 (09-30-2015)
Upstream view of Stream 3 when rechannelizes at UNT to Winters Run (S8). View is west from flag S3-6B.

Photo 15 (09-30-2015)
Downstream view of Stream 4, intermittent stream draining Wetland 2 into UNT to Winters Run (S8). View is east from flag S4-1.

Photo 16 (09-30-2015)
Upstream view of Stream 4 at junction with UNT to Winters Run (S8). View is northwest from flag S4-2.

Photo 17 (09-30-2015)
Downstream view of Stream 5, intermittent stream draining Wetland 2 into UNT to Winters Run (S8). View is east from flag S5-2.

Photo 18 (09-30-2015)
Upstream view of Stream 5 at junction with UNT to Winters Run (S8). View is west from flag S5-3.

Photo 19 (09-30-2015)
Downstream view of Stream 6, ephemeral drainage of overland flow from agricultural field into UNT to Winters Run (S8). View is southeast from flag S6-1.

Photo 20 (09-30-2015)
Upstream view of Stream 6 from junction with UNT to Winters Run (S8). View is northwest from flag S6-2.

Photo 21 (09-30-2015)
Downstream view of Stream 7, ephemeral drainage of overland flow from agricultural field into UNT to Winters Run (S8). View is southeast from flag S7-1.

Photo 22 (09-30-2015)
Upstream view of Stream 7 from junction with UNT to Winters Run (S8). View is north from flag S7-3.

Photo 23 (09-29-2015)
Downstream view of Stream 8, UNT to Winters Run (S8). View is north near flag W2-11.

Photo 24 (09-29-2015)
Upstream view of Stream 8, UNT to Winters Run (S8). View is southwest near flag W2-11.

Photo 25 (09-30-2015)
Downstream view of Stream 8, UNT to Winters Run (S8) at junction with Winters Run after heavy rains previous evening. View is southeast near flag S7-3.

Photo 26 (09-30-2015)
Downstream view of Winters Run (WR) at junction with UNT to Winters Run (S8) after heavy rains previous evening. View is southeast.

Photo 27 (09-30-2015)
Upstream view of Winters Run (WR) at junction with UNT to Winters Run (S8) after heavy rains previous evening. View is north.

Photo 28 (11-02-2015)
View of springhouse source of Stream 3. View is northwest.

Photo 29 (09-30-2015)
View of harvested corn field and reforestation area in distance. View is east.

Photo 30 (09-30-2015)
View of harvested corn field with former barn and new residential development construction in distance. View is southwest.

APPENDIX C
WETLAND FIELD DATA FORMS AND FUNCTION & VALUE FORMS

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Bel Air Reservoir City/County: Bel Air / Harford County Sampling Date: 09/29/2015

Applicant/Owner: Maryland American Water (MAW) State: MD Sampling Point: Plot U1

Investigator(s): A. Thomas, S. Hockenberry Section, Township, Range: Town of Bel Air

Landform (hillslope, terrace, etc.): floodplain terrace Local relief (concave, convex, none): none

Slope (%): 0 Lat: 36.517583°N Long: 76.368791°W Datum: NAD83

Soil Map Unit Name: Codorus silt loam (Cu) NWI classification: --

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ___ No ✓

Hydric Soil Present? Yes ___ No ✓

Wetland Hydrology Present? Yes ___ No ✓

Is the Sampled Area within a Wetland? Yes ___ No ✓

Remarks:

Plot U1 was the non-hydric sampling plot associated with Wetland 1 (W1). Plot U1 was located on a floodplain bench near Winters Run.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres on Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): ___

Water Table Present? Yes ___ No ✓ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No ✓ Depth (inches): ___

Wetland Hydrology Present? Yes ___ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: Plot U1

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. Juglans nigra	40	Y	FACU
2.			
3.			
4.			
5.			
6.			

Total Cover: 40

50% of total cover: 20 20% of total cover: 8

Sapling Stratum (Plot size: 15)			
1.			
2.			
3.			
4.			
5.			
6.			

Total Cover: 0

50% of total cover: 0 20% of total cover: 0

Shrub Stratum (Plot size: 15)			
1. Lindera benzoin	20	Y	FAC
2. Rubus occidentalis	20	Y	UPL
3. Rosa multiflora	5		FACU
4.			
5.			
6.			

Total Cover: 45

50% of total cover: 22.5 20% of total cover: 9

Herb Stratum (Plot size: 5)			
1. Microstegium vimineum	80	Y	FAC
2. Persicaria hydropiperoides	10		OBL
3. Pilea pumila	5		FACW
4. Persicaria maculosa	5		FACW
5.			
6.			
7.			
8.			
9.			
10.			
11.			

Total Cover: 100

50% of total cover: 50 20% of total cover: 20

Woody Vine Stratum (Plot size: 30)			
1.			
2.			
3.			
4.			

Total Cover: 0

50% of total cover: 0 20% of total cover: 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	10	x 1 =	10
FACW species	10	x 2 =	20
FAC species	100	x 3 =	300
FACU species	45	x 4 =	180
UPL species	20	x 5 =	100
Column Totals:	185 (A)		610 (B)

Prevalence Index = B/A = 3.30

Hydrophytic Vegetation Indicators:

___ 1- Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? **Yes** ___ **No** ✓

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: Plot U1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0 - 18+	7.5YR 4/4	100					LS	Fibrous roots in upper 2"

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

[2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ 2 cm Muck (A10) **(LRR N)**
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
___ Thin Dark Surface (S9) **(MLRA 147, 148)**
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
___ Umbric Surface (F13) **(MLRA 136, 122)**
___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) **(MLRA 147)**
___ Coastal Prairie Redox (A16) (MLRA 147, 148)
___ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ______ **No** ✓

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Bel Air Reservoir City/County: Bel Air / Harford County Sampling Date: 09/29/2015
Applicant/Owner: Maryland American Water (MAW) State: MD Sampling Point: Plot W1
Investigator(s): A. Thomas, S. Hockenberry Section, Township, Range: Town of Bel Air
Landform (hillslope, terrace, etc.): linear depression Local relief (concave, convex, none): concave
Slope (%): 0 Lat: 39.518001°N Long: 76.36885°W Datum: NAD83
Soil Map Unit Name: Codorus silt loam (Cu) NWI classification: PEM
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ______ (If no, explain in Remarks.)
Are Vegetation ______, Soil ______, or Hydrology ______ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ______
Are Vegetation ______, Soil ______, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ✓ No ______
Hydric Soil Present? Yes ✓ No ______
Wetland Hydrology Present? Yes ✓ No ______

Is the Sampled Area within a Wetland? **Yes** ✓ **No** ______

Remarks:

Plot W1 was the hydric sampling plot associated with Wetland 1 (W1). Plot W1 was within a linear depression along the base of a forested slope located in the floodplain of Winters Run.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ✓ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ✓ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ✓ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ✓ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ✓ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No ✓ Depth (inches): ______
Water Table Present? Yes ______ No ✓ Depth (inches): ______
Saturation Present? (includes capillary fringe) Yes ______ No ✓ Depth (inches): ______

Wetland Hydrology Present? **Yes** ✓ **No** ______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

The sampling plot was located in a vegetated area of the wetland; however, the middle section of the wetland was a "sparsely vegetated concave surface". The middle section lacked vegetation except scattered over-wintering flowers of skunk cabbage that had recently broken the soil surface.

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: Plot W1

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			

Total Cover: 0

50% of total cover: 0 20% of total cover: 0

Sapling Stratum (Plot size: 15)			
1.			
2.			
3.			
4.			
5.			
6.			

Total Cover: 0

50% of total cover: 0 20% of total cover: 0

Shrub Stratum (Plot size: 15)			
1. Rosa multiflora	10	Y	FACU
2.			
3.			
4.			
5.			
6.			

Total Cover: 10

50% of total cover: 5 20% of total cover: 2

Herb Stratum (Plot size: 5)			
1. Microstegium vimineum	70	Y	FAC
2. Persicaria hydropiperoides	15		OBL
3. Pilea pumila	10		FACW
4. Impatiens capensis	10		FACW
5. Persicaria hydropiper	5		OBL
6. Persicaria maculosa	5		FACW
7. Phalaris arundinacea	5		FACW
8. Laportea canadensis	5		FACW
9.			
10.			
11.			

Total Cover: 125

50% of total cover: 62.5 20% of total cover: 25

Woody Vine Stratum (Plot size: 30)			
1.			
2.			
3.			
4.			

Total Cover: 0

50% of total cover: 0 20% of total cover: 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	20	x 1 =	20
FACW species	35	x 2 =	70
FAC species	70	x 3 =	210
FACU species	10	x 4 =	40
UPL species	0	x 5 =	0
Column Totals:	135 (A)		340 (B)

Prevalence Index = B/A = 2.5

Hydrophytic Vegetation Indicators:

___ 1- Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

✓ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? **Yes** ✓ **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: Plot W1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 2	10YR 4/2	85	7.5YR 4/6	10	C	M	SiS	fine sand & fibrous roots
			7.5YR 3/4	5	C	PL		
2 - 10	10YR 5/2	75	10YR 5/6	20	C	M	S	fine and coarse sand
			10YR 4/6	5	C	PL		
10 - 18+	10YR 5/1	80	7.5YR 4/6	15	C	M	SiS	buried organics
			7.5YR 4/4	5	C	PL		

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

[2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ 2 cm Muck (A10) **(LRR N)**
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
___ Sandy Gleyed Matrix (S4)
✓ Sandy Redox (S5)
___ Stripped Matrix (S6)

___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
___ Thin Dark Surface (S9) **(MLRA 147, 148)**
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
___ Umbric Surface (F13) **(MLRA 136, 122)**
___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) **(MLRA 147)**
___ Coastal Prairie Redox (A16) (MLRA 147, 148)
___ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? **Yes** ✓ **No** ___

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Bel Air Reservoir City/County: Bel Air / Harford County Sampling Date: 09/30/2015
Applicant/Owner: Maryland American Water (MAW) State: MD Sampling Point: Plot W2
Investigator(s): A. Thomas, S. Hockenberry Section, Township, Range: Town of Bel Air
Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): none
Slope (%): 0 Lat: 39.51458°N Long: 76.372586°W Datum: NAD83
Soil Map Unit Name: Delanco silt loam, 3 to 8 percent slopes (DcB) NWI classification: PEM
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ___ (If no, explain in Remarks.)
Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ___
Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ✓ No ___
Hydric Soil Present? Yes ✓ No ___
Wetland Hydrology Present? Yes ✓ No ___

Is the Sampled Area within a Wetland? **Yes** ✓ **No** ___

Remarks:

Plot W2 was the hydric sampling plot associated with Wetland 2 (W2). Plot W2 was within a terrace located at the base of hills that were recently harvested for corn and along the floodplain of an unnamed tributary to Winters Run.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ✓ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ✓ Hydrogen Sulfide Odor (C1)
- ✓ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ✓ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ✓ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): ___
Water Table Present? Yes ✓ No ___ Depth (inches): 10
Saturation Present? Yes ✓ No ___ Depth (inches): 0 (surface)
(includes capillary fringe)

Wetland Hydrology Present? **Yes** ✓ **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: Plot W2

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			

Total Cover: 0

50% of total cover: 0   20% of total cover: 0

Sapling Stratum (Plot size: 15)			
1.			
2.			
3.			
4.			
5.			
6.			

Total Cover: 0

50% of total cover: 0   20% of total cover: 0

Shrub Stratum (Plot size: 15)			
1.			
2.			
3.			
4.			
5.			
6.			

Total Cover: 0

50% of total cover: 0   20% of total cover: 0

Herb Stratum (Plot size: 5)			
1. Persicaria sagittata	50	Y	OBL
2. Phalaris arundinacea	30	Y	FACW
3. Persicaria hydropiperoides	20		OBL
4. Leersia oryzoides	20		OBL
5. Impatiens capensis	10		FACW
6. Persicaria hydropiper	10		OBL
7. Pilea pumila	5		FACW
8. Persicaria arifolia	5		OBL
9.			
10.			
11.			

Total Cover: 150

50% of total cover: 75   20% of total cover: 30

Woody Vine Stratum (Plot size: 30)			
1.			
2.			
3.			
4.			

Total Cover: 0

50% of total cover: 0   20% of total cover: 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

✓ 1- Rapid Test for Hydrophytic Vegetation

✓ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size. Includes woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? **Yes** ✓ **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

The center of Wetland 2 was dominated by Typha latifolia (OBL).

SOIL

Sampling Point: Plot W2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0 - 4	10YR 4/1	97	10YR 4/6	3	C	PL	SSiL	fibrous roots
4 - 10	10YR 5/2	95	10YR 4/6	5	C	M	SSiL	
10 - 20+	10YR 4/2	97	10YR 4/4	3	C	M	SiL	

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

[2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ 2 cm Muck (A10) **(LRR N)**
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
___ Thin Dark Surface (S9) **(MLRA 147, 148)**
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
✓ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
___ Umbric Surface (F13) **(MLRA 136, 122)**
___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) **(MLRA 147)**
___ Coastal Prairie Redox (A16) (MLRA 147, 148)
___ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ✓ **No** ___

Remarks:

Wetland Function-Value Evaluation Form

Total area of wetland 0.161 Human made? No Is wetland part of a wildlife corridor? Yes or a "habitat island"? No

Adjacent land use Winters Run, floodplain, Water Treatment Plant Distance to nearest roadway or other development <50 feet

Dominant wetland systems present PEM Contiguous undeveloped buffer zone present No

Is the wetland a separate hydraulic system? No If not, where does the wetland lie in the drainage basin? along reservoir

How many tributaries contribute to the wetland? None Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. W1

Latitude 39.5180°N Longitude 76.3689°W

Prepared by: SRH Date 10/5/2015

Wetland Impact:
Type Unknown Area Unknown

Evaluation based on:
Office X Field X

Corps manual wetland delineation completed? Y X N

Function/Value	Suitability		Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
	Y	N			
Groundwater Recharge/Discharge		X			
Floodflow Alteration	X		2, 4, 5, 7, 9, 10, 13	X	W1 is in a toe-slope linear depression in the Winters Run floodplain.
Fish and Shellfish Habitat		X			
Sediment/Toxicant Retention	X		1, 2, 3, 4, 10		
Nutrient Removal	X		3, 4, 7		
Production Export		X			
Sediment/Shoreline Stabilization		X			
Wildlife Habitat		X			
Recreation		X			
Educational/Scientific Value		X			
Uniqueness/Heritage		X			
Visual Quality/Aesthetics		X			
ES Endangered Species Habitat		X			
Other		X			

Notes:

Wetland Function-Value Evaluation Form

Total area of wetland 1.872 Human made? No Is wetland part of a wildlife corridor? Yes or a "habitat island"? No

Adjacent land use Ag. Fields, UNT to Winters Run Distance to nearest roadway or other development 200+ feet

Dominant wetland systems present PEM Contiguous undeveloped buffer zone present No

Is the wetland a separate hydraulic system? No If not, where does the wetland lie in the drainage basin? along reservoir

How many tributaries contribute to the wetland? None Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. W2

Latitude 39.5146°N Longitude 76.3726°W

Prepared by: SRH Date 10/5/2015

Wetland Impact:
Type Unknown Area Unknown

Evaluation based on:
Office X Field X

Corps manual wetland delineation completed? Y X N

Function/Value	Suitability		Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
	Y	N			
Groundwater Recharge/Discharge	X		1, 2, 4, 5, 10, 13, 15	X	Spring house and spring were located on edge of wetland.
Floodflow Alteration		X			
Fish and Shellfish Habitat		X			
Sediment/Toxicant Retention	X		1, 2, 3, 4, 5, 6, 7, 8, 10, 16	X	Located downslope of agricultural fields and within floodplain of stream.
Nutrient Removal	X		3, 4, 5, 6, 7, 9, 10		Deep organic, mucky soils in center of wetland.
Production Export		X			
Sediment/Shoreline Stabilization		X			
Wildlife Habitat	X		1, 3, 6, 8, 11, 17, 18, 19, 21	X	Raccoon, deer, and opossum tracks were visible, damselflies were present.
Recreation		X			
Educational/Scientific Value		X			
Uniqueness/Heritage		X			
Visual Quality/Aesthetics		X			
ES Endangered Species Habitat		X			
Other		X			

Notes:

APPENDIX D
PROJECT ENVIRONMENTAL REVIEW LETTERS

MARYLAND
DEPARTMENT OF
NATURAL RESOURCES

Martin O'Malley, *Governor*
Anthony G. Brown, *Lt. Governor*
Joseph P. Gill, *Secretary*
Frank W. Dawson III, *Deputy Secretary*

September 17, 2014

Danielle Iuliucci
Gannett Fleming, Inc.
PO Box 67100
Harrisburg, PA 17106-7100

RE: Environmental Review for The American Water Company, Bel Air Reservoir Feasibility Study, Bel Air, US Route 1, Winters Run, Harford County, MD.

Dear Ms. Iuliucci:

The Wildlife and Heritage Service has determined that there are no State or Federal records for rare, threatened or endangered species within the boundaries of the project site as delineated. As a result, we have no specific comments or requirements pertaining to protection measures at this time. This statement should not be interpreted however as meaning that rare, threatened or endangered species are not in fact present. If appropriate habitat is available, certain species could be present without documentation because adequate surveys have not been conducted.

Thank you for allowing us the opportunity to review this project. If you should have any further questions regarding this information, please contact me at (410) 260-8573.

Sincerely,

Lori A. Byrne

Lori A. Byrne,
Environmental Review Coordinator
Wildlife and Heritage Service
MD Dept. of Natural Resources

ER# 2014.1333.ha

Gannett Fleming

GANNETT FLEMING, INC.
P.O. Box 67100
Harrisburg, PA 17106-7100

Location:
207 Senate Avenue
Camp Hill, PA 17011

Office: (717) 763-7211
Fax: (717) 763-8150
www.gannettfleming.com

August 27, 2014

Lori Byrne
DNR Wildlife & Heritage Service
580 Taylor Avenue
Tawes Office Bldg E-1
Annapolis, MD 21401

MAILED 8/27/14
Certified 7013 2250 0000 4345 7922

RE: Request for Environmental Review
The Maryland American Water Company
Bel Air Reservoir Feasibility Study
Bel Air, Harford County, Maryland

Dear Ms. Byrne:

Gannett Fleming, Inc. (Gannett Fleming) is requesting an environmental review of a project located on the east and west sides of the Bel Air Bypass (US Route 1) approximately 1 mile south of its intersection with MD Route 24 in Bel Air, Harford County, Maryland (39.517203 N, 76.375215 W). Gannett Fleming was retained by the Maryland American Water Company (MAWC) to evaluate the feasibility of creating an off-stream raw water storage reservoir that would provide the Town of Bel Air with drinking water during dry periods. This project is currently in a conceptual design phase with field reconnaissance and preliminary engineering studies to occur in the near future. To support permitting, we are requesting an environmental review to determine if any species of concern occur within or in close proximity to the study area. Please refer to **Figure 1** for the USGS topographic map of the study area. **Figure 2** provides an aerial photograph of the project study area.

The Bel Air water system is supplied primarily by Winters Run. The Maryland Department of the Environment (MDE) regulates the Harford County water treatment plant, operated by the MAWC. When stream flow falls below the minimum pass-by flow stipulated by the MDE, water should not be withdrawn from Winters Run. During such times historically, Harford County has allowed the MAWC system to continue operating to meet system demands. However, since Harford County expects the Bel Air water supply to experience long-term supply shortfalls, alternative water supply systems are being evaluated. Gannett Fleming is evaluating the feasibility of building a reservoir in an off-stream agricultural area adjacent to Winters Run to store water from Winters Run during periods of high flow. The reservoir would provide Bel Air with water when water levels in Winters Run fall below MDE withdraw limits.

Please provide Gannett Fleming with an official response letter regarding any species of concern within or in close proximity to the study area. We would appreciate an expedited environmental review, if possible. Please contact me at (717) 763-7211, extension 2914, with any questions or requests for additional information. Thank you for your cooperation; we look forward to working with you on this project.

Very truly yours,

Danielle Iuliucci
Environmental Scientist

Attachments

Copies Furnished (electronically):	S. Liskovich, GF Project Manager D. Graff, GF Sr. Environmental Scientist File

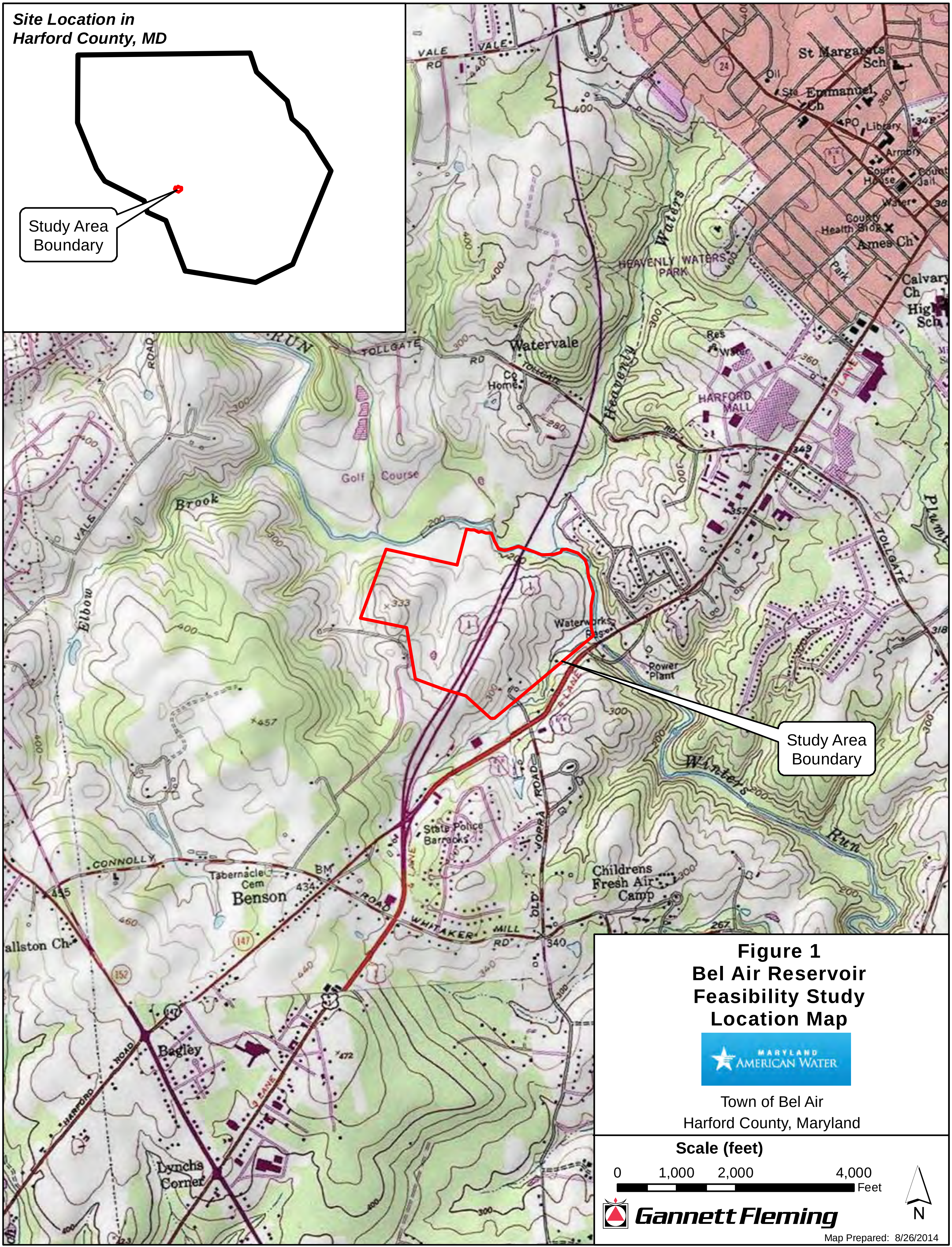


Figure 1
Bel Air Reservoir Feasibility Study Location Map

Town of Bel Air

Harford County, Maryland

Map Prepared: 8/26/2014

Data Source: USGS topo map with excerpts from 7.5' Quadrangles - Jarrettsville, Maryland, and Belair, Maryland, provided by ESRI through ArcGIS Online webservice.

Figure 2
Bel Air Reservoir Feasibility Study
Aerial Location Map

Maryland American Water

Town of Bel Air

Harford County, Maryland

Scale (feet)

Gannett Fleming

Map Prepared: 8/26/2014

Data Source: Aerial imagery map provided by ESRI through ArcGIS Online webservice.

United States Department of the Interior
U.S. Fish & Wildlife Service
Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401
410/573 4575

Online Certification Letter

Today's date: September 22, 2014

Project: The Maryland American Water Company
Bel Air Reservoir Feasibility Study
Bel Air, Harford County, Maryland

Dear Applicant for online certification:

Thank you for using the U.S. Fish and Wildlife Service (Service) Chesapeake Bay Field Office online project review process. By printing this letter in conjunction with your project review package, you are certifying that you have completed the online project review process for the referenced project in accordance with all instructions provided, using the best available information to reach your conclusions. This letter, and the enclosed project review package, completes the review of your project in accordance with the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (ESA).This letter also provides information for your project review under the National Environmental Policy Act of 1969 (P.L. 91-190, 42 U.S.C. 4321-4347, 83 Stat. 852), as amended. A copy of this letter and the project review package must be submitted to this office for this certification to be valid. This letter and the project review package will be maintained in our records.

Based on this information and in accordance with section 7 of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), we certify that except for occasional transient individuals, no federally proposed or listed endangered or threatened species are known to exist within the project area. Therefore, no Biological Assessment or further section 7 consultation with the U.S. Fish and Wildlife Service is required. Should project plans change, or if additional information on the distribution of listed or proposed species becomes available, this determination may be reconsidered.

This response relates only to federally protected threatened or endangered species under our jurisdiction. For additional information on threatened or endangered species in Maryland, you should contact the Maryland Wildlife and Heritage Division at (410) 260-8540. For information in Delaware you should contact the Delaware Natural Heritage and Endangered Species Program, at (302) 653-2880. For information in the District of Columbia, you should contact the National Park Service at (202) 535-1739.

The U.S. Fish and Wildlife Service also works with other Federal agencies and states to minimize loss of wetlands, reduce impacts to fish and migratory birds, including bald eagles, and restore habitat for wildlife. Information on these conservation issues and how development projects can avoid affecting these resources can be found on our website (www.fws.gov/chesapeakebay)

We appreciate the opportunity to provide information relative to fish and wildlife issues, and thank you for your interest in these resources. If you have any questions or need further assistance, please contact Chesapeake Bay Field Office Threatened and Endangered Species program at (410) 573-4527.

Sincerely,

Genevieve LaRouche
Field Supervisor

GANNETT FLEMING, INC.
P.O. Box 67100
Harrisburg, PA 17106-7100

Location:
207 Senate Avenue
Camp Hill, PA 17011

Office: (717) 763-7211
Fax: (717) 763-8150
www.gannettfleming.com

August 27, 2014

US Fish and Wildlife Service
Chesapeake Bay Ecological Services Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401

SUBMITTED ELECTRONICALLY
8/27/14

RE: Project Review Request
The Maryland American Water Company
Bel Air Reservoir Feasibility Study
Bel Air, Harford County, Maryland

To whom it may concern:

Gannett Fleming, Inc. (Gannett Fleming) is requesting a project review from the US Fish and Wildlife Service's Chesapeake Bay Ecological Services Field Office for a project located on the east and west sides of the Bel Air Bypass (US Route 1) approximately 1 mile south of its intersection with MD Route 24 in Bel Air, Harford County, Maryland (39.517203 N, 76.375215 W). Gannett Fleming was retained by the Maryland American Water Company (MAWC) to evaluate the feasibility of creating an off-stream raw water storage reservoir that would provide the Town of Bel Air with drinking water during dry periods. This project is currently in a conceptual design phase with field reconnaissance and preliminary engineering studies to occur in the near future. To support permitting, we are requesting a project review to determine if any species of concern occur within or in close proximity to the study area.

Gannett Fleming was retained by the Maryland American Water Company (MAWC) to evaluate the feasibility of creating an off-stream raw water storage reservoir that would provide the Town of Bel Air with drinking water during dry periods. This project is currently in a conceptual design phase with field reconnaissance and preliminary engineering studies to occur in the near future. The Bel Air water system is supplied primarily by Winters Run. The Maryland Department of the Environment (MDE) regulates the Harford County water treatment plant, operated by the MAWC.

The Bel Air water system is supplied primarily by Winters Run. The Maryland Department of the Environment (MDE) regulates the Harford County water treatment plant, operated by the MAWC. When stream flow falls below the minimum pass-by flow stipulated by the MDE, water should not be withdrawn from Winters Run. During such times historically, Harford County has allowed the MAWC system to continue operating to meet system demands. However, since Harford County expects the Bel Air water supply to experience long-term supply shortfalls, alternative water supply systems are being evaluated. Gannett Fleming is evaluating the feasibility of building a reservoir in

an off-stream agricultural area adjacent to Winters Run to store water from Winters Run during periods of high flow. The reservoir would provide Bel Air with water when water levels in Winters Run fall below MDE withdraw limits.

The Information, Planning, and Conservation (IPaC) System indicated that no listed species, critical habitats, or national wildlife refuges were found within the vicinity of the proposed project. The IPaC System identified 13 migratory birds of concern that may be impacted. Three (3) National Wetlands Inventory wetland types were identified within the project study area, including freshwater forested/shrub wetland (PFO1A), freshwater pond (PUBHx), and riverine (R2UBH). Please refer to **Attachment 1** for the USGS topographic map of the study area. **Attachment 2** provides an aerial photograph of the project study area and **Attachment 3** provides the IPaC System Trust Resources List.

Please provide Gannett Fleming with an official response letter regarding any species of concern within or in close proximity to the study area as well as any conservation measures that should be implemented. We would appreciate an expedited review, if possible. Please contact me at (717) 763-7211, extension 2914, with any questions or requests for additional information. Thank you for your cooperation; we look forward to working with you on this project.

Very truly yours,

Danielle Iuliucci
Environmental Scientist

Attachments

Copies Furnished (electronically): S. Liskovich, GF Project Manager
D. Graff, GF Sr. Environmental Scientist
S. Smith, GF Environmental Scientist
File

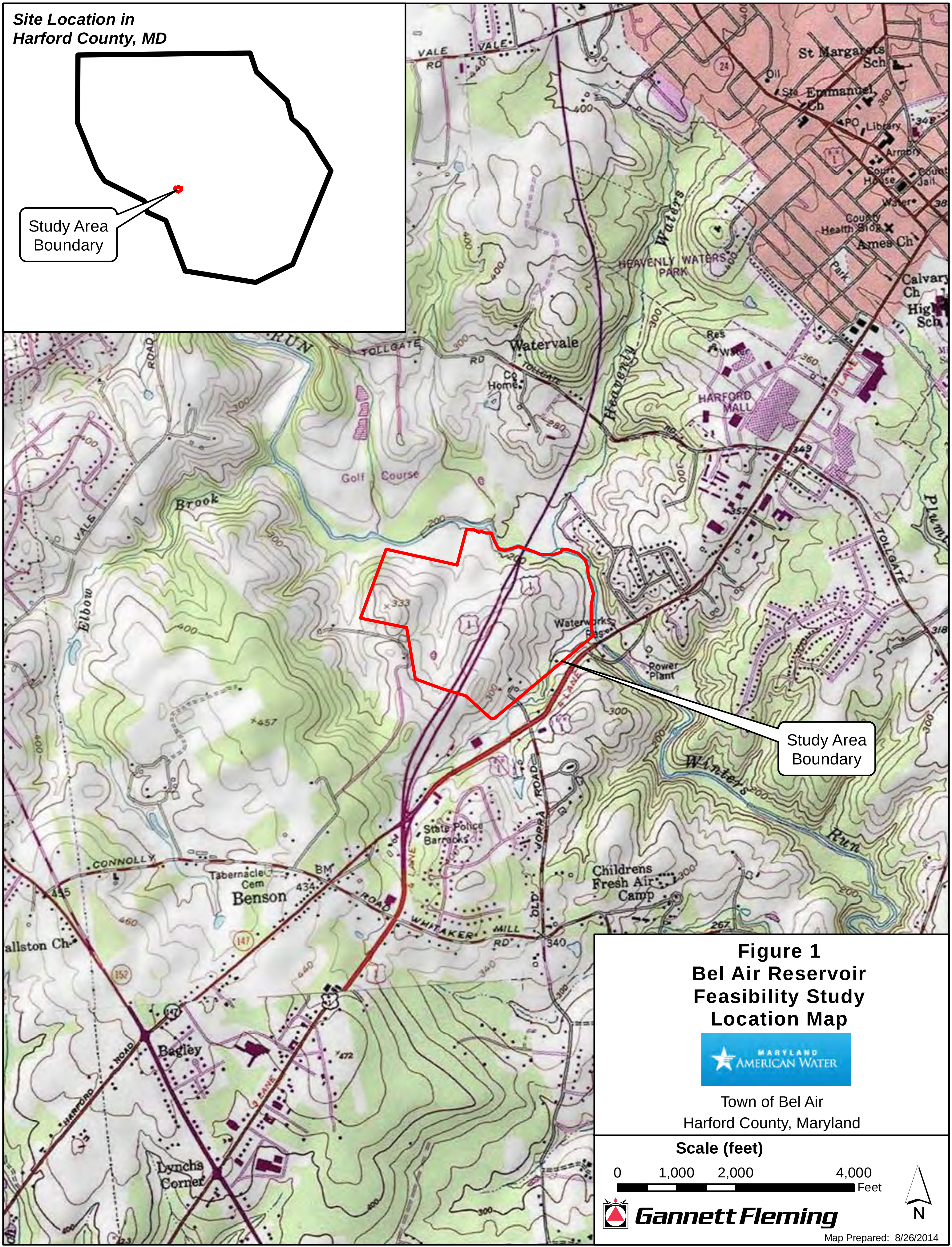


Figure 1
Bel Air Reservoir Feasibility Study Location Map

MARYLAND AMERICAN WATER

Town of Bel Air
Harford County, Maryland

Gannett Fleming

Data Source: USGS topo map with excerpts from 7.5' Quadrangles - Jarrettsville, Maryland, and Belair, Maryland, provided by ESRI through ArcGIS Online webservice.

Figure 2
Bel Air Reservoir Feasibility Study
Aerial Location Map

MARYLAND AMERICAN WATER

Town of Bel Air
Harford County, Maryland

Scale (feet)

0 500 1,000 2,000 Feet

N

Gannett Fleming

Map Prepared: 8/26/2014

Data Source: Aerial imagery map provided by ESRI through ArcGIS Online webservice.

U.S. Fish and Wildlife Service

Trust Resources List

This resource list is to be used for planning purposes only — it is not an official species list.

Endangered Species Act species list information for your project is available online and listed below for the following FWS Field Offices:

Chesapeake Bay Ecological Services Field Office
177 ADMIRAL COCHRANE DRIVE
ANNAPOLIS, MD 21401
(410) 573-4599

Project Name:

Bel Air Reservoir Feasibility Study

Trust Resources List

Project Location Map:

Project Counties:

Harford, MD

Geographic coordinates (Open Geospatial Consortium Well-Known Text, NAD83):

MULTIPOLYGON (((-76.3774704 39.519473, -76.376612 39.5211613, -76.3759469 39.5208799, -76.3750885 39.5208634, -76.3745736 39.519953, -76.3732217 39.5201185, -76.3722776 39.5197047, -76.3702177 39.5198206, -76.3695739 39.5194399, -76.3692306 39.5187281, -76.3691877 39.5180329, -76.3690804 39.5174039, -76.3693808 39.5162783, -76.3690589 39.5156161, -76.3757069 39.5123041, -76.3772133 39.5133644, -76.3801487 39.5142417, -76.3804985 39.5165925, -76.383288 39.5171884, -76.3815724 39.5204824, -76.3774704 39.519473)))

Trust Resources List

Project Type:

Dam

Endangered Species Act Species List (USFWS Endangered Species Program).

There are no listed species found within the vicinity of your project.

Critical habitats within your project area:

There are no critical habitats within your project area.

FWS National Wildlife Refuges (USFWS National Wildlife Refuges Program).

There are no refuges found within the vicinity of your project.

FWS Migratory Birds (USFWS Migratory Bird Program).

The protection of birds is regulated by the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA). Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. For more information regarding these Acts see http://www.fws.gov/migratorybirds/RegulationsandPolicies.html.

All project proponents are responsible for complying with the appropriate regulations protecting birds when planning and developing a project. To meet these conservation obligations, proponents should identify potential or existing project-related impacts to migratory birds and their habitat and develop and implement conservation measures that avoid, minimize, or compensate for these impacts. The Service's Birds of Conservation Concern (2008) report identifies species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become listed under the Endangered Species Act as amended (16 U.S.C 1531 et seq.).

For information about Birds of Conservation Concern, go to http://www.fws.gov/migratorybirds/CurrentBirdIssues/Management/BCC.html.

Migratory birds of concern that may be affected by your project:

There are **13** birds on your Migratory birds of concern list. The Division of Migratory Bird Management is in the process of populating migratory bird data with an estimated completion time of Fall 2014; therefore, the list below may not include all the migratory birds of concern in your project area at this time. While this information is being populated, please contact the Field Office for information about migratory birds in your project area.

Species Name	Bird of Conservation Concern (BCC)	Species Profile	Seasonal Occurrence in Project Area
American bittern (*Botaurus lentiginosus*)	Yes	species info	Wintering
Bald eagle (*Haliaeetus leucocephalus*)	Yes	species info	Year-round
Black-billed Cuckoo (*Coccyzus erythropthalmus*)	Yes	species info	Breeding
cerulean warbler (*Dendroica cerulea*)	Yes	species info	Breeding
Golden-Winged Warbler (*Vermivora chrysoptera*)	Yes	species info	Breeding
Least Bittern (*Ixobrychus exilis*)	Yes	species info	Breeding
Marbled Godwit (*Limosa fedoa*)	Yes	species info	Wintering
Pied-billed Grebe (*Podilymbus podiceps*)	Yes	species info	Breeding
Purple Sandpiper (*Calidris maritima*)	Yes	species info	Wintering
Rusty Blackbird (*Euphagus carolinus*)	Yes	species info	Wintering
Short-billed Dowitcher (*Limnodromus griseus*)	Yes	species info	Wintering
Wood Thrush (*Hylocichla mustelina*)	Yes	species info	Breeding
Worm eating Warbler (*Helmitheros vermivorum*)	Yes	species info	Breeding

Trust Resources List

NWI Wetlands (USFWS National Wetlands Inventory).

The U.S. Fish and Wildlife Service is the principal Federal agency that provides information on the extent and status of wetlands in the U.S., via the National Wetlands Inventory Program (NWI). In addition to impacts to wetlands within your immediate project area, wetlands outside of your project area may need to be considered in any evaluation of project impacts, due to the hydrologic nature of wetlands (for example, project activities may affect local hydrology within, and outside of, your immediate project area). It may be helpful to refer to the USFWS National Wetland Inventory website. The designated FWS office can also assist you. Impacts to wetlands and other aquatic habitats from your project may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal Statutes. Project Proponents should discuss the relationship of these requirements to their project with the Regulatory Program of the appropriate U.S. Army Corps of Engineers District.

Data Limitations, Exclusions and Precautions

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery and/or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Exclusions - Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Precautions - Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the

advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

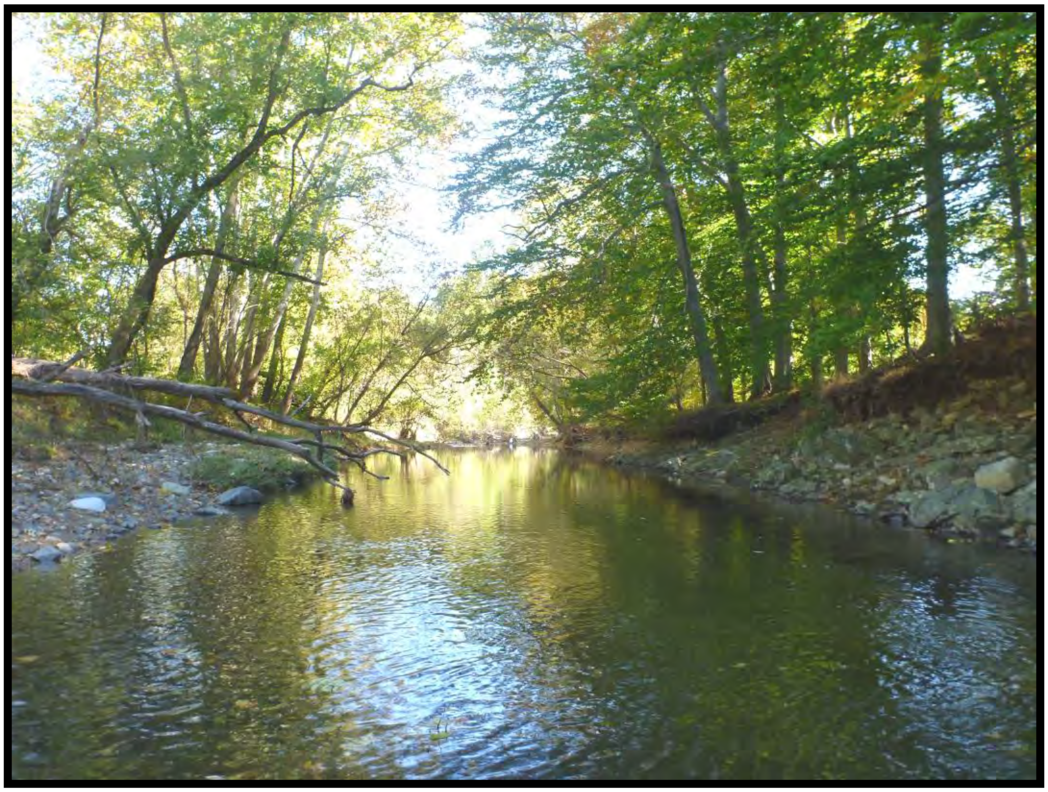
The following wetland types intersect your project area in one or more locations:

Wetland Types	NWI Classification Code	Total Acres
Freshwater Forested/Shrub Wetland	PFO1A	1.7732
Freshwater Pond	PUBHx	0.1999
Riverine	R2UBH	61.948

3.2

Stream Assessment Report

STREAM ASSESSMENT REPORT



Bel Air Impoundment Project

Bel Air, Harford County, Maryland

Prepared for:

MARYLAND AMERICAN WATER

Prepared by:

Gannett Fleming

November 2015

STREAM ASSESSMENT REPORT

Maryland American Water
Bel Air Impoundment Project
Town of Bel Air, Harford County, Maryland

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APPENDIX B PHOTOGRAPHIC REFERENCE COLLECTION
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APPENDIX D RAPID BIOASSESSMENT DATA FORMS
APPENDIX E SUMMARY OF CROSS-SECTION ANALYSIS OF INTAKE AND FLOW-BY RATES

1.0 Introduction

Maryland American Water Company (MAWC) is proposing to construct an off-stream raw water storage reservoir to serve the Town of Bel Air. The proposed project requires a raw water intake structure on Winters Run and associated pipeline crossings on Winters Run to connect the existing Winters Run Water Treatment Plant (WTP). Construction for this project is proposed in an upland field currently used as agricultural land. The connecting infrastructure between the impoundment and the plant will need to cross Winters Run and its floodplain.

The existing Bel Air water system is supplied primarily from the existing Winters Run Water Treatment Plant (2.0 MGD nominal capacity) that treats water from Winters Run. The Winters Run withdrawal is permitted by the Maryland Department of the Environment (MDE) at 1.4 MGD, annual average. The MAWC water system is also supplemented by water supply wells. Finally, MACW has an agreement with Harford County for a 0.5 MGD supply through an existing metered interconnection.

When stream flow drops below the minimum pass-by flow stipulated by MDE, water cannot be withdrawn by the water treatment plant. During such times historically, the Harford County has allowed the MAWC system to take water in excess of the agreement amount to meet system demands. The County is now facing projected long-term supply shortfalls and has alerted MAWC that they can no longer commit to supplemental supply. As a result, the MAWC identified and evaluated a number of options for a supplemental supply.

In working with Harford County and MDE to evaluate supply alternatives, the County identified a County-owned parcel adjacent to Winters Run, upstream of the Winters Run Water Treatment Plant that could potentially be used for construction of an off-stream storage reservoir. The reservoir would be purchased by MAWC and used to supply the WTP when withdrawal from the stream is restricted or prohibited. The reservoir would be refilled from the stream when flows are sufficient to meet both the supply needs and the refill rates.

The permitted average flow from Winters Run is 1.4 million gallons per day (MGD) with a flow-by requirement of 6.07 MGD. When high flow events occur in Winters Run, MAWC proposes a higher flow-by requirement of 10.62 MGD for withdrawals greater than 1.7 MGD up to a maximum of 8.4 MGD. This will enable the refilling of the off-stream storage reservoir. Retaining the intake’s existing withdrawal rate will allow the WTP to continue to readily supply water to the Town of Bel Air, and the additional higher flow-by and withdrawal rate will maintain the normal pool and refill the reservoir supply for when higher flows occur in Winters Run. This scenario allows MAWC to take raw water during higher flow events and will not deprive downstream users and aquatic life.

2.0 Purpose

The purpose of this report is to confirm the macroinvertebrate assemblage and water quality of Winters Runs immediately upstream and downstream of the Winters Run Water Treatment Plant.

The data collected will be used to support future permitting efforts and assessing impacts to Winters Run.

3.0 Study Area Description

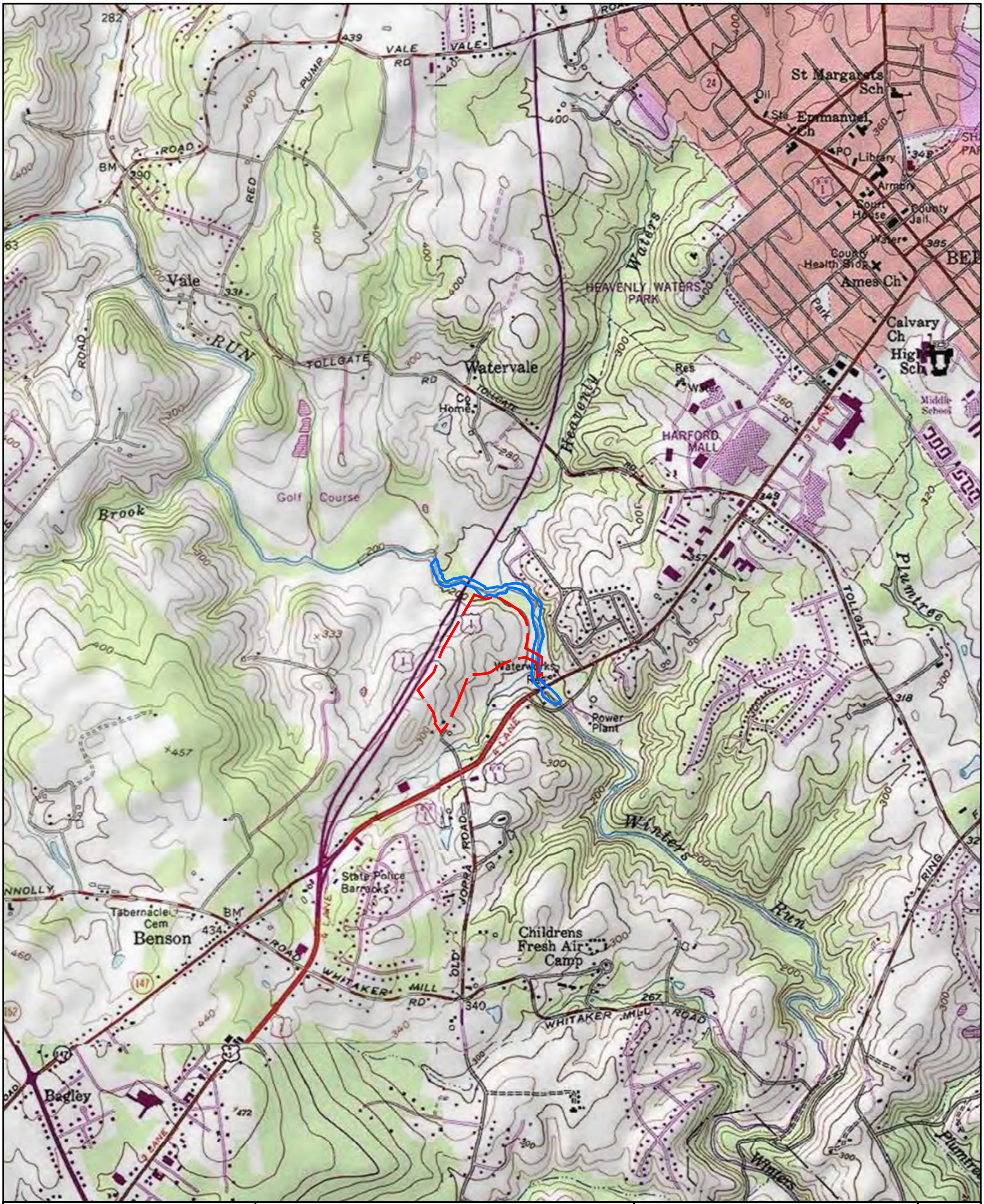
MAWC has proposed to construct an off-stream storage reservoir in an agricultural field southwest of Winters Run between Route 1/Bel Air Bypass and Baltimore Pike. The stream assessment study area encompassed approximately 4,000 linear feet of Winters Run from the Lake Fanny Road Bridge at the downstream limit to approximately 750 linear feet upstream of the U.S. Route 1/Bel Air Bypass Bridge over Winters Run.

3.1 Surface Waters

Winters Run is identified as a perennial stream by the U.S. Geological Survey (USGS) (**Figure 2**). Two perennial tributaries, Heavenly Waters and an unnamed tributary, enter Winters Run within the stream assessment study area. Maryland Department of the Environment (MDE) identified the Designated Use Class for Winters Run and its tributaries as Use Class IV-P: Recreational Trout Waters and Public Water Supply. Maryland classifies surface water bodies according to use classes which describe the suite of specific designated uses or goals for that water body. The Maryland Department of Natural Resources (MDNR) does not stock Winters Run or its tributaries, nor does it list these streams as a wild trout waters.

3.2 Previous Stream Studies

Winters Run (above Atkinson Reservoir) was evaluated in *Assessing the Quality of Streams in and around Maryland’s Multi-Component Chesapeake Bay National Estuarine Research Reserve* (2007), a large scale non-tidal tributary assessment study conducted between 2000 and 2006 by MDNR’s Maryland Biological Stream Survey (MBSS). The benthic macroinvertebrate assemblages and biological integrity metrics were poor and reflect impairment. However, the fish biological integrity metrics were good and indicated streams conditions were good for fishes. Nitrate concentrations were moderately high within the Winters Run watershed. The poor assemblage of benthic macroinvertebrates observed in Winters Run was attributed to adverse impacts to stream water chemistry and physical habitat quality associated with increased urban development and land conversion to impervious surfaces.



Legend

🟦 Stream Assessment Study Area

🟥 Project Limit of Disturbance

Figure 1
Site Location Map

Bel Air Impoundment Project

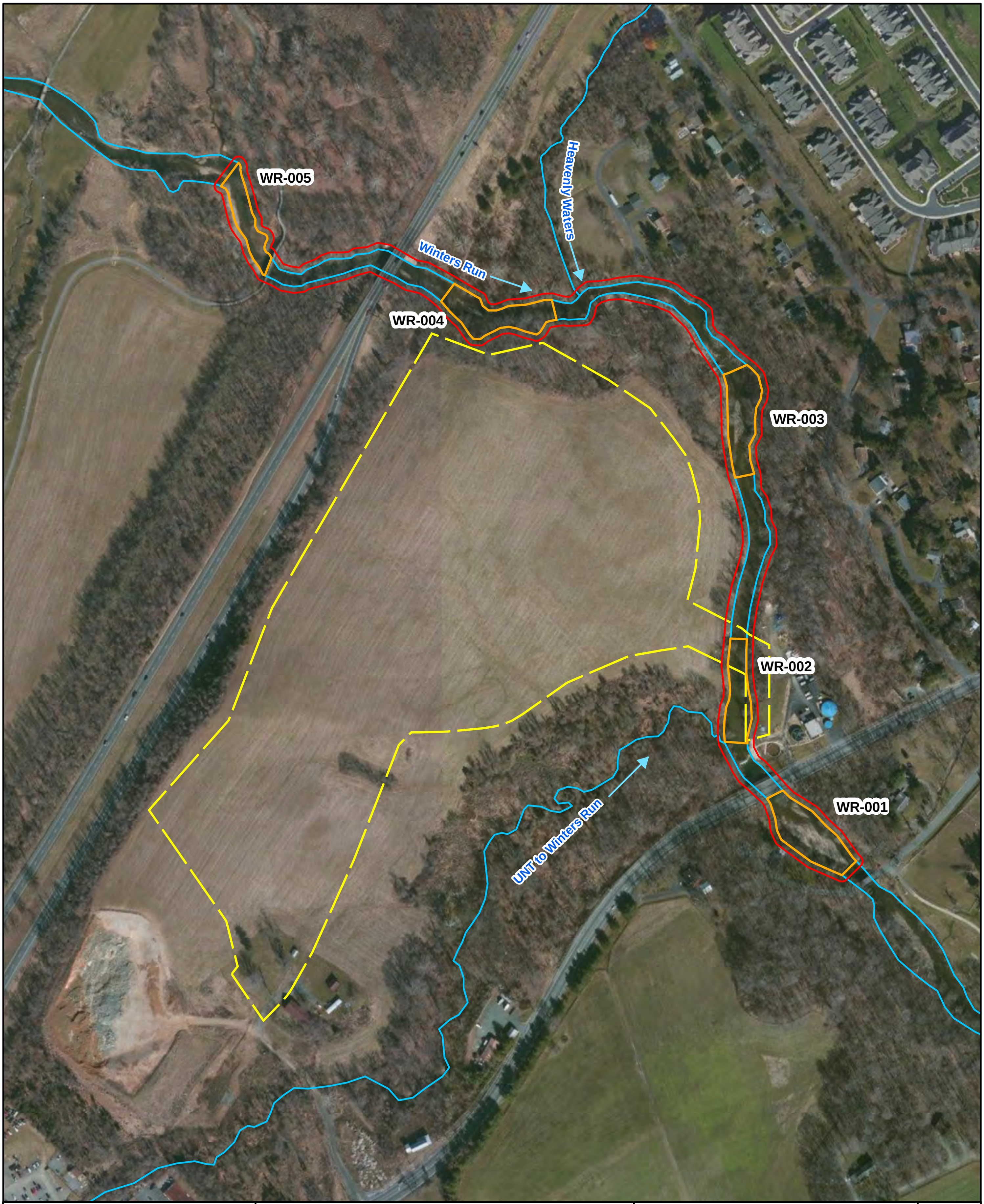
MARYLAND AMERICAN WATER
Bel Air, Harford County, Maryland

Feet
2,000 1,000 0 2,000

N

Gannett Fleming

Source: USGS topographic basemapping provided by ESRI ArcGIS Online webservices.



Legend

- Project Limit of Distrubance
- Stream Assessment Study Area
- Sample Locations
- Streams

Figure 2
Sample Locations

Bel Air Impoundment Project

MARYLAND AMERICAN WATER
Town of Bel Air, Harford County, Maryland

Feet
400 200 0 400

Gannett Fleming

N

Source: Aerial imagery basemapping provided by ESRI ArcGIS Online webservices.

4.0 Methods

4.1 Field Methods and Approach

Gannett Fleming's (GF) team of environmental scientists conducted the field investigations on October 19, 2015. A MDNR Fisheries Service Scientific Collection Permit (Permit No. SCP201591) was issued to Samantha Hockenberry (GF) for the purpose of benthic aquatic macroinvertebrate sample collection for the stream assessment effort. A copy of the scientific collection permit is provided in **Appendix A**.

Winters Run was evaluated and surveyed for benthic macroinvertebrates in accordance with the *Rapid Bioassessment Protocols (RBP) for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish (2nd Edition)* (Barbour *et al*, 1999). Five (5) 100-meter (approximately 330-feet) sampling reaches were identified, evaluated, and surveyed for macroinvertebrates within Winters Run within the stream assessment study area. The *Rapid Bioassessment Physical Characterization/Water Quality* and *Habitat Assessment Field Data Sheets* for low gradient streams were completed while at sampling reach locations (Barbour *et al*, 1999). Water quality measurements were taken using a Horiba U-22 multiparameter water quality meter.

Macroinvertebrates were collected using a D-frame dip net and the kick-netting method for D-frame dip nets as described in the RBP for Single and Multi-Habitat Approaches for macro-invertebrate collection. For each sampling reach, the collections from all 10 kicks were composited into one sample and stored in 95% denatured ethanol. *Rapid Bioassessment Benthic Macroinvertebrate Field Data Sheet* was completed in the field following completion of macroinvertebrate collection (Barbour *et al*, 1999). For quality control, a duplicate macroinvertebrate sample was collected at a randomly selected sampling reach to represent 20% of the total sampling effort within the Winters Run stream assessment study area.

To avoid contamination from other watersheds, equipment used for stream assessment fieldwork were thoroughly cleaned prior to use in Winters Run. The bottleware were new and had not been previously used in another watershed. The D-frame dip net and sieve were thoroughly scrubbed with 95% denatured ethanol to kill and dislodge remnant organisms from previous use. Waders were cleaned and dry prior to fieldwork, and all waders used had rubber soles. Between sampling reaches the D-frame net and sieve were rinsed with 95% denatured ethanol to kill and dislodge remaining organisms. Boot soles were inspected for trapped organisms to reduced cross-contamination between sampling reaches.

4.2 Laboratory Methods

The full sample for each reach was picked in its entirety for all macroinvertebrates. Picking efforts were quality control reviewed by re-picking/searching half of each sample's total volume for missed individuals. If the efficiency rate of the picking effort was greater than 90%, then sample passed quality control review for picking.

For each reach sample, macroinvertebrates were sorted to family and identified to the lowest practical taxonomic level, which was genus for most specimen. A photographic reference collection was assembled exhibiting all taxa identified for quality control identification review. The photographic reference collection, depicting a representative specimen from each taxon, was assembled and is provided as **Appendix B**.

Macroinvertebrates were identified and reviewed using a Wolfe DigiVu SZM 3.0 Stereomicroscope with up to 40x magnification. Dichotomous keys used for macroinvertebrate identification included:

- *An Introduction to the Aquatic Insects of North America* (Merritt *et al*, 2006);
- *Nymphs of North American Stonefly Genera (Plecoptera)* (Stewart *et al*, 1988);
- *Larvae of the North American Caddisfly Genera (Trichoptera)* (Wiggins, 1977)*;*
- *Guide to Aquatic Invertebrates of the Upper Midwest* (Bouchard *et al,* 2004); and
- *Freshwater Macroinvertebrates of Northeastern North America* (Peckarsky, 1990).

The picking and identification efforts were conducted by GF's environmental scientist with a Society of Freshwater Science Taxonomic Certification to Family Level for Aquatic Insects and academic training in the field of aquatic entomology and taxonomy.

5.0 Results

5.1 Sampling Reach Location and General Description

Sampling Reach: WR- 001

Coordinates: Lat. 39° 30' 55.68" N; Long. 76° 22' 7.99" W

Description: WR-001 was located between the Bel Air Road Bridge over Winters Run and the Lake Fanny Road Bridge over Winters Run. This sampling reach was located at the downstream limits of the stream assessment study area and is approximately 200 linear feet downstream of the Winters Run Water Treatment Plant Intake. The stream width within this sampling reach was approximately 110 feet and varied in depth from 0 to 36+ inches at the time of the field survey.

Photographs: See **Appendix C**

Canopy Cover: Trees and shrubs were observed along the top of banks. The stream within this reach was under partly open canopy consisting of sycamore, maples, and hickories.

RBP Habitat Assessment: Score 90 **(Appendix D)**

Sampling Reach: WR- 002

Coordinates: Lat. 39° 31 '0.56" N; Long. 76° 22' 9.22" W

Description: WR-002 was located immediately upstream of the Winters Run Water Treatment Plant intake. This sampling reach was located approximately 150 linear feet upstream of the Bel Air Road Bridge over Winters Run. The stream width within this sampling reach was approximately 65 feet and varied in depth from 18 to 48+ inches at the time of the field survey. The quality control duplicate sample was collected within this reach.

Photographs: See **Appendix C**

Canopy Cover: Trees and shrubs were observed along the top of banks. This sampling reach was under partly open canopy consisting of black walnut, sycamore, and box elder.

RBP Habitat Assessment: Score 99 **(Appendix D)**

Sampling Reach: WR- 003

Coordinates: Lat. 39° 31' 8.91" N; Long. 76° 22' 9.69" W

Description: WR-003 was located approximately 1,000 linear feet upstream of the Bel Air Road Bridge over Winters Run. The stream width within this sampling reach was approximately 85 feet and varied in depth from 0 to 36+ inches at the time of the field survey.

Photographs: See **Appendix C**

Canopy Cover: Trees and shrubs were observed along the top of banks. This sampling reach was under partly closed canopy consisting of sycamore, black cherry, black locust, and spicebush.

RBP Habitat Assessment: Score 97 **(Appendix D)**

Sampling Reach: WR- 004

Coordinates: Lat. 39° 31' 10.83" N; Long. 76° 22' 19.24" W

Description: WR-004 was located approximately 350 linear feet downstream of the U.S. Route 1 Bridge over Winters Run. The stream width within this sampling reach was approximately 65 feet and varied in depth from 0 to 48+ inches at the time of the field survey.

Photographs: See **Appendix C**

Canopy Cover: Trees and shrubs were observed along the top of banks. This sampling reach was under partly closed canopy consisting of American beech and red maple.

RBP Habitat Assessment: Score 107 **(Appendix D)**

Sampling Reach: WR- 005

Coordinates: Lat. 39° 31' 13.59" N; Long. 76° 22' 29.12" W
Description: WR-005 was located approximately 400 linear feet upstream of the U.S. Route 1 Bridge over Winters Run. The stream width within this sampling reach was approximately 60 feet and varied in depth from 0 to 36+ inches at the time of the field survey.

Photographs: See **Appendix C**

Canopy Cover: Trees and shrubs were observed along the top of banks. This sampling reach was under partly open canopy consisting of American sycamore, green and white ashes, and multiflora rose.

RBP Habitat Assessment: Score 105**(Appendix D)**

5.2 Water Quality Parameters

Several water quality parameters were measured in the field during the sampling events. Temperature, pH, conductivity, turbidity, dissolved oxygen (DO), and total dissolved solids (TDS) were recorded during the sampling event and the results are summarized in **Table 1** .

5.3 Macroinvertebrate Data Collection Results

Macroinvertebrates were sampled at each sampling reach on October 19, 2015. **Tables 2** and **3** present the macroinvertebrate data for October 2015.

Table 1
Water Quality Parameters Summary Table

WATER QUALITY PARAMETERS TABLE **Water Quality Meter Used: Horiba U-22**	WR-001	WR-002	WR-003	WR-004	WR-005
Date Collected	10/19/2015	10/19/2015	10/19/2015	10/19/2015	10/19/2015
Time Collected	0930hrs	1055hrs	1140hrs	1240hrs	1325hrs
Temperature (°C)	6.70	7.34	8.16	8.83	9.56
pH (Standard Units)	5.60	5.71	5.64	5.90	5.92
Conductivity (mS/cm)	0.33	0.32	0.32	0.29	0.29
Turbidity (NTUs)	6.00	7.70	3.20	2.50	2.60
Dissolved Oxygen (DO) (mg/L)	13.21	14.38	14.16	14.17	13.90
Total Dissolved Solids (TDS) (mg/L)	210	204	204	190	190

Table 2
Macroinvertebrate Data, October 2015

Order	Family	Genus	Hilsenhoff	Functional Feeding Group	WR-001	WR-002	WR-003	WR-004	WR-005	WR-002 DUP
EPHEMEROPTERA	Baetidae	*Acentrella sp.*	4	SC	2	-	1	-	1	-
		Family (recently molted)	6	CG	18	-	2	4	2	-
	Hepatgeniidae	*Maccaffertium* sp.	4	SC	-	-	-	8	-	-
	Isonychidae	*Isonychia*	3	CG	2	-	-	3	-	-
TRICHOPTERA	Hydropsychidae	*Cheumatopsyche* sp.	6	FC	37	-	15	39	15	-
		Ceratopsyche sp.	5	FC	71	-	16	49	6	-
		Family (immature)	5	FC	18	-	6	52	12	-
	Philopotamidae	*Chimarra* sp.	4	FC	5	-	3	18	2	-
COLEOPTERA	Elmidae	*Stenelmis* sp.	5	CG	2	-	1	-	1	-
	Psephenidae	*Psephenus* sp.	4	SC	1	-	-	-	-	-
DIPTERA	Chironomidae	Family	6	CG	44	1	13	62	28	2
	Simuliidae	Family	6	FC	7	-	1	1	4	-
	Tipulidae	*Tipula* sp.	4	SH	2	-	-	-	-	-
		Antocha sp.	3	CG	3	-	-	8	1	-
	Empididae	*Hermerodromia* sp.	6	PR	-	-	1	-	-	-
AMPHIPODA	Crangonyctidae	Family	4	CG	1	-	-	2	-	-
OLIGOCHAETA	-	-	10	CG	8	-	-	-	-	-
BIVALVIA (Class)	Veneridae	Family	-	-	-	-	1	-	-	-

Functional Feeding Groups	
CG	Collector-Gatherer
FC	Filter-Collector
PR	Predator
SC	Scraper
SH	Shredder

Total Number of Individuals	221	1	59	246	72	2
Total Number of Taxa	15	1	10	11	10	1

Dominant Taxon	Hydrospychidae *Ceratopsyche* sp.	Chironomidae	Chironomidae	Chironomidae	Chironomidae	Chironomidae
Percent of Sample	32.1%	100.0%	27.1%	25.2%	38.9%	100.0%

Table 3
Summary of Metrics

Metrics and IBI Score Summary	**Stations**					
Metrics:	**WR-001**	**WR-002**	**WR-003**	**WR-004**	**WR-005**	**WR-002 DUP**
EPT taxa richness	3	0	2	2	2	0
Total taxa richness	15	1	10	11	10	1
Shannon Diversity Index	1.99	0.00	1.87	1.89	1.74	0.00
Hilsenhoff Biotic Index	5.57	-	5.47	5.23	5.61	-
Percent Sensitive Individuals	2.26	0.00	0.00	4.47	1.39	0.00

6.0 Discussion

The benthic macroinvertebrate communities present in Winters Run reflect poor stream condition and physical impairment likely due to increased urban development within the watershed. Chironomidae (non-biting midges) and Hydropsychidae (net-spinner caddisflies) were the dominant taxa collected in Winters Run. These taxa are widespread and tolerant of a wide water quality and physical condition range. The overall low abundance of individuals collected is attributed to the deep sandy substrate within the stream channel that is difficult for benthic macroinvertebrates to colonize and persist. The limited presence of pollution-intolerant macroinvertebrates, such as *Maccaffertium* sp. (flathead mayflies), *Isonychia* sp. (brush-legged mayflies), and *Antocha* sp. (crane flies) suggest that the water quality is good and able to support aquatic life. However, the predominantly sandy substrate limits the colonization of these particular taxa. The water quality parameter measurements indicate the stream water quality is good with sufficient dissolved oxygen to support fish communities. During the field investigation, several fish species were observed which included blacknose dace (*Rhinichthys atratulus*), creek chub (*Semotilus atromaculatus*), and Blue Ridge sculpin (*Cottus caeruleomentum*).

Based on this stream assessment conducted under the existing annual average 1.4 MGD withdrawal rate and 6.07 MGD flow-by requirement, it is expected that additional surface water withdrawals exceeding the maximum daily withdrawal rate of 1.7 MGD up to a maximum withdrawal rate of 8.4 MGD should not have a detrimental impact on Winters Run with a higher flow-by requirement up to 10.62 MGD. When high flow events occur in Winters Run, MAWC proposes a higher flow-by requirement of 10.62 MGD for withdrawals greater than 1.4 MGD up to a maximum of 8.4 MGD. This will enable the refilling of the off-stream storage reservoir. Retaining the intake’s existing withdrawal rate will allow the WTP to continue to readily supply water to the Town of Bel Air, and the additional higher flow-by and withdrawal rate will maintain the normal pool and refill the reservoir supply for when higher flows occur in Winters Run. Based on this stream assessment, this scenario allows MAWC to withdrawal additional raw water during higher flow events and will not deprive downstream users and aquatic life. A summary of cross-section analysis of current and proposed intake and flow-by rates are provided in **Appendix E**.

7.0 Contributors

David H. Graff, Senior Environmental Scientist, QA/QC

Professional Experience: 17 years

Education: B.S., Environmental Studies
M.A.Ed., Environmental Studies

- 38 Hour U.S. Army Corps of Engineers Wetland Delineator Certification Training
- Habitat Evaluation Procedures (HEP) Certified
- Professional Wetland Scientist, (PWS) No. 001385, Society of Wetland Scientists
- Certified Senior Ecologist (CSE), Ecological Society of America
- Certified Wildlife Biologist (CWB), The Wildlife Society

Autumn M. Thomas, Senior Environmental Scientist

Professional Experience: 16 years

Education: B.S., Environmental Science and Natural Resources Biology

- Rutgers Wetland Delineation Certificate Series
- Region Supplement to the Corps of Engineers Wetland Delineation Manual Update Workshop
- USFWS & PFBC Recognized, Qualified Bog Turtle Surveyor

S**amantha R. Hockenberry**, Environmental Scientist

Professional Experience: 2 year

Education: B.S. Biology
M.S. Biology

- 36 Hour Swamp School Wetland Delineation & Regional Supplement Training
- Society of Freshwater Science Taxonomic Certification to Family Level for Aquatic Insects (2013 – 2018)
- Certified Associate Ecologist (CAE), Ecological Society of America
- MDNR Fisheries Service Scientific Collection Permit No. 201591

8.0 References

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APPENDIX A

MDNR FISHERIES SERVICE

SCIENTIFIC COLLECTION PERMIT NO. 201591

MARYLAND
DEPARTMENT OF
NATURAL RESOURCES

Larry Hogan, *Governor*
Boyd K. Rutherford, *Lt. Governor*
Mark J. Belton, *Secretary*
Mark L. Hoffman, *Acting Deputy Secretary*

Fisheries Service

October 14, 2015

Samantha Hockenberry
Gannett Fleming, Inc.
207 Senate Avenue
Camp Hill, PA 17011

Dear Samantha:

Enclosed is your 2015 Scientific Collection Permit. Your permit number is SCP201591 and expires December 31, 2015. Collectors must possess the permit while sampling. This permit authorizes you to sample and collect fish at certain locations, it does not authorize you to trespass. You must obtain permission prior to sampling on Federal, State, County and private property. A copy of your permit has been forwarded to the Natural Resources Police.

A report of all activity conducted under SCP201591 is due by January 31, 2016. For each date of activity the report should include the following types of information: date, location sampled, number caught by species and what happened to the catch.

Please contact me by e-mail at richard.bohn@maryland.gov , by phone at (410) 260-8317 or by fax at (410) 260-8279 if you have any questions.

Sincerely,

Richard Bohn

Richard Bohn
Permit Coordinator

Enclosure

MARYLAND DEPARTMENT OF NATURAL RESOURCES
FISHERIES SERVICE
SCIENTIFIC COLLECTION PERMIT

1. PERMITTEE

GANNETT FLEMING, INC.
207 SENATE AVENUE
CAMP HILL, PA 17011

2. PERMIT NUMBER **SCP201591**

3. EFFECTIVE 10-14-2015

4. EXPIRES 12-31-2015

5. PHONE 717-763-7211 x2144 (WORK)
E-MAIL shockenberry@gfnet.com

6. NAME AND TITLE OF PRINCIPAL OFFICER SAMANTHA R. HOCKENBERRY, ENVIRONMENTAL SCIENTIST

7. CONDITIONS AND AUTHORIZATIONS:

A. AUTHORITY FOR THIS PERMIT IS UNDER THE ANNOTATED CODE OF MARYLAND §4-212. THE CONDITIONS IN STATE LAW AND REGULATIONS ARE HEREBY MADE A PART OF THIS PERMIT. ALL ACTIVITIES AUTHORIZED HEREIN MUST BE CARRIED OUT IN ACCORD WITH AND FOR THE PURPOSES DESCRIBED IN THE APPLICATION SUBMITTED. CONTINUED VALIDITY OF THIS PERMIT IS SUBJECT TO COMPLETE AND TIMELY COMPLIANCE WITH ALL APPLICABLE CONDITIONS, INCLUDING THE FILING OF ALL REQUIRED INFORMATION AND REPORTS, AND CONDITIONED UPON STRICT OBSERVANCE OF ALL APPLICABLE FOREIGN, FEDERAL, LOCAL OR OTHER STATE LAWS.

B. YOU MUST REPORT THE COLLECTION OF ANY MARKED FISH TO THE APPROPRIATE AGENCY. MARKINGS MAY INCLUDE FIN CLIPS, STREAMER OR FLOY TAGS, ETC.

C. YOU MUST CONTACT THE DEPARTMENT OF NATURAL RESOURCES POLICE AT **410-260-8940** TO LET THEM KNOW WHEN YOU WILL BE OPERATING IN MARYLAND WATERS. THIS ELIMINATES UNNECESSARY POLICE INVESTIGATIONS.

D. THIS PERMIT DOES NOT AUTHORIZE THE COLLECTION, SALVAGE, POSSESSION OR TRANSPORTATION OF ANY SPECIES CLASSIFIED AS PROHIBITED, THREATENED OR ENDANGERED AT THE STATE OR FEDERAL LEVEL (EXCEPT AS LISTED BELOW).

E. STUDY DESCRIPTION: STREAM HEALTH BASELINE ASSESSMENT OF WINTERS RUN IN HARFORD COUNTY FOR A PROPOSED RAW WATER INTAKE AND STORAGE RESERVOIR AND ASSOCIATED PIPELINES FOR THE TOWN OF BEL AIR; WATER QUALITY AND MACROINVERTEBRATE COLLECTIONS USING KICK NETS AND DIP NETS.

F. ALL FISH AND INVERTEBRATES NOT RETAINED FOR IDENTIFICATION MUST BE RETURNED TO THE STREAM LIVE.

G. RESTRICTIONS: COLLECTORS MUST OBTAIN LANDOWNER OR MANAGER PERMISSION BEFORE SAMPLING. TO PREVENT THE INTRODUCTION OR SPREAD OF INVASIVE SPECIES OR AQUATIC DISEASES, COLLECTORS MUST CLEAN ALL WADERS AND COLLECTION GEAR USING EFFECTIVE DECONTAMINATION PROTOCOLS BEFORE AND AFTER SAMPLING IN MARYLAND.

H. COLLECTION OF MACROINVERTEBRATES USING DIP NETS AND KICK NETS IS PERMITTED **ACCORDING TO SECTIONS 7A-G (SEE ABOVE)** IN WINTERS RUN IN HARFORD COUNTY FOR THE PURPOSES OF ESTABLISHING A BASELINE STREAM ASSESSMENT.

I. SPECIES COLLECTED AND/OR HELD UNDER THIS PERMIT ARE NOT PERMITTED FOR PERSONAL CONSUMPTION OR SALE.

8. LIST OF COLLECTORS IN ADDITION TO THE PRINCIPAL OFFICER (at least one collector on site must be carrying a copy of this permit):

DAVID GRAFF STEVEN SMITH COREY MYERS KRISTIN CIVITELLA STEVEN WITTIG AUTUMN THOMAS

9. REPORTING REQUIREMENTS: SUMMARY REPORT OF PERMIT ACTIVITY DUE BY JANUARY 31, 2016

ISSUED BY Richard Bohn

PERMIT COORDINATOR
410-260-8317

EXPIRES
12-31-2015

APPENDIX B

PHOTOGRAPHIC REFERENCE COLLECTION

Macroinvertebrate Reference Collection

Identification Summary

Order

Ephemeroptera

Family

Baetidae

Genus

Acentrella

Common Name

Small Minnow Mayflies

Life Stage

Larvae

Hilsenhof Tolerance Value

4

Functional Feeding Group

Scraper

Collection Summary

Stream

Winters Run

Collection Method & Equipment

Kick-Netting with D-Frame Net

Collection Date

October 19, 2015

Found in Sampling Reaches

WR-001, WR-003, WR-005

Dorsal View

Ventral View

Penny to Show Scale

Macroinvertebrate Reference Collection

Identification Summary
Order Ephemeroptera
Family Baetidae
Genus Family
Common Name Small Minnow Mayflies
Life Stage Larvae
Hilsenhof Tolerance Value 6
Functional Feeding Group Collector-Gatherer

Collection Summary
Stream Winters Run
Collection Method & Equipment Kick-Netting with D-Frame Net
Collection Date October 19, 2015
Found in Sampling Reaches WR-001, WR-003, WR-004, WR-005

Dorsal View

Ventral View

Penny to Show Scale

Macroinvertebrate Reference Collection

Identification Summary
Order Ephemeroptera
Family Hepatgeniidae
Genus *Maccaffertium*
Common Name Flathead Mayflies
Life Stage Larvae
Hilsenhof Tolerance Value 4
Functional Feeding Group Scraper

Collection Summary
Stream Winters Run
Collection Method & Equipment Kick-Netting with D-Frame Net
Collection Date October 19, 2015
Found in Sampling Reaches WR-001, WR-003, WR-005

Dorsal View

Ventral View

Penny to Show Scale

Macroinvertebrate Reference Collection

Identification Summary
Order Ephemeroptera
Family Isonychidae
Genus *Isonychia*
Common Name Brush-Legged Mayflies
Life Stage Larvae
Hilsenhof Tolerance Value 3
Functional Feeding Group Collector-Gatherer

Collection Summary
Stream Winters Run
Collection Method & Equipment Kick-Netting with D-Frame Net
Collection Date October 19, 2015
Found in Sampling Reaches WR-001, WR-004

Dorsal View

Ventral View

Penny to Show Scale

Macroinvertebrate Reference Collection

Identification Summary

Order

Trichoptera

Family

Hydropsychidae

Genus

Cheumatopsyche

Common Name

Common Net-Spinner Caddisflies

Life Stage

Larvae

Hilsenhof Tolerance Value

6

Functional Feeding Group

Filter-Collector

Collection Summary

Stream

Winters Run

Collection Method & Equipment

Kick-Netting with D-Frame Net

Collection Date

October 19, 2015

Found in Sampling Reaches

WR-001, WR-003, WR-004, WR-005

Dorsal View

Ventral View

Penny to Show Scale

Macroinvertebrate Reference Collection

Identification Summary

Order

Trichoptera

Family

Hydropsychidae

Genus

Ceratopsyche

Common Name

Common Net-Spinner Caddisflies

Life Stage

Larvae

Hilsenhof Tolerance Value

5

Functional Feeding Group

Filter-Collector

Collection Summary

Stream

Winters Run

Collection Method & Equipment

Kick-Netting with D-Frame Net

Collection Date

October 19, 2015

Found in Sampling Reaches

WR-001, WR-003, WR-004,
WR-005

Dorsal View

Ventral View

Penny to Show Scale

Macroinvertebrate Reference Collection

Identification Summary
Order Trichoptera
Family Hydropsychidae
Genus Family (immature)
Common Name Common Net-Spinner Caddisflies
Life Stage Larvae
Hilsenhof Tolerance Value 5
Functional Feeding Group Filter-Collector

Collection Summary
Stream Winters Run
Collection Method & Equipment Kick-Netting with D-Frame Net
Collection Date October 19, 2015
Found in Sampling Reaches WR-001, WR-003, WR-004, WR-005

Dorsal View

Ventral View

Penny to Show Scale

Macroinvertebrate Reference Collection

Identification Summary
Order Trichoptera
Family Philopotamidae
Genus *Chimarra*
Common Name Finger-Net Caddisflies
Life Stage Larvae
Hilsenhof Tolerance Value 4
Functional Feeding Group Filter-Collector

Collection Summary
Stream Winters Run
Collection Method & Equipment Kick-Netting with D-Frame Net
Collection Date October 19, 2015
Found in Sampling Reaches WR-001, WR-003, WR-004, WR-005

Dorsal View

Ventral View

Penny to Show Scale

Macroinvertebrate Reference Collection

Identification Summary
Order Coleoptera
Family Elmidae
Genus *Stenelmis*
Common Name Riffle Beetles
Life Stage Larvae
Hilsenhof Tolerance Value 5
Functional Feeding Group Collector-Gatherer

Collection Summary
Stream Winters Run
Collection Method & Equipment Kick-Netting with D-Frame Net
Collection Date October 19, 2015
Found in Sampling Reaches WR-001, WR-003, WR-005

Dorsal View

Ventral View

Penny to Show Scale

Macroinvertebrate Reference Collection

Identification Summary
Order
Coleoptera
Family
Psephenidae
Genus
Psephenus
Common Name
Water Pennies
Life Stage
Larvae
Hilsenhof Tolerance Value
4
Functional Feeding Group
Scraper

Collection Summary
Stream
Winters Run
Collection Method & Equipment
Kick-Netting with D-Frame Net
Collection Date
October 19, 2015
Found in Sampling Reaches
WR-001

Dorsal View

Ventral View

Penny to Show Scale

Macroinvertebrate Reference Collection

Identification Summary
Order Diptera
Family Chironomidae
Genus Family
Common Name Non-Biting Midges
Life Stage Larvae
Hilsenhof Tolerance Value 6
Functional Feeding Group Collector-Gatherer

Collection Summary
Stream Winters Run
Collection Method & Equipment Kick-Netting with D-Frame Net
Collection Date October 19, 2015
Found in Sampling Reaches WR-001, WR-002, WR-003, WR-004, WR-005, WR-002 DUP

Dorsal View

Ventral View

Penny to Show Scale

Macroinvertebrate Reference Collection

Identification Summary
Order Diptera
Family Simuliidae
Genus Family
Common Name Black Flies, Buffalo Gnats
Life Stage Larvae
Hilsenhof Tolerance Value 6
Functional Feeding Group Filter-Collector

Collection Summary
Stream Winters Run
Collection Method & Equipment Kick-Netting with D-Frame Net
Collection Date October 19, 2015
Found in Sampling Reaches WR-001, WR-003, WR-004, WR-005

Dorsal View

Ventral View

Penny to Show Scale

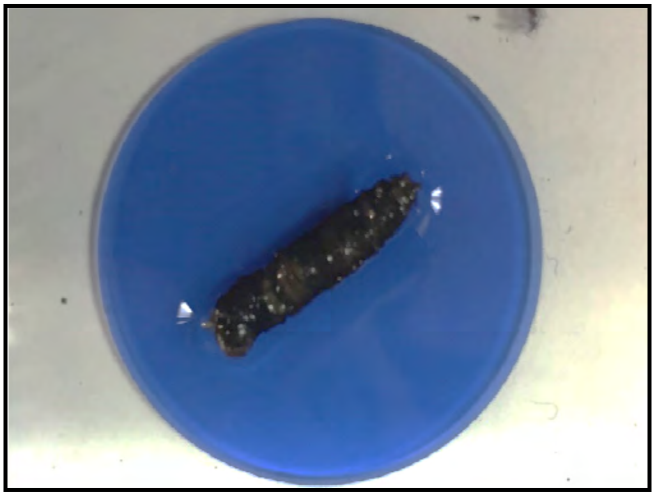
Macroinvertebrate Reference Collection

Identification Summary
Order Diptera
Family Tipulidae
Genus *Tipula*
Common Name Crane Flies
Life Stage Larvae
Hilsenhof Tolerance Value 4
Functional Feeding Group Shredder

Collection Summary
Stream Winters Run
Collection Method & Equipment Kick-Netting with D-Frame Net
Collection Date October 19, 2015
Found in Sampling Reaches WR-001

Dorsal View

Ventral View



Penny to Show Scale

Macroinvertebrate Reference Collection

Identification Summary
Order Diptera
Family Tipulidae
Genus *Antocha*
Common Name Crane Flies
Life Stage Larvae
Hilsenhof Tolerance Value 3
Functional Feeding Group Collector-Gatherer

Collection Summary
Stream Winters Run
Collection Method & Equipment Kick-Netting with D-Frame Net
Collection Date October 19, 2015
Found in Sampling Reaches WR-001, WR-004, WR-005

Dorsal View

Ventral View

Penny to Show Scale

Macroinvertebrate Reference Collection

Identification Summary
Order Diptera
Family Empididae
Genus *Hermerodromia*
Common Name Dance Flies
Life Stage Larvae
Hilsenhof Tolerance Value 6
Functional Feeding Group Predator

Collection Summary
Stream Winters Run
Collection Method & Equipment Kick-Netting with D-Frame Net
Collection Date October 19, 2015
Found in Sampling Reaches WR-003

Dorsal View

Ventral View

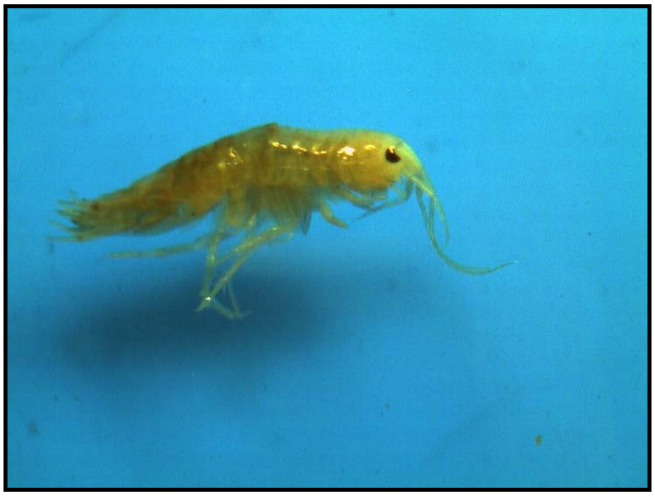
Penny to Show Scale

Macroinvertebrate Reference Collection

Identification Summary
Order Amphipoda
Family Order
Genus Order
Common Name Scuds & Side-Swimmers
Life Stage Adult
Hilsenhof Tolerance Value 4
Functional Feeding Group Collector-Gatherer

Collection Summary
Stream Winters Run
Collection Method & Equipment Kick-Netting with D-Frame Net
Collection Date October 19, 2015
Found in Sampling Reaches WR-001, WR-003

Right Lateral View



Left Lateral View

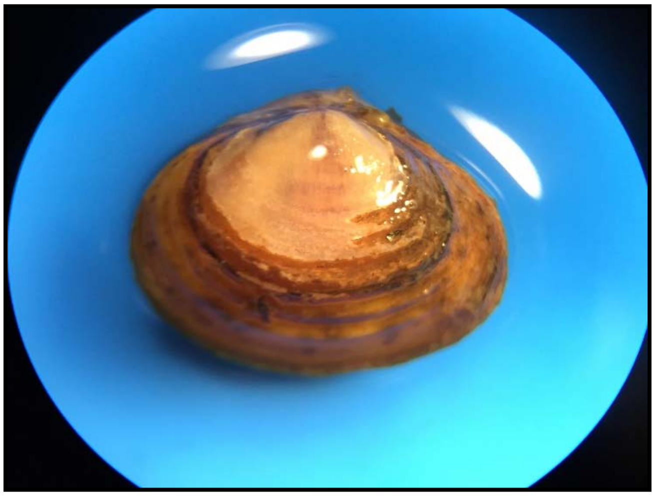
Penny to Show Scale

Macroinvertebrate Reference Collection

Identification Summary
Class Bivalvia
Family Veneridae
Genus Family
Common Name Freshwater Clams & Mussels
Life Stage Adult
Hilsenhof Tolerance Value --
Functional Feeding Group --

Collection Summary
Stream Winters Run
Collection Method & Equipment Kick-Netting with D-Frame Net
Collection Date October 19, 2015
Found in Sampling Reaches WR-001, WR-003

Dorsal View



Ventral View

Penny to Show Scale

Macroinvertebrate Reference Collection

Identification Summary
Order Oligochaeta
Family --
Genus --
Common Name Aquatic Worms
Life Stage Adult
Hilsenhof Tolerance Value --
Functional Feeding Group --

Collection Summary
Stream Winters Run
Collection Method & Equipment Kick-Netting with D-Frame Net
Collection Date October 19, 2015
Found in Sampling Reaches WR-001

Dorsal View

Ventral View

Penny to Show Scale

APPENDIX C

REACH PHOTOGRAPHS & MAPPING

Photo 1 (10-19-2015)
View upstream from Sampling Reach WR-001. The bridge carrying Bel Air Rd over Winters Run is shown, as well as the water treatment plant dam upstream of the bridge.

Photo 2 (10-19-2015)
View of Sampling Reach WR-001 looking downstream from the Bel Air Rd bridge over Winters Run. The bridge carrying Fanny Lake Rd over Winters Run is shown in the distance.

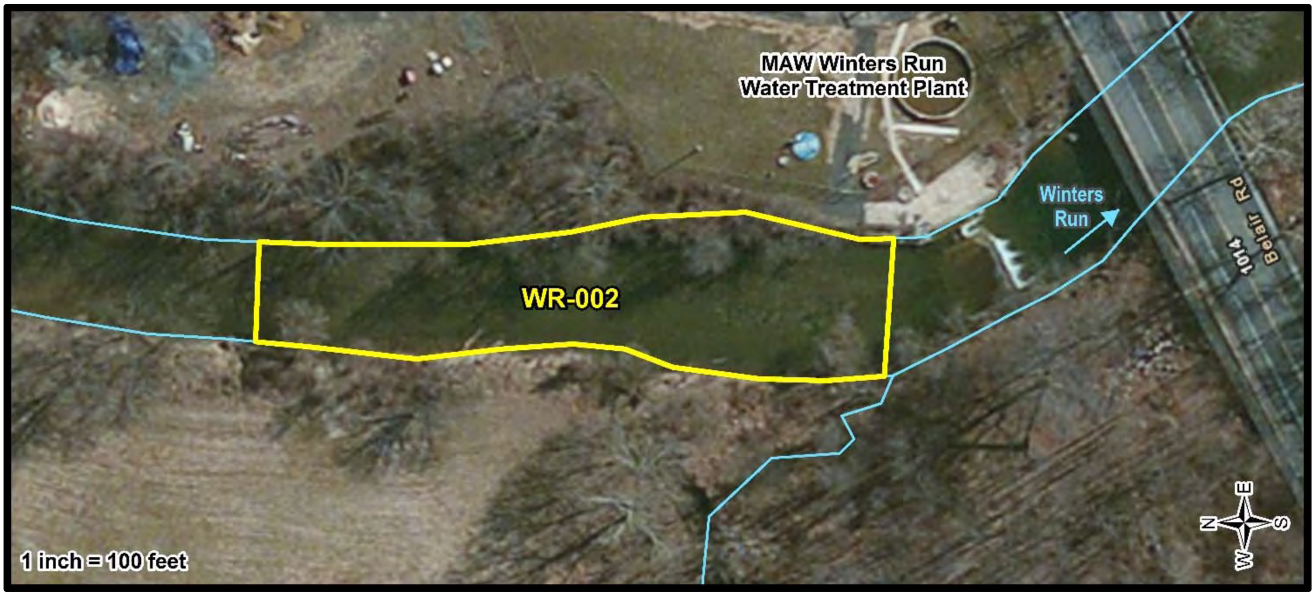


Photo 3 (10-19-2015)
View of Sampling Reach WR-002 looking upstream.

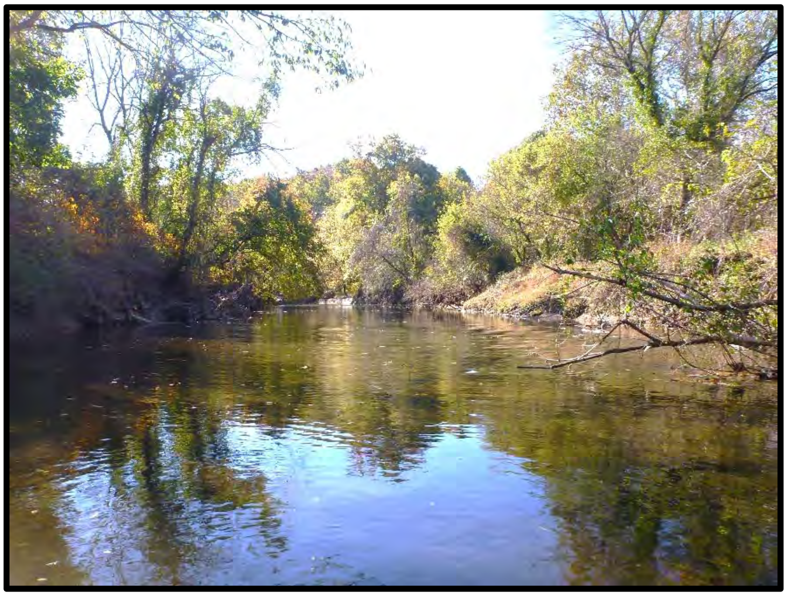
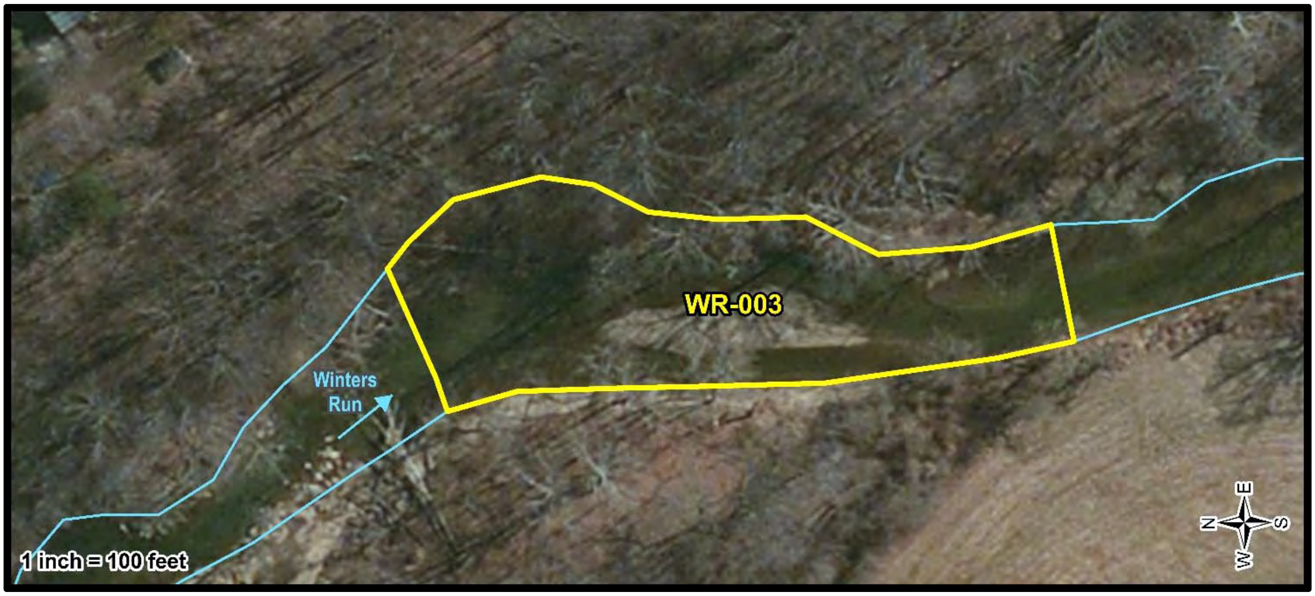


Photo 4 (10-19-2015)
View of Sampling Reach WR-002 looking downstream.



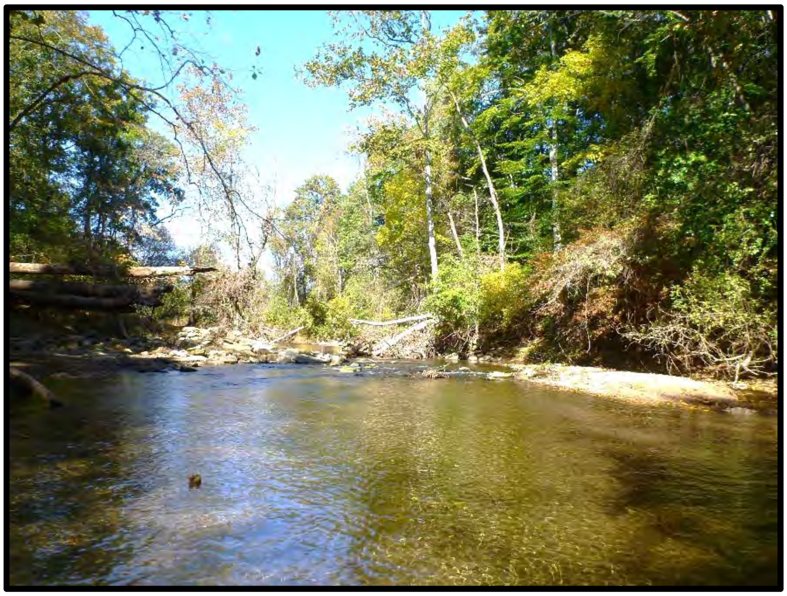


Photo 5 (10-19-2015)
View of Sampling Reach WR-003 looking upstream.

Photo 6 (10-19-2015)
View of Sampling Reach WR-003 looking downstream.

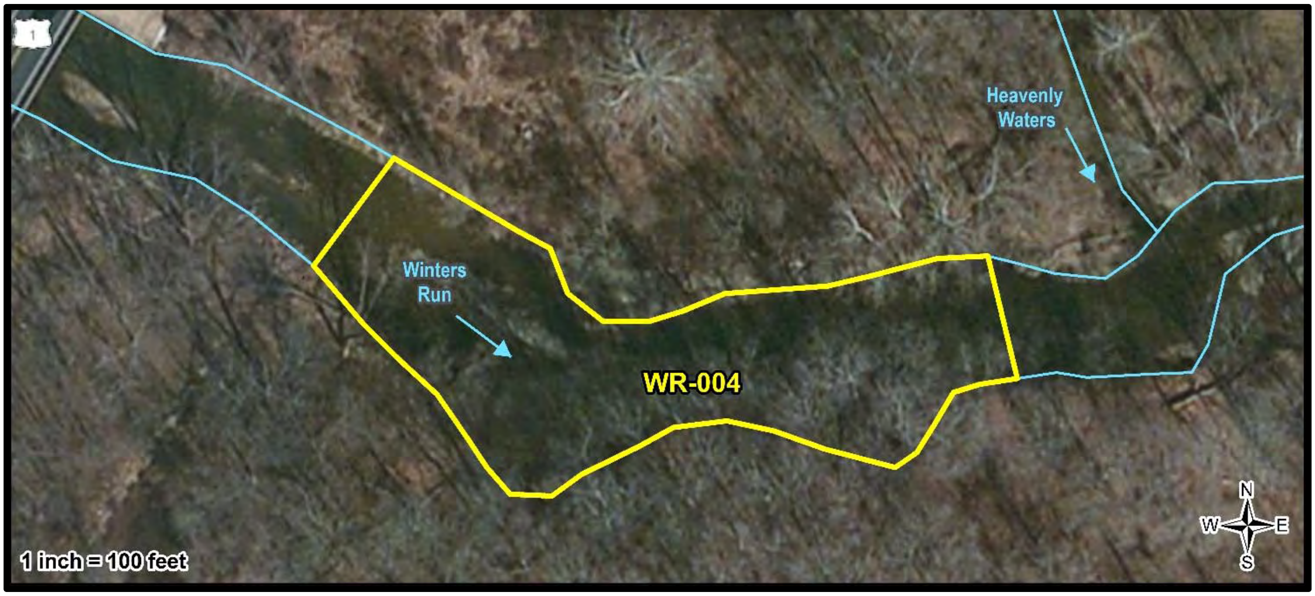


Photo 7 (10-19-2015)
View of Sampling Reach WR-004 looking upstream. The bridge carrying U.S. Route 1 over Winters Run is shown in the distance.

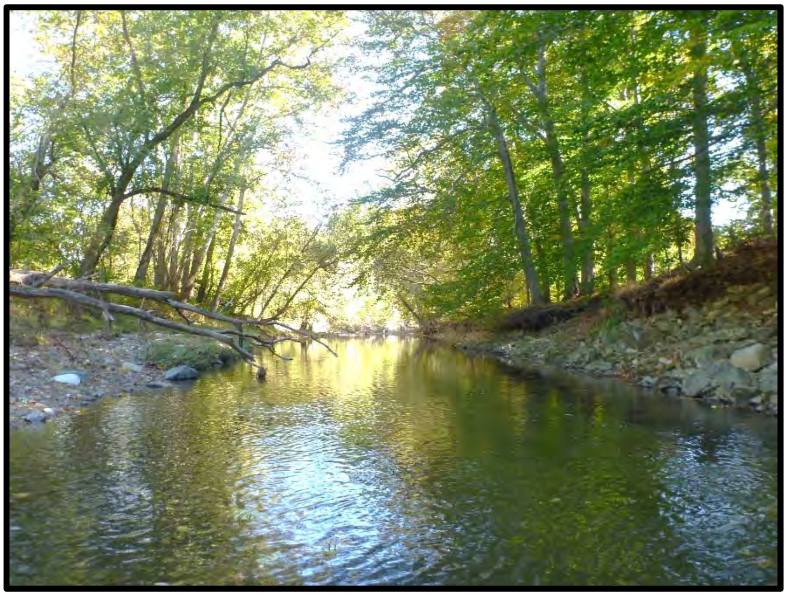


Photo 8 (10-19-2015)
View of Sampling Reach WR-004 looking downstream.

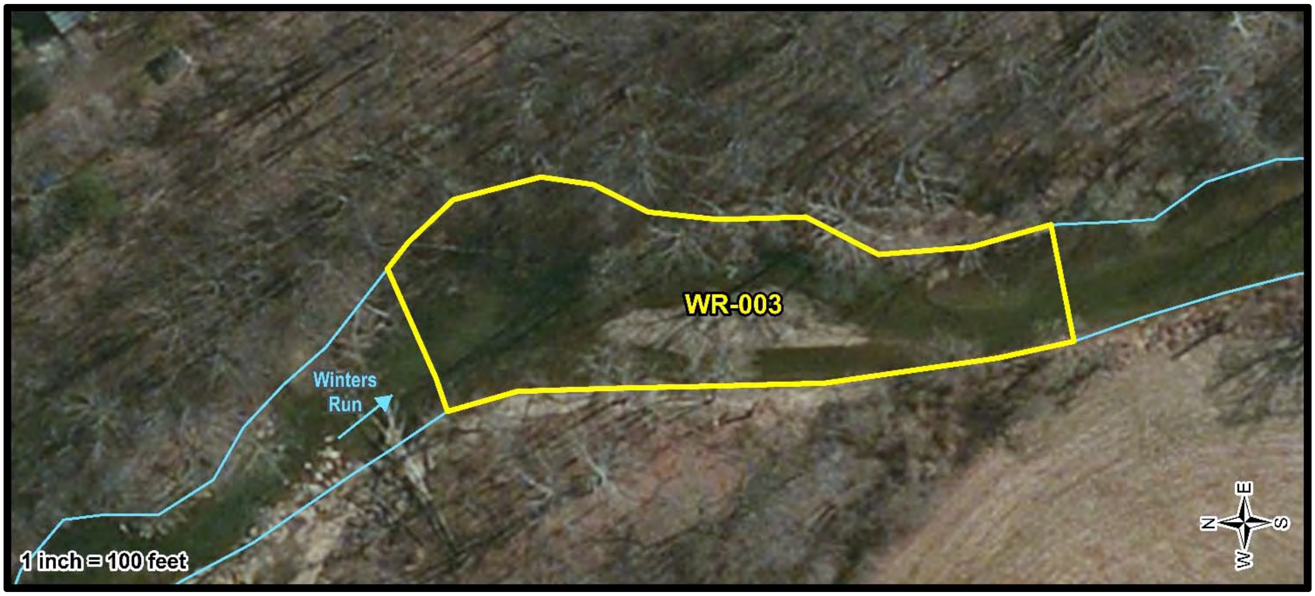


Photo 7 (10-19-2015)
View of Sampling Reach WR-005 looking upstream.

Photo 8 (10-19-2015)
View of Sampling Reach WR-005 looking downstream. The park's pedestrian bridge over Winters Run is shown.

APPENDIX D

RAPID BIOASSESSMENT DATA FORMS

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Winters Run	LOCATION Bel Air, Harford County, Maryland
STATION # WR-001 RIVERMILE --	STREAM CLASS Perennial
LAT 39.515466°N LONG 76.368886°W	RIVER BASIN Bush River
STORET # --	AGENCY MDNR Client: Maryland American Water Company
INVESTIGATORS S. Hockenberry, A. Thomas	
FORM COMPLETED BY Thomas/Hockenberry	DATE 10/19/15 TIME 09:30 ☑AM ☐PM REASON FOR SURVEY Stream Assessment & Macroinvertebrate Survey

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
____% ☐	%cloud cover	☐ ____%
☑	clear/sunny	☑

Has there been a heavy rain in the last 7 days?
☐Yes ☑No

Air Temperature 10 ⁰ C

Other Cool and breezy

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)

See Appendix C - Reach Photographs & Mapping

STREAM CHARACTERIZATION

Stream Subsystem
☑Perennial ☐Intermittent ☐Tidal

Stream Type
☑Coldwater ☐Warmwater

Stream Origin
☐Glacial
☐Non-glacial montane
☐Swamp and bog
☐Spring-fed
☑Mixture of origins
☑Other__________

Catchment Area --_________km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☑ Forest ☐ Commercial
☐ Field/Pasture ☐ Industrial
☐ Agricultural ☐ Other ________________
☑ Residential

Local Watershed NPS Pollution
☑ No evidence ☐ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☐ None ☑ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☑ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous

dominant species present Sycamore, maples, hickories

INSTREAM FEATURES

Estimated Reach Length 100 m

Estimated Stream Width 37 m

Sampling Reach Area 3700 m^2

Area in km^2 (m^2x1000) 0.0037 km^2

Estimated Stream Depth 0 to 1+ m

Surface Velocity (at thalweg) 0.3 m/sec

Canopy Cover
☑ Partly open ☐ Partly shaded ☑ Shaded

High Water Mark 2 m

Proportion of Reach Represented by Stream Morphology Types
☑ Riffle 10 % ☑ Run 90 %
☐ Pool ______%

Channelized ☑ Yes ☐ No

Dam Present ☐ Yes ☑ No

LARGE WOODY DEBRIS

LWD 0 m^2

Density of LWD 0 m^2/km^2 **(LWD/ reach area)**

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☐ Attached Algae

dominant species present none

Portion of the reach with aquatic vegetation 0 %

WATER QUALITY

Temperature 6.7 ^{0} C

Specific Conductance 0.325 mS/CM

Dissolved Oxygen 13.21 mg/L

pH 5.6

Turbidity 6.0 NTUs

WQ Instrument Used Horiba U-22

Water Odors
☑ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other_________________

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☑ None ☐ Other___________________________

Turbidity (if not measured)
☑ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other________

SEDIMENT/ SUBSTRATE

Odors
☑ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other____________________________________

Oils
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☑ Sand
☐ Relict shells ☐ Other__________________

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		--
Boulder	> 256 mm (10")	--
Cobble	64-256 mm (2.5"-10")	50
Gravel	2-64 mm (0.1"-2.5")	--
Sand	0.06-2mm (gritty)	50
Silt	0.004-0.06 mm	--
Clay	< 0.004 mm (slick)	--

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	--
Muck-Mud	black, very fine organic (FPOM)	--
Marl	grey, shell fragments	--

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME Winters Run	LOCATION Bel Air, Harford County, Maryland
STATION # WR-001 RIVERMILE --	STREAM CLASS Perennial
LAT 39.515466°N LONG 76.368886°W	RIVER BASIN Bush River
STORET # --	AGENCY MDNR Client: Maryland American Water Company
INVESTIGATORS S. Hockenberry, A. Thomas	
FORM COMPLETED BY Thomas/Hockenberry	DATE 10/19/15 TIME 09:30 ☑AM ☐PM
	REASON FOR SURVEY Stream Assessment & Macroinvertebrate Survey

	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
Parameters to be evaluated in sampling reach	**1. Epifaunal Substrate/ Available Cover**	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE 11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
	SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 10 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 8 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 95

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME Winters Run
LOCATION Bel Air, Harford County, Maryland
STATION # WR-001 RIVERMILE --
STREAM CLASS Perennial
LAT 39.515466°N LONG 76.368886°W
RIVER BASIN Bush River
STORET # --
AGENCY MDNR Client: Maryland American Water Company
INVESTIGATORS S. Hockenberry, A. Thomas
LOT NUMBER --
FORM COMPLETED BY Thomas/Hockenberry
DATE 10/19/15
TIME 09:30 ☑AM ☐PM
REASON FOR SURVEY Stream Assessment & Macroinvertebrate Survey

HABITAT TYPES

Indicate the percentage of each habitat type present
☑Cobble 50 % ☐Snags____% ☐Vegetated Banks____% ☑Sand 50 %
☐Submerged Macrophytes____% ☐Other ( )____%

SAMPLE COLLECTION

Gear used ☑D-frame ☐kick-net ☐Other ____________

How were the samples collected? ☑wading ☐from bank ☐from boat

Indicate the number of jabs/kicks taken in each habitat type.
☑Cobble 10 ☐Snags____ ☐Vegetated Banks____ ☑Sand 10
☐Submerged Macrophytes____ ☐Other ( )____

GENERAL COMMENTS

QUALITATIVE LISTING OF AQUATIC BIOTA

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	[✓ 0]	1	2	3	4	Slimes	[✓ 0]	1	2	3	4
Filamentous Algae	[✓ 0]	1	2	3	4	Macroinvertebrates	0	1	[✓ 2]	3	4
Macrophytes	[✓ 0]	1	2	3	4	Fish	0	1	[✓ 2]	3	4

FIELD OBSERVATIONS OF MACROBENTHOS

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	[✓ 0]	1	2	3	4	Anisoptera	[✓ 0]	1	2	3	4	Chironomidae	0	1	2	[✓ 3]	4
Hydrozoa	[✓ 0]	1	2	3	4	Zygoptera	[✓ 0]	1	2	3	4	Ephemeroptera	0	1	2	[✓ 3]	4
Platyhelminthes	[✓ 0]	1	2	3	4	Hemiptera	[✓ 0]	1	2	3	4	Trichoptera	0	1	2	3	[✓ 4]
Turbellaria	[✓ 0]	1	2	3	4	Coleoptera	0	[✓ 1]	2	3	4	Other	[✓ 0]	1	2	3	4
Hirudinea	[✓ 0]	1	2	3	4	Lepidoptera	[✓ 0]	1	2	3	4						
Oligochaeta	0	1	[✓ 2]	3	4	Sialidae	[✓ 0]	1	2	3	4						
Isopoda	[✓ 0]	1	2	3	4	Corydalidae	[✓ 0]	1	2	3	4						
Amphipoda	0	[✓ 1]	2	3	4	Tipulidae	0	1	[✓ 2]	3	4						
Decapoda	[✓ 0]	1	2	3	4	Empididae	[✓ 0]	1	2	3	4						
Gastropoda	[✓ 0]	1	2	3	4	Simuliidae	0	[✓ 1]	2	3	4						
Bivalvia	[✓ 0]	1	2	3	4	Tabinidae	[✓ 0]	1	2	3	4						
						Culcidae	[✓ 0]	1	2	3	4						

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Winters Run	LOCATION Bel Air, Harford County, Maryland
STATION # WR-002 RIVERMILE --	STREAM CLASS Perennial
LAT 39.516823°N LONG 76.369228°W	RIVER BASIN Bush River
STORET # --	AGENCY MDNR Client: Maryland American Water Company
INVESTIGATORS S. Hockenberry, A. Thomas	
FORM COMPLETED BY Thomas/Hockenberry	DATE 10/19/15 TIME 10:55 ☑AM ☐PM

REASON FOR SURVEY Stream Assessment & Macroinvertebrate Survey

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
____% ☐	%cloud cover	☐ ____%
☑	clear/sunny	☑

Has there been a heavy rain in the last 7 days?
☐ Yes ☑ No

Air Temperature 10 ^{0} C

Other Cool and breezy

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)

See Appendix C - Reach Photographs & Mapping

STREAM CHARACTERIZATION

Stream Subsystem
☑ Perennial ☐ Intermittent ☐ Tidal

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☑ Mixture of origins
☑ Other__________

Stream Type
☑ Coldwater ☐ Warmwater

Catchment Area -- km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☑ Forest ☐ Commercial
☐ Field/Pasture ☐ Industrial
☑ Agricultural ☐ Other ________________
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☑ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☐ None ☑ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☑ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous

dominant species present Black walnut, sycamore, and box elder

INSTREAM FEATURES

Estimated Reach Length 100 m
Estimated Stream Width 20 m
Sampling Reach Area 2,000 m^2
Area in km² (m^2x1000) 0.0020 km^2
Estimated Stream Depth 0 to 1.5+ m
Surface Velocity (at thalweg) <0.3 m/sec

Canopy Cover
☑ Partly open ☐ Partly shaded ☐ Shaded

High Water Mark 3.5 m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle_______% ☑ Run 100 %
☐ Pool_______%

Channelized ☑ Yes ☐ No

Dam Present ☑ Yes ☐ No

LARGE WOODY DEBRIS

LWD 120 m^2
Density of LWD 6,000 m^2/km^2 **(LWD/ reach area)**

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☐ Attached Algae

dominant species present none

Portion of the reach with aquatic vegetation 0 %

WATER QUALITY

Temperature 7.34 ^{0} C
Specific Conductance 0.317 mS/CM
Dissolved Oxygen 14.38 mg/L
pH 5.71
Turbidity 7.7 NTUs
WQ Instrument Used Horiba U-22

Water Odors
☑ Normal/None ☑ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other_________________

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☑ None ☐ Other___________________________

Turbidity (if not measured)
☑ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other________

SEDIMENT/ SUBSTRATE

Odors
☑ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other_____________________________________

Oils
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☑ Sand
☐ Relict shells ☐ Other_________________

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock		--	Detritus	sticks, wood, coarse plant materials (CPOM)	2
Boulder	> 256 mm (10")	--			
Cobble	64-256 mm (2.5"-10")	20	Muck-Mud	black, very fine organic (FPOM)	--
Gravel	2-64 mm (0.1"-2.5")	--			
Sand	0.06-2mm (gritty)	80	Marl	grey, shell fragments	--
Silt	0.004-0.06 mm	--			
Clay	< 0.004 mm (slick)	--			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME Winters Run	LOCATION Bel Air, Harford County, Maryland
STATION # WR-002 RIVERMILE --	STREAM CLASS Perennial
LAT 39.516823°N LONG 76.369228°W	RIVER BASIN Bush River
STOREST # --	AGENCY MDNR Client: Maryland American Water Company
INVESTIGATORS S. Hockenberry, A. Thomas	
FORM COMPLETED BY Thomas/Hockenberry	DATE 10/19/15 TIME 10:55 ☑AM ☐PM
	REASON FOR SURVEY Stream Assessment & Macroinvertebrate Survey

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 20	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 3 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 99

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME Winters Run
LOCATION Bel Air, Harford County, Maryland
STATION # WR-002 RIVERMILE --
STREAM CLASS Perennial
LAT 39.516823°N LONG 76.369228°W
RIVER BASIN Bush River
STORET # --
AGENCY MDNR Client: Maryland American Water Company
INVESTIGATORS S. Hockenberry, A. Thomas
LOT NUMBER --
FORM COMPLETED BY Thomas/Hockenberry
DATE 10/19/15
TIME 10:55 ☑AM ☐PM
REASON FOR SURVEY Stream Assessment & Macroinvertebrate Survey

HABITAT TYPES

Indicate the percentage of each habitat type present
☑Cobble 20 % ☐Snags_____% ☐Vegetated Banks_____% ☑Sand 80 %
☐Submerged Macrophytes_____% ☐Other ( )_____%

SAMPLE COLLECTION

Gear used ☑D-frame ☐kick-net ☐Other _________________________

How were the samples collected? ☑wading ☐from bank ☐from boat

Indicate the number of jabs/kicks taken in each habitat type.
☑Cobble 4 ☐Snags_____ ☐Vegetated Banks_____ ☑Sand 16
☐Submerged Macrophytes_____ ☐Other ( )_____

GENERAL COMMENTS

Reach WR-002 was also sampled for a duplicate QA/QC sample.

QUALITATIVE LISTING OF AQUATIC BIOTA

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	[✓ 0]	1	2	3	4	Slimes	[✓ 0]	1	2	3	4
Filamentous Algae	[✓ 0]	1	2	3	4	Macroinvertebrates	0	[✓ 1]	2	3	4
Macrophytes	[✓ 0]	1	2	3	4	Fish	0	1	[✓ 2]	3	4

FIELD OBSERVATIONS OF MACROBENTHOS

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	[✓ 0]	1	2	3	4	Anisoptera	[✓ 0]	1	2	3	4	Chironomidae	0	[✓ 1]	2	3	4
Hydrozoa	[✓ 0]	1	2	3	4	Zygoptera	[✓ 0]	1	2	3	4	Ephemeroptera	[✓ 0]	1	2	3	4
Platyhelminthes	[✓ 0]	1	2	3	4	Hemiptera	[✓ 0]	1	2	3	4	Trichoptera	[✓ 0]	1	2	3	4
Turbellaria	[✓ 0]	1	2	3	4	Coleoptera	[✓ 0]	1	2	3	4	Other	[✓ 0]	1	2	3	4
Hirudinea	[✓ 0]	1	2	3	4	Lepidoptera	[✓ 0]	1	2	3	4						
Oligochaeta	[✓ 0]	1	2	3	4	Sialidae	[✓ 0]	1	2	3	4						
Isopoda	[✓ 0]	1	2	3	4	Corydalidae	[✓ 0]	1	2	3	4						
Amphipoda	[✓ 0]	1	2	3	4	Tipulidae	[✓ 0]	1	2	3	4						
Decapoda	[✓ 0]	1	2	3	4	Empididae	[✓ 0]	1	2	3	4						
Gastropoda	[✓ 0]	1	2	3	4	Simuliidae	[✓ 0]	1	2	3	4						
Bivalvia	[✓ 0]	1	2	3	4	Tabinidae	[✓ 0]	1	2	3	4						
						Culcidae	[✓ 0]	1	2	3	4						

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Winters Run	LOCATION Bel Air, Harford County, Maryland
STATION # WR-003 RIVERMILE --	STREAM CLASS Perennial
LAT 39.519142°N LONG 76.369359°W	RIVER BASIN Bush River
STORET # --	AGENCY MDNR Client: Maryland American Water Company
INVESTIGATORS S. Hockenberry, A. Thomas	

FORM COMPLETED BY Thomas/Hockenberry	DATE 10/19/15 TIME 11:40 ☑AM ☐PM	REASON FOR SURVEY Stream Assessment & Macroinvertebrate Survey

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
____%☐	%cloud cover	☐____%
☑	clear/sunny	☑

Has there been a heavy rain in the last 7 days?
☐Yes ☑No

Air Temperature 10 ⁰ C

Other Cool and breezy

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)

See Appendix C - Reach Photographs & Mapping

STREAM CHARACTERIZATION

Stream Subsystem
☑Perennial ☐Intermittent ☐Tidal

Stream Type
☑Coldwater ☐Warmwater

Stream Origin
☐Glacial
☐Non-glacial montane
☐Swamp and bog
☐Spring-fed
☑Mixture of origins
☑Other__________

Catchment Area -- km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☑ Forest ☐ Commercial
☐ Field/Pasture ☐ Industrial
☑ Agricultural ☐ Other _______________
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☑ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☐ None ☑ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☑ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous

dominant species present Sycamore, black cherry, spicebush, and black locust

INSTREAM FEATURES

Estimated Reach Length 100 m
Estimated Stream Width 26 m
Sampling Reach Area 2,600 m^2
Area in km^2 (m^{2}x1000) 0.0026 km^2
Estimated Stream Depth 0 to <3.0 m
Surface Velocity (at thalweg) 0.3 m/sec

Canopy Cover
☐ Partly open ☑ Partly shaded ☑ Shaded

High Water Mark 1 m

Proportion of Reach Represented by Stream Morphology Types
☑ Riffle 10 % ☑ Run 70 %
☑ Pool 20 %

Channelized ☐ Yes ☑ No

Dam Present ☐ Yes ☑ No

LARGE WOODY DEBRIS

LWD 0 m^2
Density of LWD _______ m^2/km^2 **(LWD/ reach area)**

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☐ Attached Algae

dominant species present none

Portion of the reach with aquatic vegetation 0 %

WATER QUALITY

Temperature 8.16 ^{0} C
Specific Conductance 0.315 mS/CM
Dissolved Oxygen 14.16 mg/L
pH 5.64
Turbidity 3.2 NTUs
WQ Instrument Used Horiba U-22

Water Odors
☑ Normal/None ☑ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other_______________

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☑ None ☐ Other_______________

Turbidity (if not measured)
☑ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other________

SEDIMENT/ SUBSTRATE

Odors
☑ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other_______________

Oils
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☑ Sand
☐ Relict shells ☑ Other Silt

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock		--	Detritus	sticks, wood, coarse plant materials (CPOM)	5
Boulder	> 256 mm (10")	5			
Cobble	64-256 mm (2.5"-10")	15	Muck-Mud	black, very fine organic (FPOM)	--
Gravel	2-64 mm (0.1"-2.5")	--			
Sand	0.06-2mm (gritty)	80	Marl	grey, shell fragments	--
Silt	0.004-0.06 mm	--			
Clay	< 0.004 mm (slick)	--			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME Winters Run	LOCATION Bel Air, Harford County, Maryland
STATION # WR-003 RIVERMILE --	STREAM CLASS Perennial
LAT 39.519142°N LONG 76.369359°W	RIVER BASIN Bush River
STOREST # --	AGENCY MDNR Client: Maryland American Water Company
INVESTIGATORS S. Hockenberry, A. Thomas	
FORM COMPLETED BY Thomas/Hockenberry	DATE 10/19/15 TIME 11:40 ☑AM ☐PM
	REASON FOR SURVEY Stream Assessment & Macroinvertebrate Survey

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	**Condition Category**			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 8 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 97

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME Winters Run	LOCATION Bel Air, Harford County, Maryland
STATION # WR-003 RIVERMILE --	STREAM CLASS Perennial
LAT 39.519142°N LONG 76.369359°W	RIVER BASIN Bush River
STORET # --	AGENCY MDNR Client: Maryland American Water Company
INVESTIGATORS S. Hockenberry, A. Thomas	LOT NUMBER --
FORM COMPLETED BY Thomas/Hockenberry	DATE 10/19/15 TIME 11:40 ☑AM ☐PM
	REASON FOR SURVEY Stream Assessment & Macroinvertebrate Survey

HABITAT TYPES

Indicate the percentage of each habitat type present
☑ Cobble 15 % ☐ Snags_____% ☐ Vegetated Banks_____% ☑ Sand 80 %
☐ Submerged Macrophytes_____% ☑ Other (Boulder) 5 %

SAMPLE COLLECTION

Gear used ☑ D-frame ☐ kick-net ☐ Other ________________________

How were the samples collected? ☑ wading ☐ from bank ☐ from boat

Indicate the number of jabs/kicks taken in each habitat type.
☑ Cobble 4 ☐ Snags_____ ☐ Vegetated Banks_____ ☑ Sand 16
☐ Submerged Macrophytes_____ ☐ Other ( )_____

GENERAL COMMENTS

QUALITATIVE LISTING OF AQUATIC BIOTA

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	[✓ 0] 1 2 3 4	Slimes	[✓ 0] 1 2 3 4
Filamentous Algae	[✓ 0] 1 2 3 4	Macroinvertebrates	0 1 [✓ 2] 3 4
Macrophytes	[✓ 0] 1 2 3 4	Fish	0 1 [✓ 2] 3 4

FIELD OBSERVATIONS OF MACROBENTHOS

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	[✓ 0] 1 2 3 4	Anisoptera	[✓ 0] 1 2 3 4	Chironomidae	0 1 2 [✓ 3] 4
Hydrozoa	[✓ 0] 1 2 3 4	Zygoptera	[✓ 0] 1 2 3 4	Ephemeroptera	0 [✓ 1] 2 3 4
Platyhelminthes	[✓ 0] 1 2 3 4	Hemiptera	[✓ 0] 1 2 3 4	Trichoptera	0 1 2 [✓ 3] 4
Turbellaria	[✓ 0] 1 2 3 4	Coleoptera	0 [✓ 1] 2 3 4	Other	[✓ 0] 1 2 3 4
Hirudinea	[✓ 0] 1 2 3 4	Lepidoptera	[✓ 0] 1 2 3 4		
Oligochaeta	[✓ 0] 1 2 3 4	Sialidae	[✓ 0] 1 2 3 4		
Isopoda	[✓ 0] 1 2 3 4	Corydalidae	[✓ 0] 1 2 3 4		
Amphipoda	[✓ 0] 1 2 3 4	Tipulidae	[✓ 0] 1 2 3 4		
Decapoda	[✓ 0] 1 2 3 4	Empididae	0 [✓ 1] 2 3 4		
Gastropoda	[✓ 0] 1 2 3 4	Simuliidae	0 [✓ 1] 2 3 4		
Bivalvia	0 [✓ 1] 2 3 4	Tabinidae	[✓ 0] 1 2 3 4		
		Culcidae	[✓ 0] 1 2 3 4		

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Winters Run	LOCATION Bel Air, Harford County, Maryland
STATION # WR-004 RIVERMILE --	STREAM CLASS Perennial
LAT 39.519674°N LONG 76.372012°W	RIVER BASIN Bush River
STORET # --	AGENCY MDNR Client: Maryland American Water Company
INVESTIGATORS S. Hockenberry, A. Thomas	
FORM COMPLETED BY Thomas/Hockenberry	DATE 10/19/15 TIME 12:40 ☐AM ☑PM REASON FOR SURVEY Stream Assessment & Macroinvertebrate Survey

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
____%☐	%cloud cover	☐____%
☑	clear/sunny	☑

Has there been a heavy rain in the last 7 days?
☐Yes ☑No

Air Temperature 10 ⁰ C

Other Cool and breezy

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)

See Appendix C - Reach Photographs & Mapping

STREAM CHARACTERIZATION

Stream Subsystem
☑Perennial ☐Intermittent ☐Tidal

Stream Type
☑Coldwater ☐Warmwater

Stream Origin
☐Glacial
☐Non-glacial montane
☐Swamp and bog
☐Spring-fed
☑Mixture of origins
☐Other__________

Catchment Area -- km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☐ Forest
☑ Field/Pasture
☑ Agricultural
☐ Residential
☐ Commercial
☐ Industrial
☐ Other _______________

Local Watershed NPS Pollution
☐ No evidence ☑ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☐ None ☑ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☑ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous

dominant species present Beech and red maple

INSTREAM FEATURES

Estimated Reach Length 100 m

Estimated Stream Width 20 m

Sampling Reach Area 2,000 m^2

Area in km² (m^2x1000) 0.0020 km^2

Estimated Stream Depth 0 to 1.5 m

Surface Velocity (at thalweg) 0.6 m/sec

Canopy Cover
☐ Partly open ☑ Partly shaded ☑ Shaded

High Water Mark 1.5 m

Proportion of Reach Represented by Stream Morphology Types
☑ Riffle 30 % ☑ Run 30 %
☑ Pool 40 %

Channelized ☐ Yes ☑ No

Dam Present ☐ Yes ☑ No

LARGE WOODY DEBRIS

LWD 0 m^2

Density of LWD 0 m^2/km^2 **(LWD/ reach area)**

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☐ Attached Algae

dominant species present none

Portion of the reach with aquatic vegetation 0 %

WATER QUALITY

Temperature 8.83 ^{0} C

Specific Conductance 0.293 mS/CM

Dissolved Oxygen 14.17 mg/L

pH 5.90

Turbidity 2.50 NTUs

WQ Instrument Used Horiba U-22

Water Odors
☑ Normal/None ☑ Sewage
☐ Petroleum ☑ Chemical
☐ Fishy ☐ Other________________

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☑ None ☐ Other__________________________

Turbidity (if not measured)
☑ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other________

SEDIMENT/ SUBSTRATE

Odors
☑ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other____________________________________

Oils
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☑ Sand
☐ Relict shells ☑ Other Silt

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock		--	Detritus	sticks, wood, coarse plant materials (CPOM)	5
Boulder	> 256 mm (10")	--			
Cobble	64-256 mm (2.5"-10")	30	Muck-Mud	black, very fine organic (FPOM)	--
Gravel	2-64 mm (0.1"-2.5")	--			
Sand	0.06-2mm (gritty)	70	Marl	grey, shell fragments	--
Silt	0.004-0.06 mm	--			
Clay	< 0.004 mm (slick)	--			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME Winters Run	LOCATION Bel Air, Harford County, Maryland	
STATION # WR-004 RIVERMILE --	STREAM CLASS Perennial	
LAT 39.519674°N LONG 76.372012°W	RIVER BASIN Bush River	
STORET # --	AGENCY MDNR Client: Maryland American Water Company	
INVESTIGATORS S. Hockenberry, A. Thomas		
FORM COMPLETED BY Thomas/Hockenberry	DATE 10/19/15 TIME 12:40 ☐AM ☑PM	REASON FOR SURVEY Stream Assessment & Macroinvertebrate Survey

	Habitat Parameter	Condition Category			
		Optimal	Suboptimal	Marginal	Poor
Parameters to be evaluated in sampling reach	**1. Epifaunal Substrate/ Available Cover**	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE 9	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
	SCORE 11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE 12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	**Condition Category**			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 16	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 107

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME Winters Run

LOCATION Bel Air, Harford County, Maryland

STATION # WR-004 RIVERMILE --

STREAM CLASS Perennial

LAT 39.519674°N LONG 76.372012°W

RIVER BASIN Bush River

STORET # --

AGENCY MDNR Client: Maryland American Water Company

INVESTIGATORS S. Hockenberry, A. Thomas

LOT NUMBER --

FORM COMPLETED BY Thomas/Hockenberry

DATE 10/19/15
TIME 12:40 ☐AM ☑PM

REASON FOR SURVEY Stream Assessment & Macroinvertebrate Survey

HABITAT TYPES

Indicate the percentage of each habitat type present
☑Cobble 30 % ☐Snags____% ☐Vegetated Banks____% ☑Sand 70 %
☐Submerged Macrophytes____% ☐Other ( )____%

SAMPLE COLLECTION

Gear used ☑D-frame ☐kick-net ☐Other ____________

How were the samples collected? ☑wading ☐from bank ☐from boat

Indicate the number of jabs/kicks taken in each habitat type.
☑Cobble 6 ☐Snags____ ☐Vegetated Banks____ ☑Sand 14
☐Submerged Macrophytes____ ☐Other ( )____

GENERAL COMMENTS

QUALITATIVE LISTING OF AQUATIC BIOTA

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	[✓ 0]	1	2	3	4	Slimes	[✓ 0]	1	2	3	4
Filamentous Algae	[✓ 0]	1	2	3	4	Macroinvertebrates	0	1	[✓ 2]	3	4
Macrophytes	[✓ 0]	1	2	3	4	Fish	0	1	[✓ 2]	3	4

FIELD OBSERVATIONS OF MACROBENTHOS

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	[✓ 0]	1	2	3	4	Anisoptera	[✓ 0]	1	2	3	4	Chironomidae	0	1	2	3	[✓ 4]
Hydrozoa	[✓ 0]	1	2	3	4	Zygoptera	[✓ 0]	1	2	3	4	Ephemeroptera	0	1	2	[✓ 3]	4
Platyhelminthes	[✓ 0]	1	2	3	4	Hemiptera	[✓ 0]	1	2	3	4	Trichoptera	0	1	2	3	[✓ 4]
Turbellaria	[✓ 0]	1	2	3	4	Coleoptera	[✓ 0]	1	2	3	4	Other	[✓ 0]	1	2	3	4
Hirudinea	[✓ 0]	1	2	3	4	Lepidoptera	[✓ 0]	1	2	3	4						
Oligochaeta	[✓ 0]	1	2	3	4	Sialidae	[✓ 0]	1	2	3	4						
Isopoda	[✓ 0]	1	2	3	4	Corydalidae	[✓ 0]	1	2	3	4						
Amphipoda	0	[✓ 1]	2	3	4	Tipulidae	0	1	[✓ 2]	3	4						
Decapoda	[✓ 0]	1	2	3	4	Empididae	[✓ 0]	1	2	3	4						
Gastropoda	[✓ 0]	1	2	3	4	Simuliidae	0	1	[✓ 2]	3	4						
Bivalvia	[✓ 0]	1	2	3	4	Tabinidae	[✓ 0]	1	2	3	4						
						Culcidae	[✓ 0]	1	2	3	4						

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Winters Run	LOCATION Bel Air, Harford County, Maryland
STATION # WR-005 RIVERMILE --	STREAM CLASS Perennial
LAT 39.520441°N LONG 76.374756°W	RIVER BASIN Bush River
STORET # --	AGENCY MDNR Client: Maryland American Water Company
INVESTIGATORS S. Hockenberry, A. Thomas	
FORM COMPLETED BY Thomas/Hockenberry	DATE 10/19/15 TIME 13:35 ☐AM ☑PM REASON FOR SURVEY Stream Assessment & Macroinvertebrate Survey

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
____% ☐	%cloud cover	☐ ____%
☑	clear/sunny	☑

Has there been a heavy rain in the last 7 days?
☐ Yes ☑ No

Air Temperature 10 ⁰ C

Other Cool and breezy

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)

See Appendix C - Reach Photographs & Mapping

STREAM CHARACTERIZATION

Stream Subsystem
☑ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☑ Coldwater ☐ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☑ Mixture of origins
☑ Other__________

Catchment Area --_________km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☑ Forest ☐ Commercial
☑ Field/Pasture ☐ Industrial
☐ Agricultural ☐ Other _______________
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☑ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☐ None ☑ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☑ Trees ☑ Shrubs ☐ Grasses ☐ Herbaceous

dominant species present Sycamore, multiflora rose, green and white ashes

INSTREAM FEATURES

Estimated Reach Length 100 m
Estimated Stream Width 20 m
Sampling Reach Area 2,000 m^2
Area in km² (m^2x1000) 0.0020 km^2
Estimated Stream Depth 0 to 1.0+ m
Surface Velocity (at thalweg) 0.5 m/sec

Canopy Cover
☑ Partly open ☐ Partly shaded ☑ Shaded

High Water Mark 1.0 m

Proportion of Reach Represented by Stream Morphology Types
☑ Riffle 30 % ☑ Run 60 %
☑ Pool 10 %

Channelized ☐ Yes ☑ No

Dam Present ☐ Yes ☑ No

LARGE WOODY DEBRIS

LWD 0 m^2
Density of LWD 0 m^2/km^2 **(LWD/ reach area)**

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☐ Attached Algae

dominant species present none

Portion of the reach with aquatic vegetation 0 %

WATER QUALITY

Temperature 9.56 ^{0} C
Specific Conductance 0.293 mS/CM
Dissolved Oxygen 13.90 mg/L
pH 5.92
Turbidity 2.6 NTUs
WQ Instrument Used Horiba U-22

Water Odors
☑ Normal/None ☐ Sewage
☐ Petroleum ☑ Chemical
☐ Fishy ☐ Other________________

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☑ None ☐ Other__________________________

Turbidity (if not measured)
☑ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other________

SEDIMENT/ SUBSTRATE

Odors
☑ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other___________________________________

Oils
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☑ Sand
☐ Relict shells ☑ Other Silt

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock		--	Detritus	sticks, wood, coarse plant materials (CPOM)	5
Boulder	> 256 mm (10")	10			
Cobble	64-256 mm (2.5"-10")	30	Muck-Mud	black, very fine organic (FPOM)	--
Gravel	2-64 mm (0.1"-2.5")	10			
Sand	0.06-2mm (gritty)	50	Marl	grey, shell fragments	--
Silt	0.004-0.06 mm	--			
Clay	< 0.004 mm (slick)	--			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME Winters Run	LOCATION Bel Air, Harford County, Maryland	
STATION # WR-005 RIVERMILE --	STREAM CLASS Perennial	
LAT 39.520441°N LONG 76.374756°W	RIVER BASIN Bush River	
STORET # --	AGENCY MDNR	Client: Maryland American Water Company
INVESTIGATORS S. Hockenberry, A. Thomas		
FORM COMPLETED BY Thomas/Hockenberry	DATE 10/19/15 TIME 13:35 ☐AM ☑PM	REASON FOR SURVEY Stream Assessment & Macroinvertebrate Survey

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	**Condition Category**			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 11	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 105

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME Winters Run	LOCATION Bel Air, Harford County, Maryland
STATION # WR-005 RIVERMILE --	STREAM CLASS Perennial
LAT 39.520441°N LONG 76.374756°W	RIVER BASIN Bush River
STORET # --	AGENCY MDNR Client: Maryland American Water Company
INVESTIGATORS S. Hockenberry, A. Thomas	LOT NUMBER --
FORM COMPLETED BY Thomas/Hockenberry	DATE 10/19/15 TIME 13:35 ☐AM ☑PM REASON FOR SURVEY Stream Assessment & Macroinvertebrate Survey

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☑Cobble 30 % ☐Snags____% ☐Vegetated Banks____% ☑Sand 50 % ☐Submerged Macrophytes____% ☑Other (Boulder & Gravel) 20 %
SAMPLE COLLECTION	**Gear used** ☑D-frame ☐kick-net ☐Other ____ **How were the samples collected?** ☑wading ☐from bank ☐from boat **Indicate the number of jabs/kicks taken in each habitat type.** ☑Cobble 6 ☐Snags____ ☐Vegetated Banks____ ☑Sand 10 ☐Submerged Macrophytes____ ☑Other (Boulder & Gravel) 4
GENERAL COMMENTS	

QUALITATIVE LISTING OF AQUATIC BIOTA
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	[✓ 0] 1 2 3 4	Slimes	[✓ 0] 1 2 3 4
Filamentous Algae	[✓ 0] 1 2 3 4	Macroinvertebrates	0 1 [✓ 2] 3 4
Macrophytes	[✓ 0] 1 2 3 4	Fish	0 1 [✓ 2] 3 4

FIELD OBSERVATIONS OF MACROBENTHOS
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	[✓ 0] 1 2 3 4	Anisoptera	[✓ 0] 1 2 3 4	Chironomidae	0 1 2 [✓ 3] 4
Hydrozoa	[✓ 0] 1 2 3 4	Zygoptera	[✓ 0] 1 2 3 4	Ephemeroptera	0 [✓ 1] 2 3 4
Platyhelminthes	[✓ 0] 1 2 3 4	Hemiptera	[✓ 0] 1 2 3 4	Trichoptera	0 1 2 [✓ 3] 4
Turbellaria	[✓ 0] 1 2 3 4	Coleoptera	0 [✓ 1] 2 3 4	Other	[✓ 0] 1 2 3 4
Hirudinea	[✓ 0] 1 2 3 4	Lepidoptera	[✓ 0] 1 2 3 4		
Oligochaeta	[✓ 0] 1 2 3 4	Sialidae	[✓ 0] 1 2 3 4		
Isopoda	[✓ 0] 1 2 3 4	Corydalidae	[✓ 0] 1 2 3 4		
Amphipoda	[✓ 0] 1 2 3 4	Tipulidae	0 [✓ 1] 2 3 4		
Decapoda	[✓ 0] 1 2 3 4	Empididae	[✓ 0] 1 2 3 4		
Gastropoda	[✓ 0] 1 2 3 4	Simuliidae	0 [✓ 1] 2 3 4		
Bivalvia	[✓ 0] 1 2 3 4	Tabinidae	[✓ 0] 1 2 3 4		
		Culcidae	[✓ 0] 1 2 3 4		

APPENDIX E

SUMMARY OF CROSS-SECTION ANALYSIS OF INTAKE & FLOW-BY RATES

Appendix E
Summary of Cross-Section Analysis of Intake and Flow-By Rates

Cross Section @ Existing Intake (2015 GF Survey)

STATION	ELEVATION
23.0925	189.1391
24.2882	186.8681
24.6829	186.1185
26.5007	183.4786
27.854	182.5289
28.7263	181.8079
29.8307	181.0334
31.5314	180.806
33.4505	180.7759
36.0581	179.8153
38.3871	179.7351
41.0218	179.758
44.8817	179.622
47.467	179.426
50.1196	179.8375
53.5227	180.1422
56.9989	180.0971
60.626	180.1255
63.7738	180.0108
66.1	179.5168
68.1223	178.6746
69.2924	178.6147
69.4061	178.6555
71.0615	179.3312
71.516	181.0125
71.7924	181.5108
72.5405	181.7139
73.8589	182.7609
74.7424	183.0216
74.7749	183.056
75.4003	184.3134
76.1023	184.388
78.0114	185.8953
78.9808	186.8325
79.6991	186.8681

ELEVATION	WETTED PERIMETER	FLOW AREA
NAVD 88	*feet*	*square feet*
180.25	37.63	18.50
180.5	38.62	27.70
180.75	39.60	37.09
181	43.31	47.01
181.25	44.20	57.46
181.5	44.92	68.05
181.75	46.20	78.85
182	47.00	89.87
182.25	47.80	101.05
182.5	48.59	112.38
182.75	49.42	123.88
183	50.72	135.60
183.25	51.47	147.54
183.5	52.18	159.61
183.75	52.76	171.78
184	53.34	184.02
184.25	53.92	196.33
184.5	55.14	208.81
184.75	55.85	221.48
185	56.55	234.28
185.25	57.26	247.19
185.5	57.97	260.23
185.75	58.67	273.40
186	59.36	286.68
186.25	60.01	300.07
186.5	60.66	313.56
186.8681	62.20	333.72

Discharge Rating of Diversion Dam

Assume:	3H:1V	Downstream slope
	2H:1V	Upstream slope
L =	10	ft (U/S to D/S crest length)
W =	50	ft (width of weir crest)
Crest =	183.46	Based on 2015 GF Survey

Q = C*W*H^1.5 (Broad-crested weir discharge equation)

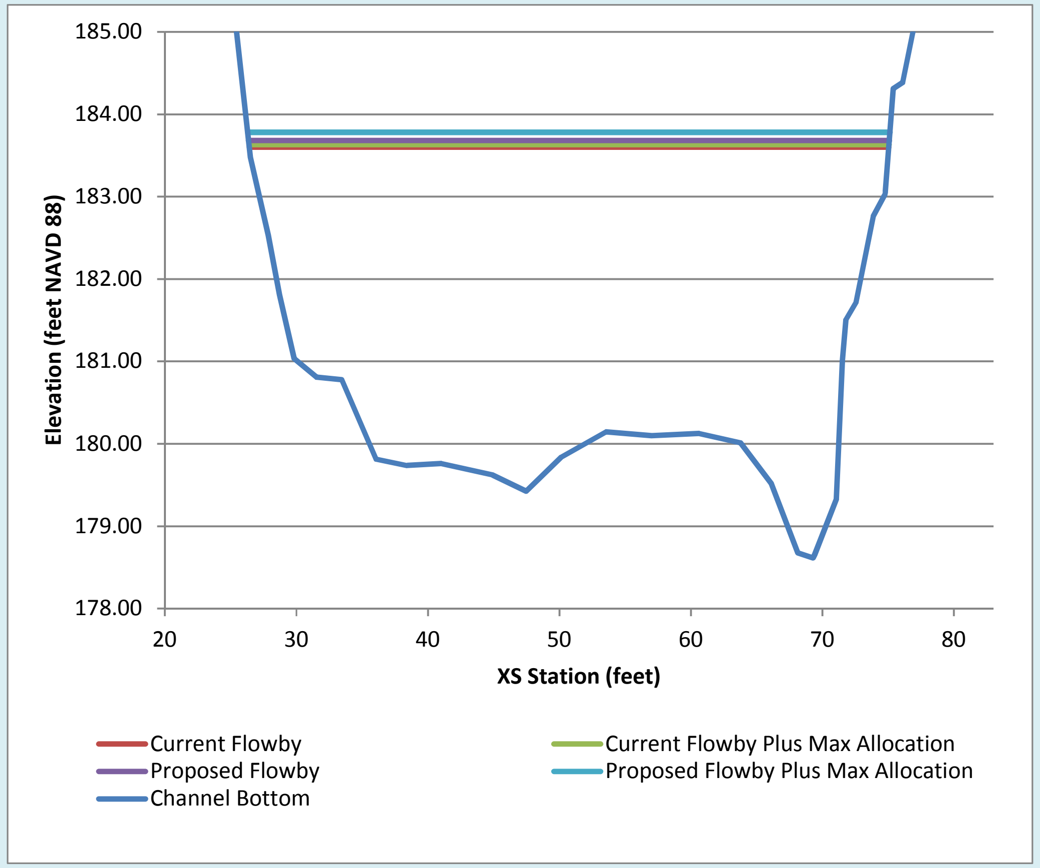
Discharge coefficients based on Figure 10 of USGS Circular 397 (1957)

ELEVATION	HEAD	h/L	C	DISCHARGE
NAVD 88	*feet*	-	-	*cfs*
183.46	0	0	2.91	0.00
183.5	0.04	0.004	2.91	1.16
183.75	0.29	0.029	2.91	22.72
184	0.54	0.054	2.91	57.74
184.25	0.79	0.079	2.91	102.17
184.5	1.04	0.104	2.91	154.32
184.75	1.29	0.129	2.91	213.18
185	1.54	0.154	2.91	278.06
185.25	1.79	0.179	2.91	348.45
185.5	2.04	0.204	2.91	423.94
185.75	2.29	0.229	2.91	504.22
186	2.54	0.254	2.92	591.02
186.25	2.79	0.279	2.92	680.39
186.5	3.04	0.304	2.93	776.51
186.75	3.29	0.329	2.94	877.23
187	3.54	0.354	2.95	982.42

Impacts of Proposed Flowby Requirement

	Current Flowby	Current Flowby Plus Max Allocation	Proposed Flowby	Proposed Flowby Plus Max Allocation
Discharge (MGD)	6.07	7.77	10.62	17.32
Discharge (cfs)	9.39	12.02	16.43	26.79
Elevation (NAVD 88)	183.60	183.63	183.68	183.78
Wetted Perimeter (feet)	52.40	52.47	52.59	52.83
Flow Area (square feet)	164.25	165.74	168.23	173.20

Percent Reduction in Wetted Perimeter Due to Max Proposed Withdrawal:	0.45%
Percent Reduction in Flow Area Due to Max Proposed Withdrawal:	2.87%



3.3

Threatened & Endangered Species Coordination

3.3.1

Maryland DNR Coordination

MARYLAND
DEPARTMENT OF
NATURAL RESOURCES

Martin O'Malley, *Governor*
Anthony G. Brown, *Lt. Governor*
Joseph P. Gill, *Secretary*
Frank W. Dawson III, *Deputy Secretary*

September 17, 2014

Danielle Iuliucci
Gannett Fleming, Inc.
PO Box 67100
Harrisburg, PA 17106-7100

RE: Environmental Review for The American Water Company, Bel Air Reservoir Feasibility Study, Bel Air, US Route 1, Winters Run, Harford County, MD.

Dear Ms. Iuliucci:

The Wildlife and Heritage Service has determined that there are no State or Federal records for rare, threatened or endangered species within the boundaries of the project site as delineated. As a result, we have no specific comments or requirements pertaining to protection measures at this time. This statement should not be interpreted however as meaning that rare, threatened or endangered species are not in fact present. If appropriate habitat is available, certain species could be present without documentation because adequate surveys have not been conducted.

Thank you for allowing us the opportunity to review this project. If you should have any further questions regarding this information, please contact me at (410) 260-8573.

Sincerely,

Lori A. Byrne

Lori A. Byrne,
Environmental Review Coordinator
Wildlife and Heritage Service
MD Dept. of Natural Resources

ER# 2014.1333.ha

Gannett Fleming

GANNETT FLEMING, INC.
P.O. Box 67100
Harrisburg, PA 17106-7100

Location:
207 Senate Avenue
Camp Hill, PA 17011

Office: (717) 763-7211
Fax: (717) 763-8150
www.gannettfleming.com

August 27, 2014

Lori Byrne
DNR Wildlife & Heritage Service
580 Taylor Avenue
Tawes Office Bldg E-1
Annapolis, MD 21401

MAILED 8/27/14
Certified 7013 2250 0000 4345 7922

RE: Request for Environmental Review
The Maryland American Water Company
Bel Air Reservoir Feasibility Study
Bel Air, Harford County, Maryland

Dear Ms. Byrne:

Gannett Fleming, Inc. (Gannett Fleming) is requesting an environmental review of a project located on the east and west sides of the Bel Air Bypass (US Route 1) approximately 1 mile south of its intersection with MD Route 24 in Bel Air, Harford County, Maryland (39.517203 N, 76.375215 W). Gannett Fleming was retained by the Maryland American Water Company (MAWC) to evaluate the feasibility of creating an off-stream raw water storage reservoir that would provide the Town of Bel Air with drinking water during dry periods. This project is currently in a conceptual design phase with field reconnaissance and preliminary engineering studies to occur in the near future. To support permitting, we are requesting an environmental review to determine if any species of concern occur within or in close proximity to the study area. Please refer to **Figure 1** for the USGS topographic map of the study area. **Figure 2** provides an aerial photograph of the project study area.

The Bel Air water system is supplied primarily by Winters Run. The Maryland Department of the Environment (MDE) regulates the Harford County water treatment plant, operated by the MAWC. When stream flow falls below the minimum pass-by flow stipulated by the MDE, water should not be withdrawn from Winters Run. During such times historically, Harford County has allowed the MAWC system to continue operating to meet system demands. However, since Harford County expects the Bel Air water supply to experience long-term supply shortfalls, alternative water supply systems are being evaluated. Gannett Fleming is evaluating the feasibility of building a reservoir in an off-stream agricultural area adjacent to Winters Run to store water from Winters Run during periods of high flow. The reservoir would provide Bel Air with water when water levels in Winters Run fall below MDE withdraw limits.

Please provide Gannett Fleming with an official response letter regarding any species of concern within or in close proximity to the study area. We would appreciate an expedited environmental review, if possible. Please contact me at (717) 763-7211, extension 2914, with any questions or requests for additional information. Thank you for your cooperation; we look forward to working with you on this project.

Very truly yours,

Danielle Iuliucci
Environmental Scientist

Attachments

Copies Furnished (electronically): S. Liskovich, GF Project Manager
D. Graff, GF Sr. Environmental Scientist
File

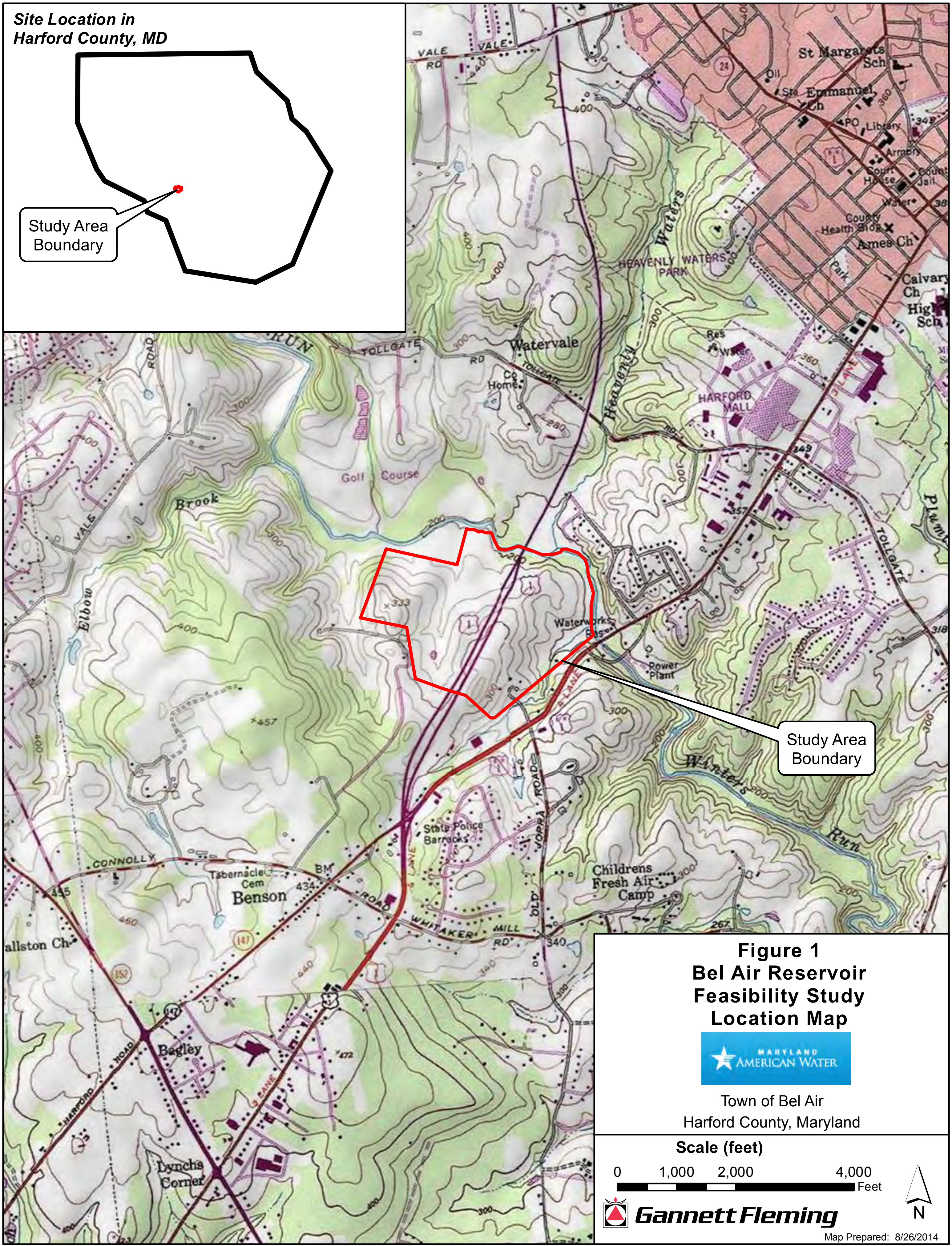


Figure 1
Bel Air Reservoir Feasibility Study Location Map

MARYLAND AMERICAN WATER

Town of Bel Air
Harford County, Maryland

Scale (feet)

0 1,000 2,000 4,000 Feet

N

Gannett Fleming

Map Prepared: 8/26/2014

Data Source: USGS topo map with excerpts from 7.5' Quadrangles - Jarrettsville, Maryland, and Belair, Maryland, provided by ESRI through ArcGIS Online webservice.

Figure 2
Bel Air Reservoir
Feasibility Study
Aerial Location Map

Town of Bel Air
Harford County, Maryland

Map Prepared: 8/26/2014

Data Source: Aerial imagery map provided by ESRI through ArcGIS Online webservice.

Current and Historical Rare, Threatened, and Endangered Species
Of Harford County, Maryland*

April 2010

Maryland Department of Natural Resources
Wildlife and Heritage Service

Scientific Name	Common Name	Global Rank	State Rank	State Status	Federal Status
Animals					
Acipenser brevirostrum	Shortnose Sturgeon	G3	S1	E	LE
Acipenser oxyrinchus	Atlantic Sturgeon	G3	S1		C
Cryptobranchus alleganiensis	Eastern Hellbender	G3G4	S1	E	
Enallagma weewa	Blackwater Bluet	G5	S2		
Erynnis martialis	Mottled Duskywing	G3	S1	E	
Etheostoma sellare	Maryland Darter	GH	SH	E	LE
Etheostoma vitreum	Glassy Darter	G4G5	S1S2	T	
Glyptemys muhlenbergii	Bog Turtle	G3	S2	T	LT
Graptemys geographica	Northern Map Turtle	G5	S1	E	
Haliaeetus leucocephalus	Bald Eagle	G5	S3B		
Leptodea ochracea	Tidewater Mucket	G3G4	S1S2		
Percina caprodes	Logperch	G5	S1S2	T	
Sorex fumeus	Smoky Shrew	G5	S2S3	I	
Sorex hoyi winnemana	Southern Pygmy Shrew	G5T4	S2		
Sperchopsis tessellatus	A Hydrophilid Beetle	GNR	S2		
Speyeria idalia	Regal Fritillary	G3	SH	X	
Sternula antillarum	Least Tern	G4	S2B	T	
Stygobromus tenuis tenuis	Slender Stygobromid	G4T4	SU		
Plants					
Amelanchier stolonifera	Running Juneberry	G5	S2		
Anemone canadensis	Canada Anemone	G5	SH	X	
Antennaria solitaria	Single-headed Pussytoes	G5	S2	T	
Asplenium bradleyi	Bradley's Spleenwort	G4	SH	X	
Asplenium pinnatifidum	Lobed Spleenwort	G4	S1	E	
Bidens bidentoides var. mariana	Maryland Bur-marigold	G3T3	S3.1		
Bidens coronata	Tickseed Sunflower	G5	S2S3		
Bidens mitis	Small-fruited Beggar-ticks	G4?	S1	E	
Boltonia asteroides	Aster-like Boltonia	G5	S1	E	
Buchnera americana	Blue-hearts	G5?	SH	X	
Campanula rotundifolia	Harebell	G5	S2		
Carex buxbaumii	Buxbaum's Sedge	G5	S2	T	
Carex davisii	Davis' Sedge	G4	S1	E	
Carex hitchcockiana	Hitchcock's Sedge	G5	S1	E	
Carex lacustris	Lake-bank Sedge	G5	S2		
Carex pellita	Woolly Sedge	G5	S2?		
Carex planispicata	A Sedge	G4Q	S1S2		
Castanea dentata	American Chestnut	G4	S2S3		
Ceratophyllum echinatum	Prickly Hornwort	G4?	S1	E	
Coreopsis tripteris	Tall Tickseed	G5	S1	E	
Cuscuta polygonorum	Smartweed Dodder	G5	S1	E	
Cyperus dentatus	Toothed Sedge	G4	SH	X	
Cystopteris tennesseensis	Tennessee Bladder-fern	G5	S1		

Desmodium rigidum	Rigid Tick-trefoil	GNRQ	S1	E
Dioscorea hirticaulis	Wild Yam	G3Q	SH	
Diplazium pycnocarpon	Glade Fern	G5	S2	T
Elatine minima	Small Waterwort	G5	S1	E
Equisetum fluviatile	Water Horsetail	G5	S1	E
Eriocaulon aquaticum	Seven-angled Pipewort	G5	S1	E
Eriocaulon parkeri	Parker's Pipewort	G3	S2	T
Euphorbia purpurea	Darlington's Spurge	G3	S1	E
Eurybia radula	Rough-leaved Aster	G5	S1	E
Gentiana andrewsii	Fringe-tip Closed Gentian	G5?	S2	T
Geum aleppicum	Yellow Avens	G5	S1	E
Hasteola suaveolens	Sweet-scented Indian-plantain	G4	S1	E
Hydrastis canadensis	Goldenseal	G4	S2	T
Hypericum ascyron	Great St. John's-wort	G4	SH	X
Iris prismatica	Slender Blue Flag	G4G5	S1	E
Juglans cinerea	Butternut	G4	S2S3	
Juncus balticus	Baltic Rush	G5	SH	X
Juncus brachycarpus	Short-fruited Rush	G4G5	SU	
Juncus longii	Long's Rush	G3Q	S1	E
Limosella australis	Mudwort	G4G5	S2	E
Linum floridanum	Florida Yellow Flax	G5?	SH	X
Linum sulcatum	Grooved Flax	G5	S1	E
Ludwigia decurrens	Primrose Willow	G5	S2S3	
Lygodium palmatum	Climbing Fern	G4	S2	T
Lysimachia hybrida	Lowland Loosestrife	G5	S2	T
Matteuccia struthiopteris	Ostrich Fern	G5	S2	
Myosotis macrosperma	Large-seeded Forget-me-not	G5	S2S3	
Panicum flexile	Wiry Witch-grass	G5	S1	E
Pedicularis lanceolata	Swamp Lousewort	G5	S1	E
Polanisia dodecandra	Clammyweed	G5	S1	E
Polemonium vanbruntiae	Jacob's-ladder	G3G4	S2	T
Polygala senega	Seneca Snakeroot	G4G5	S2	T
Potamogeton amplifolius	Large-leaved Pondweed	G5	SH	X
Potamogeton foliosus	Leafy Pondweed	G5	S1	E
Potamogeton perfoliatus	Clasping-leaved Pondweed	G5	S2	
Potamogeton pusillus	Slender Pondweed	G5	S1	
Potamogeton richardsonii	Redheadgrass	G5	SH	X
Potamogeton spirillus	Spiral Pondweed	G5	S1	
Potamogeton zosteriformis	Flatstem Pondweed	G5	S1	E
Pycnanthemum verticillatum	Whorled Mountain-mint	G5	S1	E
Quercus macrocarpa	Mossy-cup Oak	G5	S1	
Ranunculus ambigens	Water-plantain Spearwort	G4	SH	X
Rhynchospora globularis	Grass-like Beakrush	G5?	S1	E
Sagittaria australis	Long-beaked Arrowhead	GNRQ	SU	
Sagittaria calycina	Spongy Lophotocarpus	G5	S2	
Salix humilis var. tristis	Dwarf Prairie Willow	G4G5	S1	
Sanguisorba canadensis	Canada Burnet	G5	S2	T
Schoenoplectus novae-angliae	Salt-marsh Bulrush	G5	S2	
Scutellaria leonardii	Leonard's Skullcap	G4T4	S2	T
Silene nivea	Snowy Campion	G4?	S1	E
Smilacina stellata	Star-flowered False Solomon's-seal	G5	S1	E
Stellaria alsine	Trailing Stitchwort	G5	S1	E
Stenanthium gramineum	Featherbells	G4G5	S1	T
Symphyotrichum depauperatum	Serpentine Aster	G2	S1	E
Talinum teretifolium	Fameflower	G4	S1	T
Thaspium trifoliatum	Purple Meadow-parsnip	G5	S1	E

Triadenum tubulosum	Large Marsh St. John's-wort	G4?	S1	
Trichophorum planifolium	Bashful Bulrush	G4G5	S2S3	
Trillium flexipes	Drooping Trillium	G5	S1	E
Valeriana pauciflora	Valerian	G4	S1	E
Viola blanda var. palustriformis	Large-leaved White Violet	G4G5T4T5	S1	

* This report represents a compilation of information in the Wildlife and Heritage Service’s Biological and Conservation Data system as of the date on the report. It does not include species considered to be “watchlist” or more common species.

3.3.2

USFWS Coordination

United States Department of the Interior
U.S. Fish & Wildlife Service
Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401
410/573 4575

SUBMITTED
ELECTRONICALLY
9/22/2014

Online Certification Letter

Today's date: September 22, 2014

Project: The Maryland American Water Company
Bel Air Reservoir Feasibility Study
Bel Air, Harford County, Maryland

Dear Applicant for online certification:

Thank you for using the U.S. Fish and Wildlife Service (Service) Chesapeake Bay Field Office online project review process. By printing this letter in conjunction with your project review package, you are certifying that you have completed the online project review process for the referenced project in accordance with all instructions provided, using the best available information to reach your conclusions. This letter, and the enclosed project review package, completes the review of your project in accordance with the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (ESA).This letter also provides information for your project review under the National Environmental Policy Act of 1969 (P.L. 91-190, 42 U.S.C. 4321-4347, 83 Stat. 852), as amended. A copy of this letter and the project review package must be submitted to this office for this certification to be valid. This letter and the project review package will be maintained in our records.

Based on this information and in accordance with section 7 of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), we certify that except for occasional transient individuals, no federally proposed or listed endangered or threatened species are known to exist within the project area. Therefore, no Biological Assessment or further section 7 consultation with the U.S. Fish and Wildlife Service is required. Should project plans change, or if additional information on the distribution of listed or proposed species becomes available, this determination may be reconsidered.

This response relates only to federally protected threatened or endangered species under our jurisdiction. For additional information on threatened or endangered species in Maryland, you should contact the Maryland Wildlife and Heritage Division at (410) 260-8540. For information in Delaware you should contact the Delaware Natural Heritage and Endangered Species Program, at (302) 653-2880. For information in the District of Columbia, you should contact the National Park Service at (202) 535-1739.

The U.S. Fish and Wildlife Service also works with other Federal agencies and states to minimize loss of wetlands, reduce impacts to fish and migratory birds, including bald eagles, and restore habitat for wildlife. Information on these conservation issues and how development projects can avoid affecting these resources can be found on our website (www.fws.gov/chesapeakebay)

We appreciate the opportunity to provide information relative to fish and wildlife issues, and thank you for your interest in these resources. If you have any questions or need further assistance, please contact Chesapeake Bay Field Office Threatened and Endangered Species program at (410) 573-4527.

Sincerely,

Genevieve LaRouche
Field Supervisor

GANNETT FLEMING, INC.
P.O. Box 67100
Harrisburg, PA 17106-7100

Location:
207 Senate Avenue
Camp Hill, PA 17011

Office: (717) 763-7211
Fax: (717) 763-8150
www.gannettfleming.com

August 27, 2014

US Fish and Wildlife Service
Chesapeake Bay Ecological Services Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401

SUBMITTED ELECTRONICALLY
8/27/14

RE: Project Review Request
The Maryland American Water Company
Bel Air Reservoir Feasibility Study
Bel Air, Harford County, Maryland

To whom it may concern:

Gannett Fleming, Inc. (Gannett Fleming) is requesting a project review from the US Fish and Wildlife Service's Chesapeake Bay Ecological Services Field Office for a project located on the east and west sides of the Bel Air Bypass (US Route 1) approximately 1 mile south of its intersection with MD Route 24 in Bel Air, Harford County, Maryland (39.517203 N, 76.375215 W). Gannett Fleming was retained by the Maryland American Water Company (MAWC) to evaluate the feasibility of creating an off-stream raw water storage reservoir that would provide the Town of Bel Air with drinking water during dry periods. This project is currently in a conceptual design phase with field reconnaissance and preliminary engineering studies to occur in the near future. To support permitting, we are requesting a project review to determine if any species of concern occur within or in close proximity to the study area.

Gannett Fleming was retained by the Maryland American Water Company (MAWC) to evaluate the feasibility of creating an off-stream raw water storage reservoir that would provide the Town of Bel Air with drinking water during dry periods. This project is currently in a conceptual design phase with field reconnaissance and preliminary engineering studies to occur in the near future. The Bel Air water system is supplied primarily by Winters Run. The Maryland Department of the Environment (MDE) regulates the Harford County water treatment plant, operated by the MAWC.

The Bel Air water system is supplied primarily by Winters Run. The Maryland Department of the Environment (MDE) regulates the Harford County water treatment plant, operated by the MAWC. When stream flow falls below the minimum pass-by flow stipulated by the MDE, water should not be withdrawn from Winters Run. During such times historically, Harford County has allowed the MAWC system to continue operating to meet system demands. However, since Harford County expects the Bel Air water supply to experience long-term supply shortfalls, alternative water supply systems are being evaluated. Gannett Fleming is evaluating the feasibility of building a reservoir in

an off-stream agricultural area adjacent to Winters Run to store water from Winters Run during periods of high flow. The reservoir would provide Bel Air with water when water levels in Winters Run fall below MDE withdraw limits.

The Information, Planning, and Conservation (IPaC) System indicated that no listed species, critical habitats, or national wildlife refuges were found within the vicinity of the proposed project. The IPaC System identified 13 migratory birds of concern that may be impacted. Three (3) National Wetlands Inventory wetland types were identified within the project study area, including freshwater forested/shrub wetland (PFO1A), freshwater pond (PUBHx), and riverine (R2UBH). Please refer to **Attachment 1** for the USGS topographic map of the study area. **Attachment 2** provides an aerial photograph of the project study area and **Attachment 3** provides the IPaC System Trust Resources List.

Please provide Gannett Fleming with an official response letter regarding any species of concern within or in close proximity to the study area as well as any conservation measures that should be implemented. We would appreciate an expedited review, if possible. Please contact me at (717) 763-7211, extension 2914, with any questions or requests for additional information. Thank you for your cooperation; we look forward to working with you on this project.

Very truly yours,

Danielle Iuliucci
Environmental Scientist

Attachments

Copies Furnished (electronically): S. Liskovich, GF Project Manager
D. Graff, GF Sr. Environmental Scientist
S. Smith, GF Environmental Scientist
File

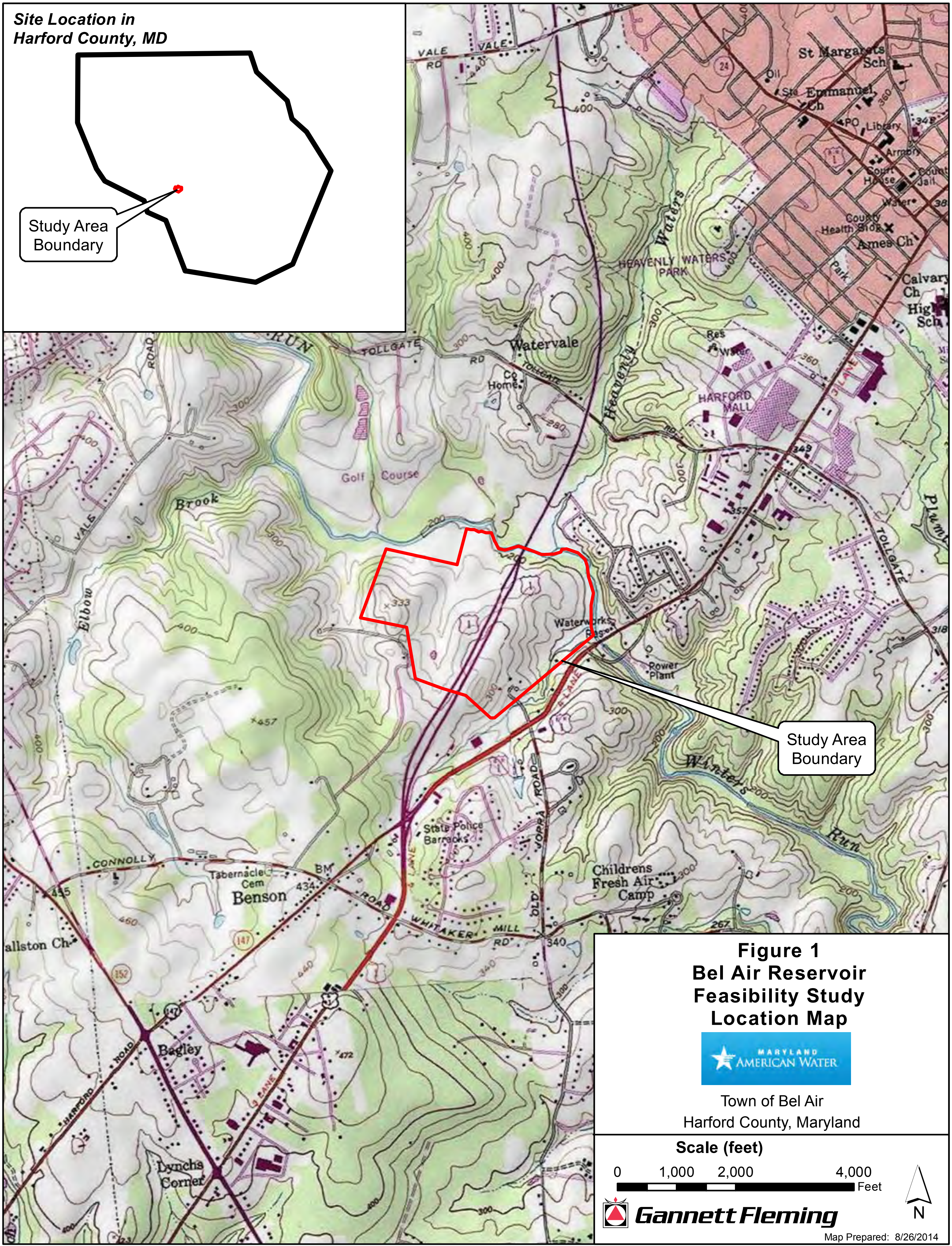


Figure 1
Bel Air Reservoir Feasibility Study Location Map

Town of Bel Air
Harford County, Maryland

Scale (feet)

Map Prepared: 8/26/2014

Data Source: USGS topo map with excerpts from 7.5' Quadrangles - Jarrettsville, Maryland, and Belair, Maryland, provided by ESRI through ArcGIS Online webservice.

Figure 2
Bel Air Reservoir
Feasibility Study
Aerial Location Map

Town of Bel Air
Harford County, Maryland

Map Prepared: 8/26/2014

Data Source: Aerial imagery map provided by ESRI through ArcGIS Online webservice.

U.S. Fish and Wildlife Service

Trust Resources List

This resource list is to be used for planning purposes only — it is not an official species list.

Endangered Species Act species list information for your project is available online and listed below for the following FWS Field Offices:

Chesapeake Bay Ecological Services Field Office
177 ADMIRAL COCHRANE DRIVE
ANNAPOLIS, MD 21401
(410) 573-4599

Project Name:

Bel Air Reservoir Feasibility Study

Project Location Map:

Project Counties:

Harford, MD

Geographic coordinates (Open Geospatial Consortium Well-Known Text, NAD83):

MULTIPOLYGON (((-76.3774704 39.519473, -76.376612 39.5211613, -76.3759469 39.5208799, -76.3750885 39.5208634, -76.3745736 39.519953, -76.3732217 39.5201185, -76.3722776 39.5197047, -76.3702177 39.5198206, -76.3695739 39.5194399, -76.3692306 39.5187281, -76.3691877 39.5180329, -76.3690804 39.5174039, -76.3693808 39.5162783, -76.3690589 39.5156161, -76.3757069 39.5123041, -76.3772133 39.5133644, -76.3801487 39.5142417, -76.3804985 39.5165925, -76.383288 39.5171884, -76.3815724 39.5204824, -76.3774704 39.519473)))

Trust Resources List

Project Type:

Dam

Endangered Species Act Species List (USFWS Endangered Species Program).

There are no listed species found within the vicinity of your project.

Critical habitats within your project area:

There are no critical habitats within your project area.

FWS National Wildlife Refuges (USFWS National Wildlife Refuges Program).

There are no refuges found within the vicinity of your project.

FWS Migratory Birds (USFWS Migratory Bird Program).

The protection of birds is regulated by the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA). Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. For more information regarding these Acts see http://www.fws.gov/migratorybirds/RegulationsandPolicies.html.

All project proponents are responsible for complying with the appropriate regulations protecting birds when planning and developing a project. To meet these conservation obligations, proponents should identify potential or existing project-related impacts to migratory birds and their habitat and develop and implement conservation measures that avoid, minimize, or compensate for these impacts. The Service's Birds of Conservation Concern (2008) report identifies species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become listed under the Endangered Species Act as amended (16 U.S.C 1531 et seq.).

For information about Birds of Conservation Concern, go to http://www.fws.gov/migratorybirds/CurrentBirdIssues/Management/BCC.html.

Trust Resources List

Migratory birds of concern that may be affected by your project:

There are **13** birds on your Migratory birds of concern list. The Division of Migratory Bird Management is in the process of populating migratory bird data with an estimated completion time of Fall 2014; therefore, the list below may not include all the migratory birds of concern in your project area at this time. While this information is being populated, please contact the Field Office for information about migratory birds in your project area.

Species Name	Bird of Conservation Concern (BCC)	Species Profile	Seasonal Occurrence in Project Area
American bittern (*Botaurus lentiginosus*)	Yes	species info	Wintering
Bald eagle (*Haliaeetus leucocephalus*)	Yes	species info	Year-round
Black-billed Cuckoo (*Coccyzus erythropthalmus*)	Yes	species info	Breeding
cerulean warbler (*Dendroica cerulea*)	Yes	species info	Breeding
Golden-Winged Warbler (*Vermivora chrysoptera*)	Yes	species info	Breeding
Least Bittern (*Ixobrychus exilis*)	Yes	species info	Breeding
Marbled Godwit (*Limosa fedoa*)	Yes	species info	Wintering
Pied-billed Grebe (*Podilymbus podiceps*)	Yes	species info	Breeding
Purple Sandpiper (*Calidris maritima*)	Yes	species info	Wintering
Rusty Blackbird (*Euphagus carolinus*)	Yes	species info	Wintering
Short-billed Dowitcher (*Limnodromus griseus*)	Yes	species info	Wintering
Wood Thrush (*Hylocichla mustelina*)	Yes	species info	Breeding
Worm eating Warbler (*Helmitheros vermivorum*)	Yes	species info	Breeding

NWI Wetlands (USFWS National Wetlands Inventory).

The U.S. Fish and Wildlife Service is the principal Federal agency that provides information on the extent and status of wetlands in the U.S., via the National Wetlands Inventory Program (NWI). In addition to impacts to wetlands within your immediate project area, wetlands outside of your project area may need to be considered in any evaluation of project impacts, due to the hydrologic nature of wetlands (for example, project activities may affect local hydrology within, and outside of, your immediate project area). It may be helpful to refer to the USFWS National Wetland Inventory website. The designated FWS office can also assist you. Impacts to wetlands and other aquatic habitats from your project may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal Statutes. Project Proponents should discuss the relationship of these requirements to their project with the Regulatory Program of the appropriate U.S. Army Corps of Engineers District.

Data Limitations, Exclusions and Precautions

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery and/or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Exclusions - Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Precautions - Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the

advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

The following wetland types intersect your project area in one or more locations:

Wetland Types	NWI Classification Code	Total Acres
Freshwater Forested/Shrub Wetland	PFO1A	1.7732
Freshwater Pond	PUBHx	0.1999
Riverine	R2UBH	61.948

GANNETT FLEMING, INC.
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Location:
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www.gannettfleming.com

August 27, 2014

US Fish and Wildlife Service
Chesapeake Bay Ecological Services Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401

SUBMITTED ELECTRONICALLY
8/27/14

RE: Project Review Request
The Maryland American Water Company
Bel Air Reservoir Feasibility Study
Bel Air, Harford County, Maryland

To whom it may concern:

Gannett Fleming, Inc. (Gannett Fleming) is requesting a project review from the US Fish and Wildlife Service’s Chesapeake Bay Ecological Services Field Office for a project located on the east and west sides of the Bel Air Bypass (US Route 1) approximately 1 mile south of its intersection with MD Route 24 in Bel Air, Harford County, Maryland (39.517203 N, 76.375215 W). Gannett Fleming was retained by the Maryland American Water Company (MAWC) to evaluate the feasibility of creating an off-stream raw water storage reservoir that would provide the Town of Bel Air with drinking water during dry periods. This project is currently in a conceptual design phase with field reconnaissance and preliminary engineering studies to occur in the near future. To support permitting, we are requesting a project review to determine if any species of concern occur within or in close proximity to the study area.

Gannett Fleming was retained by the Maryland American Water Company (MAWC) to evaluate the feasibility of creating an off-stream raw water storage reservoir that would provide the Town of Bel Air with drinking water during dry periods. This project is currently in a conceptual design phase with field reconnaissance and preliminary engineering studies to occur in the near future. The Bel Air water system is supplied primarily by Winters Run. The Maryland Department of the Environment (MDE) regulates the Harford County water treatment plant, operated by the MAWC.

The Bel Air water system is supplied primarily by Winters Run. The Maryland Department of the Environment (MDE) regulates the Harford County water treatment plant, operated by the MAWC. When stream flow falls below the minimum pass-by flow stipulated by the MDE, water should not be withdrawn from Winters Run. During such times historically, Harford County has allowed the MAWC system to continue operating to meet system demands. However, since Harford County expects the Bel Air water supply to experience long-term supply shortfalls, alternative water supply systems are being evaluated. Gannett Fleming is evaluating the feasibility of building a reservoir in

an off-stream agricultural area adjacent to Winters Run to store water from Winters Run during periods of high flow. The reservoir would provide Bel Air with water when water levels in Winters Run fall below MDE withdraw limits.

The Information, Planning, and Conservation (IPaC) System indicated that no listed species, critical habitats, or national wildlife refuges were found within the vicinity of the proposed project. The IPaC System identified 13 migratory birds of concern that may be impacted. Three (3) National Wetlands Inventory wetland types were identified within the project study area, including freshwater forested/shrub wetland (PFO1A), freshwater pond (PUBHx), and riverine (R2UBH). Please refer to **Attachment 1** for the USGS topographic map of the study area. **Attachment 2** provides an aerial photograph of the project study area and **Attachment 3** provides the IPaC System Trust Resources List.

Please provide Gannett Fleming with an official response letter regarding any species of concern within or in close proximity to the study area as well as any conservation measures that should be implemented. We would appreciate an expedited review, if possible. Please contact me at (717) 763-7211, extension 2914, with any questions or requests for additional information. Thank you for your cooperation; we look forward to working with you on this project.

Very truly yours,

Danielle Iuliucci
Environmental Scientist

Attachments

Copies Furnished (electronically):
S. Liskovich, GF Project Manager
D. Graff, GF Sr. Environmental Scientist
S. Smith, GF Environmental Scientist
File

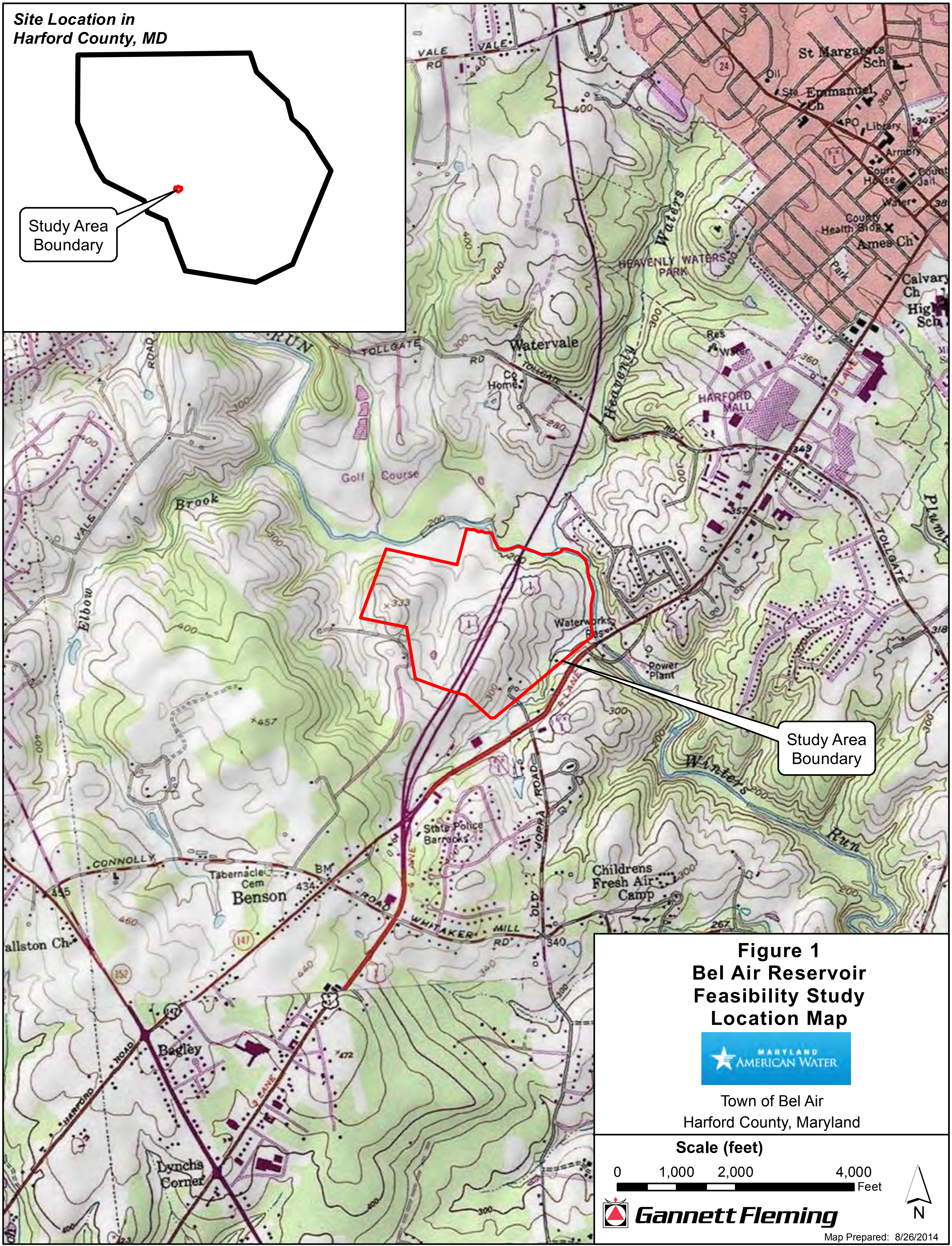

Figure 1
Bel Air Reservoir Feasibility Study Location Map

MARYLAND AMERICAN WATER

Town of Bel Air
Harford County, Maryland

Gannett Fleming

Map Prepared: 8/26/2014

Data Source: USGS topo map with excerpts from 7.5' Quadrangles - Jarrettsville, Maryland, and Belair, Maryland, provided by ESRI through ArcGIS Online webservice.

Figure 2
Bel Air Reservoir Feasibility Study Aerial Location Map

MARYLAND AMERICAN WATER

Town of Bel Air
Harford County, Maryland

Gannett Fleming

Map Prepared: 8/26/2014

Data Source: Aerial imagery map provided by ESRI through ArcGIS Online webservice.

U.S. Fish and Wildlife Service

Trust Resources List

This resource list is to be used for planning purposes only — it is not an official species list.

Endangered Species Act species list information for your project is available online and listed below for the following FWS Field Offices:

Chesapeake Bay Ecological Services Field Office
177 ADMIRAL COCHRANE DRIVE
ANNAPOLIS, MD 21401
(410) 573-4599

Project Name:

Bel Air Reservoir Feasibility Study

Project Location Map:

Project Counties:

Harford, MD

Geographic coordinates (Open Geospatial Consortium Well-Known Text, NAD83):

MULTIPOLYGON (((-76.3774704 39.519473, -76.376612 39.5211613, -76.3759469 39.5208799, -76.3750885 39.5208634, -76.3745736 39.519953, -76.3732217 39.5201185, -76.3722776 39.5197047, -76.3702177 39.5198206, -76.3695739 39.5194399, -76.3692306 39.5187281, -76.3691877 39.5180329, -76.3690804 39.5174039, -76.3693808 39.5162783, -76.3690589 39.5156161, -76.3757069 39.5123041, -76.3772133 39.5133644, -76.3801487 39.5142417, -76.3804985 39.5165925, -76.383288 39.5171884, -76.3815724 39.5204824, -76.3774704 39.519473)))

Project Type:

Dam

Endangered Species Act Species List (USFWS Endangered Species Program).

There are no listed species found within the vicinity of your project.

Critical habitats within your project area:

There are no critical habitats within your project area.

FWS National Wildlife Refuges (USFWS National Wildlife Refuges Program).

There are no refuges found within the vicinity of your project.

FWS Migratory Birds (USFWS Migratory Bird Program).

The protection of birds is regulated by the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA). Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. For more information regarding these Acts see http://www.fws.gov/migratorybirds/RegulationsandPolicies.html.

All project proponents are responsible for complying with the appropriate regulations protecting birds when planning and developing a project. To meet these conservation obligations, proponents should identify potential or existing project-related impacts to migratory birds and their habitat and develop and implement conservation measures that avoid, minimize, or compensate for these impacts. The Service's Birds of Conservation Concern (2008) report identifies species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become listed under the Endangered Species Act as amended (16 U.S.C 1531 et seq.).

For information about Birds of Conservation Concern, go to
http://www.fws.gov/migratorybirds/CurrentBirdIssues/Management/BCC.html.

Trust Resources List

Migratory birds of concern that may be affected by your project:

There are **13** birds on your Migratory birds of concern list. The Division of Migratory Bird Management is in the process of populating migratory bird data with an estimated completion time of Fall 2014; therefore, the list below may not include all the migratory birds of concern in your project area at this time. While this information is being populated, please contact the Field Office for information about migratory birds in your project area.

Species Name	Bird of Conservation Concern (BCC)	Species Profile	Seasonal Occurrence in Project Area
American bittern (*Botaurus lentiginosus*)	Yes	species info	Wintering
Bald eagle (*Haliaeetus leucocephalus*)	Yes	species info	Year-round
Black-billed Cuckoo (*Coccyzus erythropthalmus*)	Yes	species info	Breeding
cerulean warbler (*Dendroica cerulea*)	Yes	species info	Breeding
Golden-Winged Warbler (*Vermivora chrysoptera*)	Yes	species info	Breeding
Least Bittern (*Ixobrychus exilis*)	Yes	species info	Breeding
Marbled Godwit (*Limosa fedoa*)	Yes	species info	Wintering
Pied-billed Grebe (*Podilymbus podiceps*)	Yes	species info	Breeding
Purple Sandpiper (*Calidris maritima*)	Yes	species info	Wintering
Rusty Blackbird (*Euphagus carolinus*)	Yes	species info	Wintering
Short-billed Dowitcher (*Limnodromus griseus*)	Yes	species info	Wintering
Wood Thrush (*Hylocichla mustelina*)	Yes	species info	Breeding
Worm eating Warbler (*Helmitheros vermivorum*)	Yes	species info	Breeding

NWI Wetlands (USFWS National Wetlands Inventory).

The U.S. Fish and Wildlife Service is the principal Federal agency that provides information on the extent and status of wetlands in the U.S., via the National Wetlands Inventory Program (NWI). In addition to impacts to wetlands within your immediate project area, wetlands outside of your project area may need to be considered in any evaluation of project impacts, due to the hydrologic nature of wetlands (for example, project activities may affect local hydrology within, and outside of, your immediate project area). It may be helpful to refer to the USFWS National Wetland Inventory website. The designated FWS office can also assist you. Impacts to wetlands and other aquatic habitats from your project may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal Statutes. Project Proponents should discuss the relationship of these requirements to their project with the Regulatory Program of the appropriate U.S. Army Corps of Engineers District.

Data Limitations, Exclusions and Precautions

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery and/or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Exclusions - Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Precautions - Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the

advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

The following wetland types intersect your project area in one or more locations:

Wetland Types	NWI Classification Code	Total Acres
Freshwater Forested/Shrub Wetland	PFO1A	1.7732
Freshwater Pond	PUBHx	0.1999
Riverine	R2UBH	61.948

3.3.3

Phase I Bog Turtle Report

PHASE I BOG TURTLE HABITAT SURVEY REPORT

Bel Air Impoundment Project

Bel Air, Harford County, Maryland

Prepared for:
Maryland American Water Company

MARYLAND
AMERICAN WATER

Prepared by:

Gannett Fleming

November 2015

PHASE I BOG TURTLE HABITAT SURVEY REPORT

Bel Air Impoundment Project

Bel Air, Harford County, Maryland

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November 2015

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APPENDIX A – WETLANDS AND WATERWAYS MAPPING
APPENDIX B – PHASE 1 BOG TURTLE HABITAT EVALUATION FIELD FORM
APPENDIX C – PHOTOGRAPHS
APPENDIX D – PROJECT ENVIRONMENTAL REVIEW LETTERS

1.0 Project Description

Maryland American Water Company (MAWC) is proposing to construct an off-stream raw water storage reservoir to serve the Town of Bel Air. The proposed project requires a raw water intake structure on Winters Run and associated pipeline crossings on Winters Run to connect the existing Winters Run Water Treatment Plant (WTP). Construction for this project is proposed in an upland field currently used as agricultural land. The connecting infrastructure between the impoundment and the plant will need to cross Winters Run and its floodplain.

The existing Bel Air water system is supplied primarily from the existing Winters Run Water Treatment Plant (2.0 MGD nominal capacity) that treats water from Winters Run. The Winters Run withdrawal is permitted by the Maryland Department of the Environment (MDE) at 1.4 MGD, annual average. The MAWC water system is also supplemented by water supply wells. Finally, MACW has an agreement with Harford County for a 0.5 MGD supply through an existing metered interconnection.

When stream flow drops below the minimum pass-by flow stipulated by MDE, water cannot be withdrawn by the water treatment plant. During such times historically, the Harford County has allowed the MAWC system to take water in excess of the agreement amount to meet system demands. The County is now facing projected long-term supply shortfalls and has alerted MAWC that they can no longer commit to supplemental supply. As a result, the MAWC identified and evaluated a number of options for a supplemental supply.

In working with Harford County and MDE to evaluate supply alternatives, the County identified a County-owned parcel adjacent to Winters Run, upstream of the Winters Run Water Treatment Plant that could potentially be used for construction of an off-stream storage reservoir. The reservoir would be purchased by MAWC and used to supply the WTP when withdrawal from the stream is restricted or prohibited. The reservoir would be refilled from the stream when flows are sufficient to meet both the supply needs and the refill rates.

2.0 Purpose

The purpose of this report is to present the results of a survey conducted for bog turtle (*Glyptemys muhlenbergii*) habitat within wetlands identified within the project study area. **Figure 1** depicts the project location and study area on an aerial map. **Figure 2** depicts the project study area on an excerpt of USGS Topographic Maps (Bel Air and Jarrettsville, MD). This report specifically addresses a habitat assessment (referred to as Phase I survey) that was conducted to identify potential bog turtle habitat within the project study area. Previous consultations were initiated with the MDNR Wildlife and Heritage Service and the USFWS Chesapeake Bay Field Office (CBFO) on August 27, 2014 to identify potential species of concern within the project study area, and aid in jurisdictional agency coordination to avoid potential environmental impacts. No records of rare, threatened or endangered species were identified within the study area boundaries by USFWS CBFO or MDNR Wildlife and Heritage Service.

Legend

▭ Project Study Area

— Streams

Figure 1
Project Location and Study Area Map

Bel Air Impoundment Project

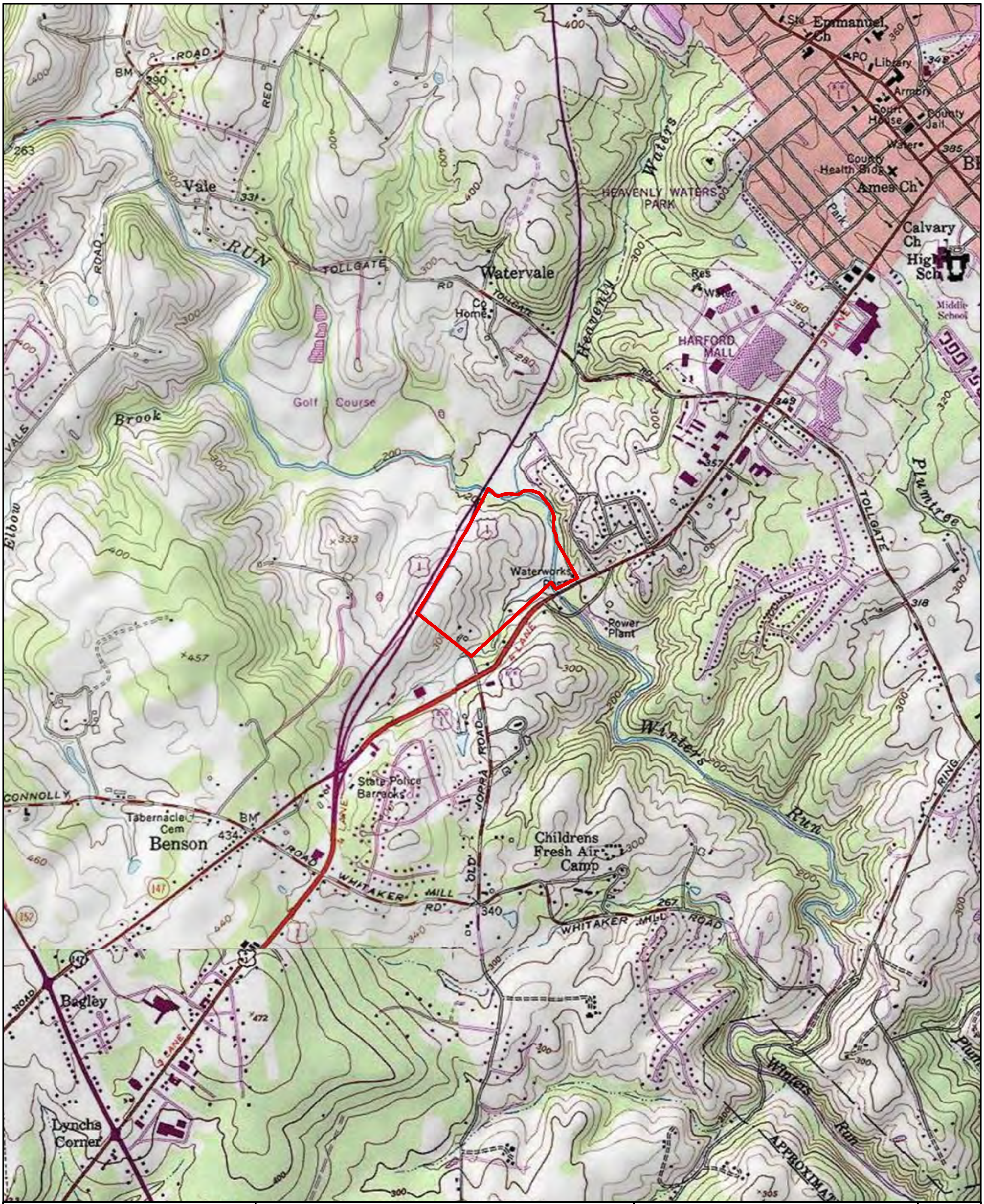
MARYLAND AMERICAN WATER
Town of Bel Air, Harford County, Maryland

Feet
400 200 0 400

Gannett Fleming

N

Source: Aerial imagery basemapping provided by ESRI ArcGIS Online webservices.



Legend

🟥 Project Study Area

Figure 2
USGS Topographic Map
Bel Air, MD and Jarrettsville, MD Quads
Bel Air Impoundment Project
MARYLAND AMERICAN WATER
Town of Bel Air, Harford County, Maryland

Feet

2,000 1,000 0 2,000

N

Gannett Fleming

Source: USGS topographic basemapping provided by ESRI ArcGIS Online webservices.

3.0 Methods

3.1 Resource Information Review

Prior to conducting the field surveys, Gannett Fleming reviewed the following background information to determine the potential extent of bog turtle habitat within the Project area:

1. U.S. Geological Survey (USGS) topographic quadrangles;
2. Aerial photographs;
3. National Wetland Inventory (NWI) mapping.

According to the U.S. Geological Survey (USGS) 7.5 minute topographic quadrangle maps (Bel Air and Jarrettsville, MD), the elevation of the project site is approximately between 180 and 320 feet above mean sea level (amsl). The project study area's highest elevation is approximately 320 feet amsl in the southwest corner of the agricultural field. The project study area's lowest elevation is approximately 180 feet amsl at Winters Run. A Project Location and Study Area Map is provided as **Figure 1**. An excerpt from the USGS Topographic Quadrangle Maps is provided as **Figure 2**.

In addition, the biology and habitat requirements of the bog turtle were reviewed to provide a comparison with the habitat conditions present within the project study area. A summary of the natural history of bog turtle is provided below.

3.2 Bog Turtle Natural History

The bog turtle was listed as federally-threatened by the US Fish and Wildlife Service (USFWS) in 1997 pursuant to the Endangered Species Act of 1973 (87 Stat. 884 as amended; 16 U.S.C. 1531 et seq.), and is listed as state-threatened in Maryland. The listing status is based on significant population declines due to factors including habitat loss, habitat degradation, and poaching. The bog turtle is the smallest, native North American freshwater turtle, with average sizes (adult carapace length) ranging from 82-99 millimeters (Carr 1952). The carapace ranges in color from light brown to black, which sometimes exhibits a "tortoiseshell" pattern, and the hinge-less plastron is brown or black with contrasting light yellow areas. The bog turtle's skin is generally brown and may be flecked with red-orange. The most distinguishing characteristic is the large orange patch on both sides of the head and neck (Behler 1989, Ernst et. al. 1994).

The bog turtle is an omnivore, eating a variety of food sources including insects, berries, seeds, insect larvae, snails, frogs, slugs, salamanders, earthworms, and small mammals (Ernst et. al. 1994). Bog turtles inhabit open, generally spring-fed wet meadows and sphagnum bogs with standing or slow-moving shallow water over a mucky substrate. Bog turtles prefer areas with good sunlight, high evaporation rates, high humidity in the near-ground microclimate, and perennial saturation of portions of the ground (Bourg, 1992).

Bog turtles emerge from hibernation as early as March and are most active in the spring (Ernst 1977, Ernst et. al. 1994). Bog turtles mate in the spring (May to June), and lay a single clutch of three to four eggs. The nesting season lasts from June to July, approximately 21-31 days after copulation (Ernst et. al. 1994). Nests are placed in the top of sedge hummocks of sedge or on top of sphagnum in open, sunny areas. After an incubation period of 42 to 56 days, hatchlings emerge in August or September, or may over-winter in nests in northern localities and emerge in April or

May. As temperatures increase in the summer months bog turtles may aestivate for a short period of time or become subterranean, congregating in wetter areas and inhabiting tunnels and burrows. Bog turtles return to winter hibernation sites during the months of October to November (Ernst et. al. 1994).

3.3 *Phase I Habitat Assessment Surveys*

This section discusses the methods used for the Phase I bog turtle habitat survey in the project study area. Survey methodology followed the "Guidelines for Bog Turtle Surveys" authored by the USFWS and found within the Bog Turtle Northern Population Recovery Plan (USFWS, revised 2006).

3.3.1 Wetland Delineation

Concurrent to the habitat assessment, a wetland delineation was conducted by Gannett Fleming within the project study area. No NWI features were mapped in the project study area, however during field surveys of the project study areas, two palustrine emergent wetlands were observed and delineated in accordance with the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region Version 2.0* (U.S. Army Corps of Engineers, 2012). All wetlands within the project study area were identified and delineated on September 29-30, 2015. Wetland information is summarized in Table 1.

Table 1 Wetland Size and Location

Wetland ID	Wetland Size (acres)	Latitude/Longitude	Is the entire wetland on site?
W1	0.161	39.517021, -76.368708	No
W2	1.872	39.515005, -76.371984	Yes

3.3.2 Habitat Assessment

A Phase I survey for bog turtle habitat was also conducted on September 29-30, 2015 on all wetlands within the 82.18 acres project study area. The location of the wetlands were delineated and depicted on the aerial maps provided in **Appendix A**. The USFWS's habitat assessment field form was completed for the wetlands as part of the assessment and provided in **Appendix B**. Representative photographs are located in **Appendix C**. The survey discussed in this report was conducted by Autumn Thomas (MD Qualified Bog Turtle Surveyor and Environmental Scientist) and Samantha Hockenberry (Environmental Scientist) who performed the wetland delineation and have extensive hands-on experience and training regarding bog turtle habitat and surveying techniques. The initial project environmental review letters and responses are provided as **Appendix D.**

Potential bog turtle habitat is recognized by three criteria, which are suitable hydrology, suitable soils, and suitable vegetation. Suitable hydrology includes some or all of the following: springs, shallow surface water, persistently saturated soils, subsurface flow, and rivulets; a groundwater component is important. Suitable soils, which are the critical criterion, include a bottom substrate of soft muck. The term "muck" does not refer to a technical soil type; it can be soft deep peat or mineral mud. Suitable vegetation includes dominant vegetation of low grasses and sedges, possibly a scrub-shrub wetland component, and a relatively open canopy.

4.0 Phase I Habitat Assessment Results

This section discusses the results of the Phase I bog turtle habitat assessment. A summary of Phase I survey results is included in Table 2. Detailed information about each wetland follows the table. Field forms and site photographs are provided in Appendix A and Appendix B, respectively.

Table 2 Summary of Phase I Survey Results

Wetland ID	Wetland Size (acres)	Wetland Type & Amount (% or acres)	Extent of "Mucky" Soils (by wetland type)	Survey Effort (in person-hrs)	Bog Turtle Habitat?
W1	0.161	PEM – 100%	PEM – 0%	2	No
W2	1.872	PEM – 100%	PEM – 80%	2	Yes

<u>Wetland 1 (W1)</u>

Wetland 1 is a PEM wetland located along the north-northwest property and study area boundary behind the water treatment plant. The wetland receives hydrology as drainage from the surrounding upland forested slope and is primarily a sparsely-vegetated, toe-slope, linear depression in the Winters Run floodplain. Dominant wetland vegetation within this wetland consisted of skunk cabbage (*Symplocarpus foetidus*), multiflora rose (*Rosa multiflora*) and Japanese stilt grass (*Microstegium vimineum*). Other vegetation at the time of survey included sedges (*Carex* spp.), Pennsylvania smartweed (*Persicaria pensylvanica*), swamp smartweed (*Persicaria hydropiperoides*), arrow-leaf tearthumb (*Persicaria sagittata*), red maple (*Acer rubrum*), spicebush (*Lindera benzoin*), and slippery elm (*Ulmus rubra*). The dominant vegetation in this emergent wetland consists of two invasive species, and the overall lack of vegetation in the majority of the wetland does not provide suitable protection or habitat for bog turtles. While saturated soils were observed and appear to persist year-round, no springs or seeps were observed and no shallow surface water in the form of small puddles or rivulets were observed. Due to the abundance of invasive plant species, lack of groundwater influence, and lack of mucky soils, this wetland is not suitable bog turtle habitat.

<u>Wetland 2 (W2)</u>

Wetland 2 is a PEM wetland located downslope of an agricultural field and within the floodplain of an UNT to Winters Run. The wetland receives hydrology from a spring house and several springs located on the upslope edge of wetland, as well as drainage from the surrounding agricultural field. Dominant vegetation within this wetland consisted of broad-leaf cat-tail (*Typha latifolia*), orange touch-me-not (*Impatiens capensis*), sensitive fern (*Onoclea sensibilis*), arrow-leaf tearthumb, and reed canary grass (*Phalaris arundinacea*). Other vegetation observed during the survey included sedges, rushes, single-vein sweetflag (*Acorus calamus*), rice cutgrass (*Leersia oryzoides*), and multiflora rose.

Several flowing seeps and springs were observed on the upslope edge of the wetland. A spring house was observed on the southwestern corner of the wetland. Numerous rivulets were observed throughout the wetland and several were delineated as drainage features into the UNT to Winters Run that abuts the eastern edge of the wetland. Several small puddles with standing water up to three inches deep were observed during the survey. Over 80% of this wetland exhibited mucky soils at least three inches deep and most of the mucky parts could be probed up to eight inches deep.

This wetland exhibits key habitat criteria that would render them suitable for bog turtles in regards to vegetation, hydrology and soil type. Therefore, this wetland was determined to have potential bog turtle.

5.0 Summary

Field investigations conducted by Gannett Fleming on September 29-30, 2015, identified and delineated wetlands and waterways in conjunction with the Bel Air Reservoir Project. Two palustrine emergent wetlands, were identified and delineated within the project study area and surveyed for potential bog turtle habitat. Wetland 2 (W2) does exhibit all three criteria for potential habitat, pending agency concurrence and final design impacts, it may require a Phase II presence/absence survey for bog turtle. No bog turtles were observed during the Phase I surveys. Frogs were observed in wetland W2 during the survey.

- Wetland 1 (W1): PEM, 0.161 ac., no suitable habitat present
- Wetland 2 (W2): PEM, 1.872 ac., suitable habitat is present

6.0 References

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7.0 List of Contributors

David H. Graff, Senior Environmental Scientist, QA/QC
Professional Experience: 17 years
Education: B.S., Environmental Studies
M.A.Ed., Environmental Studies
38 Hour U.S. Army Corps of Engineers Wetland Delineator Certification Training
Habitat Evaluation Procedures (HEP) Certified
Professional Wetland Scientist, (PWS) No. 001385, Society of Wetland Scientists
Certified Senior Ecologist (CSE), Ecological Society of America
Certified Wildlife Biologist (CWB), The Wildlife Society

DAVID H. GRAFF
001385

Autumn M. Thomas, Senior Environmental Scientist
Professional Experience: 16 years
Education: B.S., Environmental Science and Natural Resources Biology
Rutgers Wetland Delineation Certificate Series
Regional Supplement to the Corps of Engineers Wetland Delineation Manual Update Workshop
USFWS & MDNR Recognized, **Qualified Bog Turtle Surveyor**

Samantha R. Hockenberry, Environmental Scientist
Professional Experience: 2 year
Education: B.S., Biology
M.S., Biology
36 Hour Swamp School Wetland Delineation & Regional Supplement Training
Society of Freshwater Science Taxonomic Certification to Family Level for Aquatic Insects
Certified Associate Ecologist (CAE), Ecological Society of America

APPENDIX A
WETLANDS AND WATERWAYS MAPPING

Legend

Project Study Area	Mapped Waterways
Existing Reforestation Area	⊗ Springhouse
▨ Delineated Wetlands	Delineated Streams

Appendix A
Wetlands and Waterways Mapping
Overview Map
Bel Air Impoundment Project
MARYLAND AMERICAN WATER
Town of Bel Air, Harford County, Maryland

Feet

400 200 0 400

Gannett Fleming

N

Source: Aerial imagery basemapping provided by ESRI ArcGIS Online webservices.

Legend

Project Study Area
Mapped Waterways
Existing Reforestation Area
Springhouse
Delineated Wetlands
Delineated Streams
Delineation Point
Data Plot

Appendix A
Wetlands and Waterways Mapping
Map 1 of 2

Bel Air Impoundment Project

MARYLAND AMERICAN WATER
Town of Bel Air, Harford County, Maryland

Feet
100 50 0 100

Gannett Fleming

N

Source: Aerial imagery basemapping provided by ESRI ArcGIS Online webservices.

Legend

▭ Project Study Area

— Mapped Waterways

▭ Existing Reforestation Area

⊗ Springhouse

▨ Delineated Wetlands

— Delineated Streams

○ Delineation Point

⊕ Data Plot

Appendix A
Wetlands and Waterways Mapping
Map 2 of 2

Bel Air Impoundment Project

MARYLAND AMERICAN WATER
Town of Bel Air, Harford County, Maryland

Feet
100 50 0 100

Gannett Fleming

N

Source: Aerial imagery basemapping provided by ESRI ArcGIS Online webservices.

APPENDIX B
PHASE I BOG TURTLE HABITAT EVALUATION FIELD FORM

USFWS/PFBC Bog Turtle Habitat Evaluation Field Form *(revised 06/01/2006)*

Project/Property Name: 059267 MAWC Reservoir Study
Project type: Proposed upland storage reservoir and treament plant upgrades
Applicant/Landowner Name: Maryland-American Water
County: Harford Quad: Jarrettsville & Bel Air Township/Municipality: Bel Air
PNDI # n/a Potential conflict with USFWS species? ☒Y ☐N

ACTION AREA[2]

Action area size: approx. 70 acres **Does the Phase I survey include all wetlands in the action area?** ☒Y ☐N[3]

WETLAND ID: W1 **PHOTOS TAKEN:** ☒Y ☐N **WETLAND SIZE:** 0.161 **acres**
Wetland size estimation: If actual acreage is not known at time of investigation, check one:
☐ <0.1 acre ☒ 0.1 to 0.5 acre ☐ >0.5 to <1 acre ☐ 1-2 acres ☐ 2-4 acres ☐ 5+ acres ☐ 10+ acres

WETLAND LOCATION: Lat 39.517493 Long -76.368925
(approximate center of wetland) GPS Datum (check one): ☐ NAD 27 ☐ NAD 83 ☒ WGS 84

SURVEY CONDITIONS & LIMITATIONS

Date of survey: 09/29/15 Time In: 10:00 Time Out: 11:00
Last precipitation: ☐<24 hours ☐1-7 days ☐>1 week ☒unknown Drought conditions? ☐Y ☐N ☒Unknown

How much of the wetland is located *off-site* (i.e., outside the property boundaries or right-of-way)?
☐ none of it – the entire wetland is within the property boundaries (skip next 2 questions)
☒ some of it - _______acres or 5 % of the wetland appears to be located off-site

If part of this wetland continues off-site, how much of the *off-site portion* was surveyed (on foot)?
☐ none of it ☒ all of it ☐ part of it (at least ______% of it or ______ acres of the off-site portion)

How much of the *off-site portion* of the wetland is visible (e.g., from the subject property or from a public road)?
☒ all of it ☐ part of it (at least ______% of it or ____________ acres) ☐ none of it

Are there any wetlands located *off-site* and close enough to be affected by this project? ☐Y ☒N ☐Unknown
If yes, *could* they be potential bog turtle habitat? ☐Y ☐N ☐Unknown

Describe surrounding landscape (wetlands, forest, subdivision, agricultural field, fallow field, etc.):
Winters Run, upland forest, water treatment plant

WETLAND CHARACTERISTICS

Wetland type(s) present and % cover: ☒ PEM 100 ☐ PSS _____ ☐ PFO _____ ☐ POW_______

☒Y ☐N Are there any signs of disturbance to *hydrology* (ditching, filling, ponds, roads, etc.)? If yes, describe:
Ditched & bermed
☐Y ☒N Are there any signs of disturbance to *vegetation* (mowing, pasturing, burning, etc.)? If yes, describe:

Hydrology

☐ Y ☒ N Springs or seeps ☐ visible ☐ likely? Watercress present? ☐ Yes ☒ No
☐ Y ☒ N Spring houses in or adjacent to wetland?
☐ Y ☒ N Rivulets present? If yes, average depth ____ inches.
☒ Y ☐ N Saturated soils present? If yes, year round? ☒ Likely ☐ Unlikely ☐ Unknown
☐ Y ☒ N Water visible on surface? Check all that apply: ☐ small puddles/depressions (___"deep) ☐ rivulets (__" deep) ☐ larger pools/ponds (___"deep)
☒ Y ☐ N Evidence of flooding? If yes, describe indicators wrack lines, areas of concentrated flow

Project Name Maryland-American Water *Wetland* W1 *(cont.)*

Soils Mapping Unit (optional): ____________________

Field observations confirm mapped type? ☐YES ☐NO ☒Unknown

Soils – PEM Portion of Wetland			
Mucky[4]? ☐YES ☒NO	How much of it (PEM) is **mucky**? ☐ <10% ☐ 10-29% ☐ 30-49% ☐ 50-70% ☐ >70%	**Mucky** soils range in depth from: ___ to____"	**Most** of the **mucky part(s)** of the wetland can be probed[5]: ☐ 3-5" ☐ 6-8" ☐ 9-11" ☐ ≥12"
Non-mucky[6]? ☒YES ☐NO	How much of it (PEM) is **non-mucky**? ☐ <10% ☐ 10-29% ☐ 30-49% ☐ 50-70% ☒ >70%		

Soils – PSS and/or PFO Portions of Wetland			
Mucky[4]? ☐YES ☐NO	How much of it is **mucky**? ☐ <10% ☐ 10-29% ☐ 30-49% ☐ 50-70% ☐ >70%	**Mucky** soils range in depth from: ___ to____"	Most of the **mucky part(s)** of the wetland can be probed[5]: ☐ 3-5" ☐ 6-8" ☐ 9-11" ☐ ≥12"

Wetland Vegetation (characterize the wetland as a whole)

Check (X) if present (≥ 5% aereal coverage), and also circle the dominant (≥ 20% coverage).

☒ sedges ☐ rushes [✓ ☒ skunk cabbage] ☐ cattail ☐ sweet flag ☒ jewelweed ☐ sphagnum moss
☐ sensitive fern ☐rice cutgrass ☒ tearthumb ☐ reed canary grass ☐ *Phragmites* ☐ purple loosestrife
☐ alder ☐ dogwood ☒ red maple ☐ willow ☐ poison sumac [✓ ☒ multiflora rose] ☐ ________________
Additional dominant species: spicebush, slippery elm, smartweed, Japanese stiltgrass

Herptiles

Were any bog turtles observed? ☐ YES[7] ☒NO If yes, how many? ________
Other herptiles ☐observed ☐previously observed: ____________________

Additional Comments/Observations: (use additional sheets if necessary)

INVESTIGATOR'S OPINION

☐ YES ☒ NO ☐ UNSURE The hydrology criterion[8] for bog turtle habitat is met.
☐ YES ☒ NO ☐ UNSURE The soils criterion[8] for bog turtle habitat is met.
☐ YES ☒ NO ☐ UNSURE The vegetation criterion[8] for bog turtle habitat is met.
☐ YES ☒ NO ☐ UNSURE This wetland is potential bog turtle habitat.

I certify that to the best of my knowledge, all of the information provided herein is accurate and complete.

Autumn M. Thomas	Autumn M	09/29/15
Investigator's Name (print)	Investigator's Signature	Date

USFWS/PFBC Bog Turtle Habitat Evaluation Field Form *(revised 06/01/2006)*

Project/Property Name: 059267 MAWC Reservoir Study
Project type: Proposed upland storage reservoir and treament plant upgrades
Applicant/Landowner Name: Maryland-American Water
County: Harford Quad: Jarrettsville & Bel Air Township/Municipality: Bel Air
PNDI # n/a Potential conflict with USFWS species? ☒Y ☐N

ACTION AREA[2]

Action area size: approx. 70 acres **Does the Phase I survey include all wetlands in the action area?** ☒Y ☐N[3]

WETLAND ID: W2 **PHOTOS TAKEN:** ☒Y ☐N **WETLAND SIZE:** 1.872 **acres**

Wetland size estimation: If actual acreage is not known at time of investigation, check one:
☐ <0.1 acre ☐ 0.1 to 0.5 acre ☐ >0.5 to <1 acre ☒ 1-2 acres ☐ 2-4 acres ☐ 5+ acres ☐ 10+ acres

WETLAND LOCATION: Lat 39.514953 Long -76.372112
(approximate center of wetland) GPS Datum (check one): ☐ NAD 27 ☐ NAD 83 ☒ WGS 84

SURVEY CONDITIONS & LIMITATIONS

Date of survey: 09/30/15 Time In: 07:30 Time Out: 08:30
Last precipitation: ☒<24 hours ☐1-7 days ☐>1 week ☐unknown Drought conditions? ☐Y ☐N ☒Unknown

How much of the wetland is located *off-site* (i.e., outside the property boundaries or right-of-way)?
☒ none of it – the entire wetland is within the property boundaries (skip next 2 questions)
☐ some of it - _______acres or _____% of the wetland appears to be located off-site

If part of this wetland continues off-site, how much of the *off-site portion* was surveyed (on foot)?
☐ none of it ☐ all of it ☐ part of it (at least ______% of it or ______ acres of the off-site portion)

How much of the *off-site portion* of the wetland is visible (e.g., from the subject property or from a public road)?
☐ all of it ☐ part of it (at least ______% of it or ____________ acres) ☐ none of it

Are there any wetlands located *off-site* and close enough to be affected by this project? ☐Y ☒N ☐Unknown
If yes, *could* they be potential bog turtle habitat? ☐Y ☐N ☐Unknown

Describe surrounding landscape (wetlands, forest, subdivision, agricultural field, fallow field, etc.):
UNT Winters Run, agricultural field

WETLAND CHARACTERISTICS

Wetland type(s) present and % cover: ☒ PEM 100 ☐ PSS _____ ☐ PFO _____ ☐ POW_______

☐Y ☒N Are there any signs of disturbance to *hydrology* (ditching, filling, ponds, roads, etc.)? If yes, describe:

☐Y ☒N Are there any signs of disturbance to *vegetation* (mowing, pasturing, burning, etc.)? If yes, describe:

Hydrology

☒ Y ☐ N Springs or seeps ☒ visible ☐ likely? Watercress present? ☐ Yes ☒ No
☒ Y ☐ N Spring houses in or adjacent to wetland?
☒ Y ☐ N Rivulets present? If yes, average depth 2-4 inches.
☒ Y ☐ N Saturated soils present? If yes, year round? ☒ Likely ☐ Unlikely ☐ Unknown
☒ Y ☐ N Water visible on surface? Check all that apply: ☐ small puddles/depressions (3 "deep)
☒ rivulets (2 " deep) ☐ larger pools/ponds (___"deep)
☐ Y ☒ N Evidence of flooding? If yes, describe indicators

Project Name Maryland-American Water *Wetland* W2 *(cont.)*

Soils Mapping Unit (optional): ____________________

Field observations confirm mapped type? ☐YES ☐NO ☒Unknown

Soils – PEM Portion of Wetland			
Mucky[4]? ☒YES ☐NO	How much of it (PEM) is **mucky**? ☐ <10% ☐ 10-29% ☐ 30-49% ☒ 50-70% ☐ >70%	**Mucky** soils range in depth from: 2 to 10 ”	**Most** of the **mucky part(s)** of the wetland can be probed[5]: ☐ 3-5” ☒ 6-8” ☐ 9-11” ☐ ≥12”
Non-mucky[6]? ☐YES ☒NO	How much of it (PEM) is **non-mucky**? ☐ <10% ☒ 10-29% ☐ 30-49% ☐ 50-70% ☐ >70%		

Soils – PSS and/or PFO Portions of Wetland			
Mucky[4]? ☐YES ☐NO	How much of it is **mucky**? ☐ <10% ☐ 10-29% ☐ 30-49% ☐ 50-70% ☐ >70%	**Mucky** soils range in depth from: ___ to____”	Most of the **mucky part(s)** of the wetland can be probed[5]: ☐ 3-5” ☐ 6-8” ☐ 9-11” ☐ ≥12”

Wetland Vegetation (characterize the wetland as a whole)

Check (X) if present (≥ 5% aereal coverage), and also circle the dominant (≥ 20% coverage).

☒ sedges ☒ rushes ☐ skunk cabbage ☒ [✓ cattail] ☒ sweet flag ☒ [✓ jewelweed] ☐ sphagnum moss
☒ [✓ sensitive fern] ☒ rice cutgrass ☒ [✓ tearthumb] ☒ [✓ reed canary grass] ☐ *Phragmites* ☐ purple loosestrife
☐ alder ☐ dogwood ☒ red maple ☐ willow ☐ poison sumac ☒ multiflora rose ☐ ________________

Additional dominant species: ________________________________

Herptiles

Were any bog turtles observed? ☐ YES[7] ☒NO If yes, how many? ________

Other herptiles ☒observed ☐previously observed: frogs

Additional Comments/Observations: (use additional sheets if necessary)

Several spring/seeps observed between wetland and agricultural field. Recently planted mitigation buffer between wetland edge and field.

INVESTIGATOR’S OPINION

☒ YES ☐ NO ☐ UNSURE The hydrology criterion[8] for bog turtle habitat is met.
☒ YES ☐ NO ☐ UNSURE The soils criterion[8] for bog turtle habitat is met.
☒ YES ☐ NO ☐ UNSURE The vegetation criterion[8] for bog turtle habitat is met.
☒ YES ☐ NO ☐ UNSURE This wetland is potential bog turtle habitat.

I certify that to the best of my knowledge, all of the information provided herein is accurate and complete.

Autumn M. Thomas 09/30/15

Investigator’s Name (print) Investigator’s Signature Date

APPENDIX C
PHOTOGRAPHS

Photo 1 (09-29-2015)
Wetland 1 (W1) is a palustrine emergent (PEM) wetland located on the eastern bank floodplain of Winters Run. View is close-up of wetland plot.

Photo 2 (09-29-2015)
Wetland 1 (W1) extends off the project study area for a short distance before connecting to Winters Run. View is northwest from wetland plot.

Photo 3 (09-29-2015)
Wetland 1 is a toe-of-slope drainage swale that is partially an unvegetated, concave surface. View is southeast from wetland plot.

Photo 4 (09-29-2015)
Upland plot for the project study area is on the floodplain of Winters Run. View is southwest near Wetland 1 boundary and start of Stream 1.

Photo 5 (09-29-2015)
Stream 1 (S1) is an ephemeral watercourse located between Wetland 1 and Winters Run. View is north and upstream from Flag S1-1.

Photo 6 (09-29-2015)
Upstream view of Stream 1 from flag S1-4 looking northeast.

Photo 7 (09-29-2015)
Downstream view of Stream 1 at flag S1-4 looking south at junction with Winters Run.

Photo 8 (09-30-2015)
Wetland 2 (W2) is a PEM wetland dominated by tearthumb, reed canary grass, and cattail. View is northeast at the wetland plot.

Photo 9 (09-30-2015)
Wetland 2 overview from flag W2-11 and left bank of UNT to Winters Run (S8). View is looking west.

Photo 10 (09-30-2015)
Upstream view of Stream 2, ephemeral stream originating at spring. View is west from flag S2-1.

Photo 11 (09-30-2015)
Downstream view of Stream 2. View is east from flag S2-1.

Photo 12 (09-30-2015)
Upstream view of Stream 3, perennial stream originating at springhouse. View is east from flag S3-4.

Photo 13 (09-30-2015)
Downstream view of Stream 3 before diffusing into Wetland 2. View is east from flag S3-4.

Photo 14 (09-30-2015)
Upstream view of Stream 3 when rechannelizes at UNT to Winters Run (S8). View is west from flag S3-6B.

Photo 15 (09-30-2015)
Downstream view of Stream 4, intermittent stream draining Wetland 2 into UNT to Winters Run (S8). View is east from flag S4-1.

Photo 16 (09-30-2015)
Upstream view of Stream 4 at junction with UNT to Winters Run (S8). View is northwest from flag S4-2.

Photo 17 (09-30-2015)
Downstream view of Stream 5, intermittent stream draining Wetland 2 into UNT to Winters Run (S8). View is east from flag S5-2.

Photo 18 (09-30-2015)
Upstream view of Stream 5 at junction with UNT to Winters Run (S8). View is west from flag S5-3.

Photo 19 (09-30-2015)
Downstream view of Stream 6, ephemeral drainage of overland flow from agricultural field into UNT to Winters Run (S8). View is southeast from flag S6-1.

Photo 20 (09-30-2015)
Upstream view of Stream 6 from junction with UNT to Winters Run (S8). View is northwest from flag S6-2.

Photo 21 (09-30-2015)
Downstream view of Stream 7, ephemeral drainage of overland flow from agricultural field into UNT to Winters Run (S8). View is southeast from flag S7-1.

Photo 22 (09-30-2015)
Upstream view of Stream 7 from junction with UNT to Winters Run (S8). View is north from flag S7-3.

Photo 23 (09-29-2015)
Downstream view of Stream 8, UNT to Winters Run (S8). View is north near flag W2-11.

Photo 24 (09-29-2015)
Upstream view of Stream 8, UNT to Winters Run (S8). View is southwest near flag W2-11.

Photo 25 (09-30-2015)
Downstream view of Stream 8, UNT to Winters Run (S8) at junction with Winters Run after heavy rains previous evening. View is southeast near flag S7-3.

Photo 26 (09-30-2015)
Downstream view of Winters Run (WR) at junction with UNT to Winters Run (S8) after heavy rains previous evening. View is southeast.

Photo 27 (09-30-2015)
Upstream view of Winters Run (WR) at junction with UNT to Winters Run (S8) after heavy rains previous evening. View is north.

Photo 28 (11-02-2015)
View of springhouse source of Stream 3. View is northwest.

Photo 29 (09-30-2015)
View of harvested corn field and reforestation area in distance. View is east.

Photo 30 (09-30-2015)
View of harvested corn field with former barn and new residential development construction in distance. View is southwest.

APPENDIX D
PROJECT ENVIRONMENTAL REVIEW LETTERS

MARYLAND
DEPARTMENT OF
NATURAL RESOURCES

Martin O'Malley, *Governor*
Anthony G. Brown, *Lt. Governor*
Joseph P. Gill, *Secretary*
Frank W. Dawson III, *Deputy Secretary*

September 17, 2014

Danielle Iuliucci
Gannett Fleming, Inc.
PO Box 67100
Harrisburg, PA 17106-7100

RE: Environmental Review for The American Water Company, Bel Air Reservoir Feasibility Study, Bel Air, US Route 1, Winters Run, Harford County, MD.

Dear Ms. Iuliucci:

The Wildlife and Heritage Service has determined that there are no State or Federal records for rare, threatened or endangered species within the boundaries of the project site as delineated. As a result, we have no specific comments or requirements pertaining to protection measures at this time. This statement should not be interpreted however as meaning that rare, threatened or endangered species are not in fact present. If appropriate habitat is available, certain species could be present without documentation because adequate surveys have not been conducted.

Thank you for allowing us the opportunity to review this project. If you should have any further questions regarding this information, please contact me at (410) 260-8573.

Sincerely,

Lori A. Byrne

Lori A. Byrne,
Environmental Review Coordinator
Wildlife and Heritage Service
MD Dept. of Natural Resources

ER# 2014.1333.ha

Tawes State Office Building – 580 Taylor Avenue – Annapolis, Maryland 21401
410-260-8DNR or toll free in Maryland 877-620-8DNR – *dnr.maryland.gov* – TTY Users Call via the Maryland Relay

Gannett Fleming

GANNETT FLEMING, INC.
P.O. Box 67100
Harrisburg, PA 17106-7100

Location:
207 Senate Avenue
Camp Hill, PA 17011

Office: (717) 763-7211
Fax: (717) 763-8150
www.gannettfleming.com

August 27, 2014

Lori Byrne
DNR Wildlife & Heritage Service
580 Taylor Avenue
Tawes Office Bldg E-1
Annapolis, MD 21401

MAILED 8/27/14
Certified 7013 2250 0000 4345 7922

RE: Request for Environmental Review
The Maryland American Water Company
Bel Air Reservoir Feasibility Study
Bel Air, Harford County, Maryland

Dear Ms. Byrne:

Gannett Fleming, Inc. (Gannett Fleming) is requesting an environmental review of a project located on the east and west sides of the Bel Air Bypass (US Route 1) approximately 1 mile south of its intersection with MD Route 24 in Bel Air, Harford County, Maryland (39.517203 N, 76.375215 W). Gannett Fleming was retained by the Maryland American Water Company (MAWC) to evaluate the feasibility of creating an off-stream raw water storage reservoir that would provide the Town of Bel Air with drinking water during dry periods. This project is currently in a conceptual design phase with field reconnaissance and preliminary engineering studies to occur in the near future. To support permitting, we are requesting an environmental review to determine if any species of concern occur within or in close proximity to the study area. Please refer to **Figure 1** for the USGS topographic map of the study area. **Figure 2** provides an aerial photograph of the project study area.

The Bel Air water system is supplied primarily by Winters Run. The Maryland Department of the Environment (MDE) regulates the Harford County water treatment plant, operated by the MAWC. When stream flow falls below the minimum pass-by flow stipulated by the MDE, water should not be withdrawn from Winters Run. During such times historically, Harford County has allowed the MAWC system to continue operating to meet system demands. However, since Harford County expects the Bel Air water supply to experience long-term supply shortfalls, alternative water supply systems are being evaluated. Gannett Fleming is evaluating the feasibility of building a reservoir in an off-stream agricultural area adjacent to Winters Run to store water from Winters Run during periods of high flow. The reservoir would provide Bel Air with water when water levels in Winters Run fall below MDE withdraw limits.

Please provide Gannett Fleming with an official response letter regarding any species of concern within or in close proximity to the study area. We would appreciate an expedited environmental review, if possible. Please contact me at (717) 763-7211, extension 2914, with any questions or requests for additional information. Thank you for your cooperation; we look forward to working with you on this project.

Very truly yours,

Danielle Iuliucci
Environmental Scientist

Attachments

Copies Furnished (electronically): S. Liskovich, GF Project Manager
D. Graff, GF Sr. Environmental Scientist
File

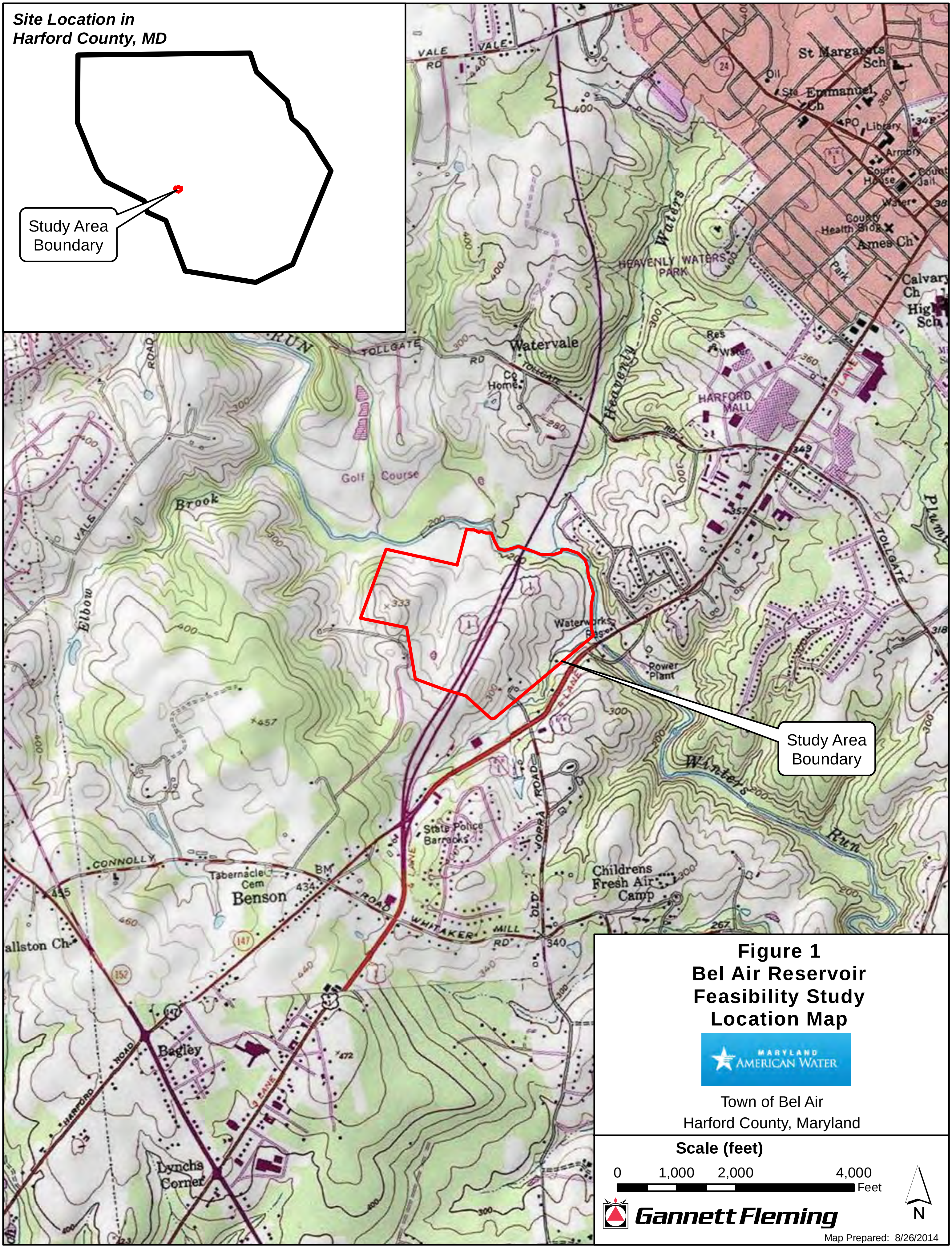


Figure 1
Bel Air Reservoir Feasibility Study Location Map

MARYLAND AMERICAN WATER

Town of Bel Air
Harford County, Maryland

Gannett Fleming

Map Prepared: 8/26/2014

Data Source: USGS topo map with excerpts from 7.5' Quadrangles - Jarrettsville, Maryland, and Belair, Maryland, provided by ESRI through ArcGIS Online webservice.

Figure 2
Bel Air Reservoir Feasibility Study
Aerial Location Map

MARYLAND AMERICAN WATER

Town of Bel Air
Harford County, Maryland

Scale (feet)

0 500 1,000 2,000 Feet

N

Gannett Fleming

Map Prepared: 8/26/2014

Data Source: Aerial imagery map provided by ESRI through ArcGIS Online webservice.

Gannett Fleming

GANNETT FLEMING, INC.
P.O. Box 67100
Harrisburg, PA 17106-7100

Location:
207 Senate Avenue
Camp Hill, PA 17011

Office: (717) 763-7211
Fax: (717) 763-8150
www.gannettfleming.com

August 27, 2014

US Fish and Wildlife Service
Chesapeake Bay Ecological Services Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401

SUBMITTED ELECTRONICALLY
8/27/14

RE: Project Review Request
The Maryland American Water Company
Bel Air Reservoir Feasibility Study
Bel Air, Harford County, Maryland

To whom it may concern:

Gannett Fleming, Inc. (Gannett Fleming) is requesting a project review from the US Fish and Wildlife Service's Chesapeake Bay Ecological Services Field Office for a project located on the east and west sides of the Bel Air Bypass (US Route 1) approximately 1 mile south of its intersection with MD Route 24 in Bel Air, Harford County, Maryland (39.517203 N, 76.375215 W). Gannett Fleming was retained by the Maryland American Water Company (MAWC) to evaluate the feasibility of creating an off-stream raw water storage reservoir that would provide the Town of Bel Air with drinking water during dry periods. This project is currently in a conceptual design phase with field reconnaissance and preliminary engineering studies to occur in the near future. To support permitting, we are requesting a project review to determine if any species of concern occur within or in close proximity to the study area.

Gannett Fleming was retained by the Maryland American Water Company (MAWC) to evaluate the feasibility of creating an off-stream raw water storage reservoir that would provide the Town of Bel Air with drinking water during dry periods. This project is currently in a conceptual design phase with field reconnaissance and preliminary engineering studies to occur in the near future. The Bel Air water system is supplied primarily by Winters Run. The Maryland Department of the Environment (MDE) regulates the Harford County water treatment plant, operated by the MAWC.

The Bel Air water system is supplied primarily by Winters Run. The Maryland Department of the Environment (MDE) regulates the Harford County water treatment plant, operated by the MAWC. When stream flow falls below the minimum pass-by flow stipulated by the MDE, water should not be withdrawn from Winters Run. During such times historically, Harford County has allowed the MAWC system to continue operating to meet system demands. However, since Harford County expects the Bel Air water supply to experience long-term supply shortfalls, alternative water supply systems are being evaluated. Gannett Fleming is evaluating the feasibility of building a reservoir in

an off-stream agricultural area adjacent to Winters Run to store water from Winters Run during periods of high flow. The reservoir would provide Bel Air with water when water levels in Winters Run fall below MDE withdraw limits.

The Information, Planning, and Conservation (IPaC) System indicated that no listed species, critical habitats, or national wildlife refuges were found within the vicinity of the proposed project. The IPaC System identified 13 migratory birds of concern that may be impacted. Three (3) National Wetlands Inventory wetland types were identified within the project study area, including freshwater forested/shrub wetland (PFO1A), freshwater pond (PUBHx), and riverine (R2UBH). Please refer to **Attachment 1** for the USGS topographic map of the study area. **Attachment 2** provides an aerial photograph of the project study area and **Attachment 3** provides the IPaC System Trust Resources List.

Please provide Gannett Fleming with an official response letter regarding any species of concern within or in close proximity to the study area as well as any conservation measures that should be implemented. We would appreciate an expedited review, if possible. Please contact me at (717) 763-7211, extension 2914, with any questions or requests for additional information. Thank you for your cooperation; we look forward to working with you on this project.

Very truly yours,

Danielle Iuliucci
Environmental Scientist

Attachments

Copies Furnished (electronically):
S. Liskovich, GF Project Manager
D. Graff, GF Sr. Environmental Scientist
S. Smith, GF Environmental Scientist
File

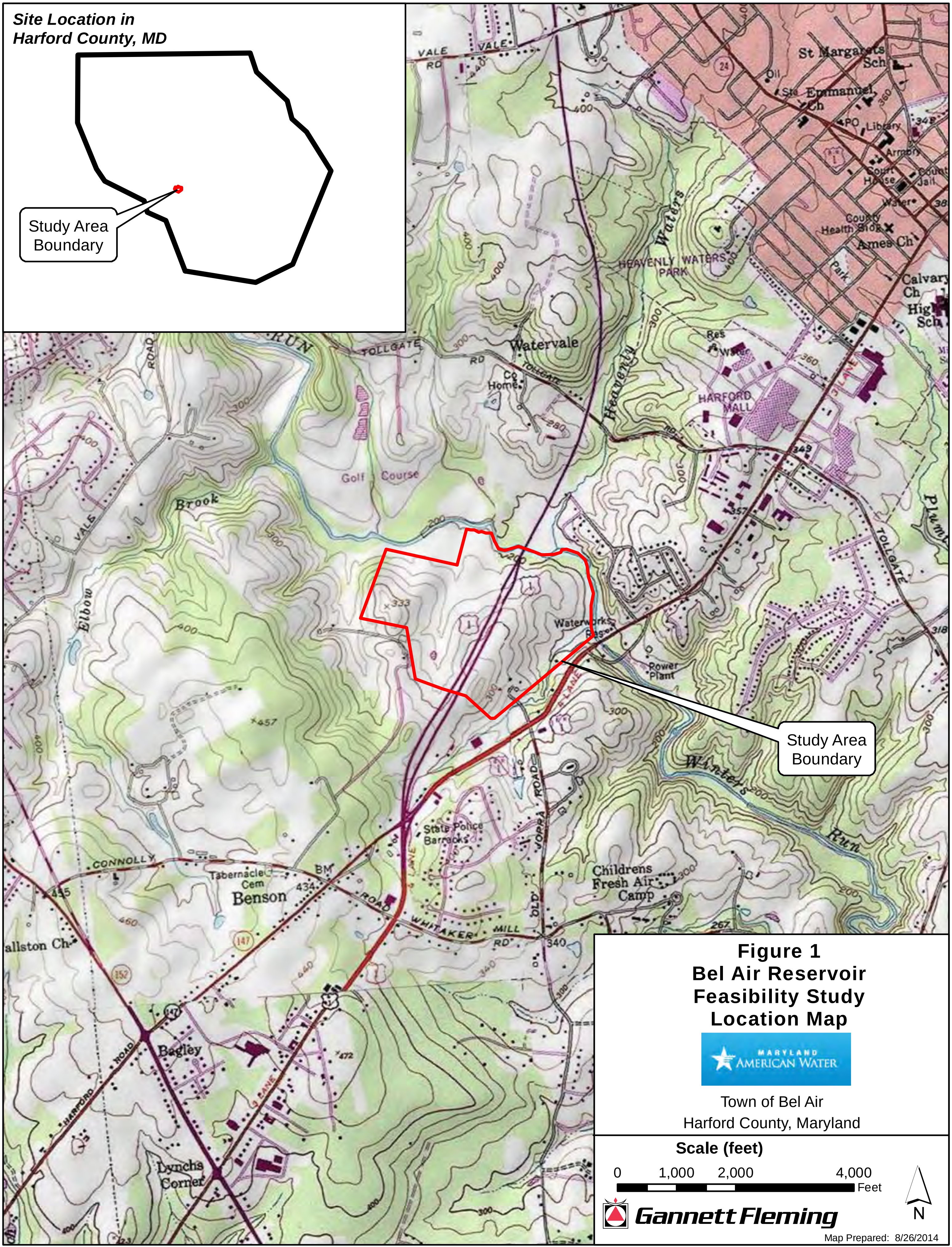


Figure 1
Bel Air Reservoir Feasibility Study
Location Map

MARYLAND AMERICAN WATER

Town of Bel Air
Harford County, Maryland

Scale (feet)

0 1,000 2,000 4,000
Feet

N

Gannett Fleming

Map Prepared: 8/26/2014

Data Source: USGS topo map with excerpts from 7.5' Quadrangles - Jarrettsville, Maryland, and Belair, Maryland, provided by ESRI through ArcGIS Online webservice.

Figure 2
Bel Air Reservoir Feasibility Study
Aerial Location Map

MARYLAND AMERICAN WATER

Town of Bel Air

Harford County, Maryland

Scale (feet)

Gannett Fleming

Map Prepared: 8/26/2014

Data Source: Aerial imagery map provided by ESRI through ArcGIS Online webservice.

U.S. Fish and Wildlife Service

Trust Resources List

This resource list is to be used for planning purposes only — it is not an official species list.

Endangered Species Act species list information for your project is available online and listed below for the following FWS Field Offices:

Chesapeake Bay Ecological Services Field Office
177 ADMIRAL COCHRANE DRIVE
ANNAPOLIS, MD 21401
(410) 573-4599

Project Name:

Bel Air Reservoir Feasibility Study

Project Location Map:

Project Counties:

Harford, MD

Geographic coordinates (Open Geospatial Consortium Well-Known Text, NAD83):

MULTIPOLYGON (((-76.3774704 39.519473, -76.376612 39.5211613, -76.3759469 39.5208799, -76.3750885 39.5208634, -76.3745736 39.519953, -76.3732217 39.5201185, -76.3722776 39.5197047, -76.3702177 39.5198206, -76.3695739 39.5194399, -76.3692306 39.5187281, -76.3691877 39.5180329, -76.3690804 39.5174039, -76.3693808 39.5162783, -76.3690589 39.5156161, -76.3757069 39.5123041, -76.3772133 39.5133644, -76.3801487 39.5142417, -76.3804985 39.5165925, -76.383288 39.5171884, -76.3815724 39.5204824, -76.3774704 39.519473)))

Trust Resources List

Project Type:

Dam

Endangered Species Act Species List (USFWS Endangered Species Program).

There are no listed species found within the vicinity of your project.

Critical habitats within your project area:

There are no critical habitats within your project area.

FWS National Wildlife Refuges (USFWS National Wildlife Refuges Program).

There are no refuges found within the vicinity of your project.

FWS Migratory Birds (USFWS Migratory Bird Program).

The protection of birds is regulated by the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA). Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. For more information regarding these Acts see http://www.fws.gov/migratorybirds/RegulationsandPolicies.html.

All project proponents are responsible for complying with the appropriate regulations protecting birds when planning and developing a project. To meet these conservation obligations, proponents should identify potential or existing project-related impacts to migratory birds and their habitat and develop and implement conservation measures that avoid, minimize, or compensate for these impacts. The Service's Birds of Conservation Concern (2008) report identifies species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become listed under the Endangered Species Act as amended (16 U.S.C 1531 et seq.).

For information about Birds of Conservation Concern, go to http://www.fws.gov/migratorybirds/CurrentBirdIssues/Management/BCC.html.

Trust Resources List

Migratory birds of concern that may be affected by your project:

There are **13** birds on your Migratory birds of concern list. The Division of Migratory Bird Management is in the process of populating migratory bird data with an estimated completion time of Fall 2014; therefore, the list below may not include all the migratory birds of concern in your project area at this time. While this information is being populated, please contact the Field Office for information about migratory birds in your project area.

Species Name	Bird of Conservation Concern (BCC)	Species Profile	Seasonal Occurrence in Project Area
American bittern (*Botaurus lentiginosus*)	Yes	species info	Wintering
Bald eagle (*Haliaeetus leucocephalus*)	Yes	species info	Year-round
Black-billed Cuckoo (*Coccyzus erythropthalmus*)	Yes	species info	Breeding
cerulean warbler (*Dendroica cerulea*)	Yes	species info	Breeding
Golden-Winged Warbler (*Vermivora chrysoptera*)	Yes	species info	Breeding
Least Bittern (*Ixobrychus exilis*)	Yes	species info	Breeding
Marbled Godwit (*Limosa fedoa*)	Yes	species info	Wintering
Pied-billed Grebe (*Podilymbus podiceps*)	Yes	species info	Breeding
Purple Sandpiper (*Calidris maritima*)	Yes	species info	Wintering
Rusty Blackbird (*Euphagus carolinus*)	Yes	species info	Wintering
Short-billed Dowitcher (*Limnodromus griseus*)	Yes	species info	Wintering
Wood Thrush (*Hylocichla mustelina*)	Yes	species info	Breeding
Worm eating Warbler (*Helmitheros vermivorum*)	Yes	species info	Breeding

Trust Resources List

NWI Wetlands (USFWS National Wetlands Inventory).

The U.S. Fish and Wildlife Service is the principal Federal agency that provides information on the extent and status of wetlands in the U.S., via the National Wetlands Inventory Program (NWI). In addition to impacts to wetlands within your immediate project area, wetlands outside of your project area may need to be considered in any evaluation of project impacts, due to the hydrologic nature of wetlands (for example, project activities may affect local hydrology within, and outside of, your immediate project area). It may be helpful to refer to the USFWS National Wetland Inventory website. The designated FWS office can also assist you. Impacts to wetlands and other aquatic habitats from your project may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal Statutes. Project Proponents should discuss the relationship of these requirements to their project with the Regulatory Program of the appropriate U.S. Army Corps of Engineers District.

Data Limitations, Exclusions and Precautions

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery and/or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Exclusions - Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Precautions - Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the

advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

The following wetland types intersect your project area in one or more locations:

Wetland Types	NWI Classification Code	Total Acres
Freshwater Forested/Shrub Wetland	PFO1A	1.7732
Freshwater Pond	PUBHx	0.1999
Riverine	R2UBH	61.948

United States Department of the Interior
U.S. Fish & Wildlife Service
Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401
410/573 4575

Online Certification Letter

Today's date: September 22, 2014

Project:
The Maryland American Water Company
Bel Air Reservoir Feasibility Study
Bel Air, Harford County, Maryland

Dear Applicant for online certification:

Thank you for using the U.S. Fish and Wildlife Service (Service) Chesapeake Bay Field Office online project review process. By printing this letter in conjunction with your project review package, you are certifying that you have completed the online project review process for the referenced project in accordance with all instructions provided, using the best available information to reach your conclusions. This letter, and the enclosed project review package, completes the review of your project in accordance with the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (ESA).This letter also provides information for your project review under the National Environmental Policy Act of 1969 (P.L. 91-190, 42 U.S.C. 4321-4347, 83 Stat. 852), as amended. A copy of this letter and the project review package must be submitted to this office for this certification to be valid. This letter and the project review package will be maintained in our records.

Based on this information and in accordance with section 7 of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), we certify that except for occasional transient individuals, no federally proposed or listed endangered or threatened species are known to exist within the project area. Therefore, no Biological Assessment or further section 7 consultation with the U.S. Fish and Wildlife Service is required. Should project plans change, or if additional information on the distribution of listed or proposed species becomes available, this determination may be reconsidered.

This response relates only to federally protected threatened or endangered species under our jurisdiction. For additional information on threatened or endangered species in Maryland, you should contact the Maryland Wildlife and Heritage Division at (410) 260-8540. For information in Delaware you should contact the Delaware Natural Heritage and Endangered Species Program, at (302) 653-2880. For information in the District of Columbia, you should contact the National Park Service at (202) 535-1739.

The U.S. Fish and Wildlife Service also works with other Federal agencies and states to minimize loss of wetlands, reduce impacts to fish and migratory birds, including bald eagles, and restore habitat for wildlife. Information on these conservation issues and how development projects can avoid affecting these resources can be found on our website (www.fws.gov/chesapeakebay)

We appreciate the opportunity to provide information relative to fish and wildlife issues, and thank you for your interest in these resources. If you have any questions or need further assistance, please contact Chesapeake Bay Field Office Threatened and Endangered Species program at (410) 573-4527.

Sincerely,

Genevieve LaRouche
Field Supervisor

3.4

Maryland Historic Trust Coordination

MDP

Larry Hogan, Governor
Boyd Rutherford, Lt. Governor

David R. Craig, Secretary
Wendi W. Peters, Deputy Secretary

Maryland Department of Planning
Maryland Historical Trust

December 23, 2015

Mr. David Graff
Senior Environmental Scientist
Gannett Fleming, Inc.
P.O. Box 67100
Harrisburg, PA 17106-7100

Re: Bel Air Impoundment Project / Reservoir Feasibility Study
Harford County, Maryland

Dear Mr. Graff:

Thank you for your recent letter, dated November 18, 2015 and received by the Maryland Historical Trust (Trust) on November 20, 2015, regarding the above-referenced project. Your letter provided updates and additional information on the proposed project as requested in our prior letter dated October 20, 2014. Since the project may entail federal and state permitting through the Corps of Engineers and Maryland Department of the Environment, we are reviewing it for possible effects on historic and archeological resources, pursuant to Section 106 of the National Historic Preservation Act of 1966, and the Maryland Historical Trust Act of 1985. We offer the following comments.

Since our initial review of the undertaking, project plans have been further developed. The project area now encompasses a circa 82 acre parcel situated entirely on the east side of US 1. Therefore, the Edgely Grove farmstead (MIHP #HA-1081) is no longer within the area of potential effect for this undertaking. The southern portion of the current project area does contain remnant outbuildings associated with the Amos-Archer farmstead (MIHP #HA-1260). In 2008, the Trust determined that HA-1260 does not meet the criteria for eligibility in the National Register of Historic Places. Thus, the current project area does not contain any properties eligible for the National Register. While the parcel may contain archeological resources related to its former uses as a farmstead, the majority of the area slated for construction encompasses sloping terrain and does not incorporate the core area of the farmstead and its outbuilding. In our opinion, the project area is unlikely to contain National Register eligible archeological resources and archeological investigations are not warranted for this project.

For the reasons noted above, we concur that the undertaking will have no effect on historic properties, including archeological sites. Please include a copy of this letter with any permit/grant applications to federal or state agencies for this project, to document the results of consultation with our office.

For questions or further assistance, please contact or me at beth.cole@maryland.gov / 410-514-7631. Thank you for providing us this opportunity to comment.

Sincerely,

Beth Cole

Beth Cole
Administrator, Project Review and Compliance

EJC/201505180

Gannett Fleming
100 Years of Excellence Delivered As Promised

November 18, 2015

CERTIFIED MAIL NO. 7014 1200 0002 0474 0402
RETURN RECEIPT REQUESTED

Mr. Jonathan Sager, Preservation Officer
Maryland Historic Trust
100 Community Place
Crownsville, MD 21032

RE: Request for Maryland Historical Trust Review
Bel Air Impoundment Project
(Bel Air Reservoir Feasibility Study)
Town of Bel Air, Harford County Maryland

Dear Mr. Sager,

Gannett Fleming (GF) on behalf of Maryland American Water Company (MAWC) is continuing coordination efforts that began in August 2014. Gannett Fleming requested an initial project review from the Maryland Historic Trust (MHT) for the Bel Air Reservoir Feasibility Study. On October 20, 2014, MHT issued a letter that identified Edgely Grove, a farm located in western portion of the feasibility study's project area, as a local landmark and as listed in the Maryland Inventory of Historic Properties (MIHP) as HA-1081. The letter also requested more detailed project information to conduct a meaningful evaluation of the project area.

Since our initial coordination, the access road and culvert from Bel Air Road have been developed. Current site plans and limit of disturbance boundaries do not encroach on the Edgely Grove buildings. The temporary access to our project site is adjacent to the Edgely Grove barn. The project does not propose to disturb the existing barn or other associated structures.

More detailed project information is now available and we are requesting the project review be continued to support permitting. The following information has been enclosed to aid in your review of this project:

- Enclosure 1 – MHT Letter dated October 20, 2014
- Enclosure 2 – Project Description and Location Maps
- Enclosure 3 – Site Photographs
- Enclosure 4 – Conceptual Project Layout Plan

- Enclosure 5 – List of Federal and State Agency Permits and Authorizations

The official MHT decision will be included in project required permit applications and authorizations.

Please do not hesitate to call me at (717) 763-7212 x2073 if you have any questions regarding this request or the proposed project. We look forward to your prompt response to this letter.

Very truly yours,

David H. Graff, PWS, CSE, CWB
Senior Environmental Scientist
GANNETT FLEMING, INC.

Enclosures

cc: T. Nokovich, PE (MAWC)
S. Liskovich, PE (GF)
C. Beenenga, PE (GF)
File 059267

ENCLOSURE 1

MHT LETTER DATED
OCTOBER 20, 2014

MDP
Sustainable Attainable
Maryland Department of Planning
Maryland Historical Trust

October 20, 2014

Ms. Danielle Iuliucci
Gannett Fleming, Inc.
P.O. Box 67100
Harrisburg, PA 17106-7100

Re: Bel Air Reservoir Feasibility Study
Harford County, Maryland

Dear Ms. Iuliucci:

Thank you for your recent letter, dated August 27, 2014 and received by the Maryland Historical Trust (Trust) on September 2, 2014, requesting our review of the above-referenced project. According to your submittal, Gannett Fleming is examining the feasibility of creating an off-stream raw water storage reservoir to provide the Town of Bel Air with drinking water during dry periods. The study area encompasses a large parcel of land on either side of US 1 immediately south of Winter's Run. Since the project may require federal and state permitting through the U.S. Army Corps of Engineers and Maryland Department of the Environment, we are reviewing it for possible effects on historic and archeological resources, pursuant to Section 106 of the National Historic Preservation Act and Sections 5A-325 and 5A-326 of the Annotated Code of Maryland.

The western portion of the project area includes agricultural fields and other landscape features that are associated with a farm known as "Edgely Grove." Edgely Grove has not been formally evaluated to determine if it is eligible for listing in the National Register of Historic Places and therefore "historic" for the purpose of the laws mentioned above. However, the designation of the property as a local landmark and its inclusion in the Maryland Inventory of Historic Properties (MIHP) as number HA-1081 indicates that the property may be eligible and, depending on the expected impacts of the project, a formal evaluation of the property may be necessary.

The MIHP does not record any known archeological sites within or immediately adjacent to the study area. However, given the parcel's proximity to Winter's Run as well as documented historic occupation on the property and vicinity, the project area has the potential to contain archeological resources that have not yet been identified.

In order to make meaningful comments regarding the project's possible effects on cultural resources, we require further information regarding the proposed project. Specifically, please provide the following items when available:

- a detailed description of the proposed improvements (including the facility itself as well as any associated infrastructure, access, environmental mitigation activities, and any other related actions);
- conceptual layout and plans for the project; and

- a list of all possible federal and state agency involvement in the project (anticipated funds, permits, licenses).

Once we receive the information noted above, we will provide our comments and make recommendations on the need for cultural resources investigations.

We look forward to further consultation to successfully complete the historic preservation review of this project. For questions or further assistance, please contact Jonathan Sager (regarding historic buildings and landscapes) at jonathan.sager@maryland.gov / 410-514-7636 or Beth Cole (regarding archeology) at beth.cole@maryland.gov / 410-514-7631. Thank you for providing us this opportunity to comment.

Sincerely,

Jonathan Sager
Preservation Officer
Maryland Historical Trust

JES \ EJC
201404661

ENCLOSURE 2

PROJECT DESCRIPTION AND LOCATION MAPS

Project Description

Maryland American Water Company (MAWC) is proposing to construct an off-stream raw water storage reservoir to serve the Town of Bel Air, Maryland. The proposed project requires a raw water intake structure on Winters Run and associated pipeline crossings on Winters Run to connect the existing Winters Run Water Treatment Plant. Construction for this project is proposed in an upland field currently used as agricultural land. The connecting infrastructure between the impoundment and the plant will need to cross Winters Run and its floodplain.

The existing Bel Air water system is supplied primarily from the existing Winters Run Water Treatment Plant (2.0 MGD nominal capacity) that treats water from Winters Run. The Winters Run withdrawal is permitted by the Maryland Department of the Environment (MDE) at 1.4 MGD, annual average. The MAWC also has an agreement with Harford County for a 0.5 MGD supply through an existing metered interconnection.

When stream flow drops below the minimum pass-by flow stipulated by MDE, water cannot be withdrawn by the water treatment plant. During such times historically, the Harford County has allowed the MAWC system to take water in excess of the agreement amount to meet system demands. The County is now facing projected long-term supply shortfalls and has alerted MAWC that they can no longer commit to a supplemental supply. As a result, the MAWC identified and evaluated a number of options for a supplemental supply.

In working with Harford County and MDE to evaluate supply alternatives, the County identified a County-owned parcel adjacent to Winters Run, upstream of the Winters Run Water Treatment Plant that could potentially be used for construction of an off-stream storage reservoir. The reservoir would be purchased by MAWC and used to supply the WTP when withdrawal from the stream is restricted or prohibited. The reservoir would be refilled from the stream when flows are sufficient to meet both the supply needs and the refill rates.

Project Site Description

The project study area investigated was approximately 82.18 acres in size (Figures 1 and 2). The limit of disturbance is provided as a conceptual layout plan for your review and is concentrated in the agricultural field (Enclosure 4). Construction access will enter the site from Old Joppa Road through the agricultural field. Activities within the floodplain of Winters Run will consist of installation of the Reservoir outfall structure and the necessary water pipelines to connect the reservoir to the existing Winters Run Water Treatment Plant and intake.

Legend

▭ Project Study Area

— Streams

Figure 1
Project Location and Study Area Map

Bel Air Impoundment Project

MARYLAND AMERICAN WATER
Town of Bel Air, Harford County, Maryland

Feet
400 200 0 400

Gannett Fleming

N

Source: Aerial imagery basemapping provided by ESRI ArcGIS Online webservices.

Legend

□ Project Study Area

Figure 2
USGS Topographic Map
Bel Air, MD and Jarrettsville, MD Quads
Bel Air Impoundment Project
MARYLAND AMERICAN WATER
Town of Bel Air, Harford County, Maryland

Feet
2,000 1,000 0 2,000

N

Gannett Fleming

Source: USGS topographic basemapping provided by ESRI ArcGIS Online webservices.

ENCLOSURE 3

SITE PHOTOGRAPHS

Legend

Project Study Area

Streams

Enclosure 3
Photo Location and Orientation Map

Bel Air Impoundment Project

MARYLAND AMERICAN WATER
Town of Bel Air, Harford County, Maryland

Feet
400 200 0 400

Gannett Fleming

N

Source: Aerial imagery basemapping provided by ESRI ArcGIS Online webservices.

Photo 1 (09-29-2015)
View of the agricultural field looking southwest from the approximate reservoir location. New residential construction and the Edgely Grove Barn are visible in the distance.

Photo 2 (09-29-2015)
View of the agricultural field and reforestation planting area looking east.

Photo 3 (09-29-2015)
View of the agricultural field and approximate reservoir location looking south from floodplain forest tree line.

Photo 4 (09-29-2015)
View of the agricultural field and floodplain forest tree line looking east from the northwestern most corner of the agricultural field.

Photo 5 (10-19-2015)
View of Winters Run looking downstream from near the proposed floodplain and stream crossing. View is south.

Photo 6 (10-19-2015)
View of the downstream right bank of Winters Run at the approximate location of the proposed outfall structure and water pipeline crossing. View is west.

Photo 7 (10-19-2015)
View of the downstream left bank of Winters Run at the approximate water pipeline crossing. View is east.

Photo 8 (11-02-2015)
View of springhouse located downslope of the reforestation planting area and the wetland complex.

Photo 9 (09-30-2015)
Downstream view from the spring house. The watercourse drains into a palustrine emergent (PEM) wetland complex, then to an unnamed tributary to Winters Run. View is east.

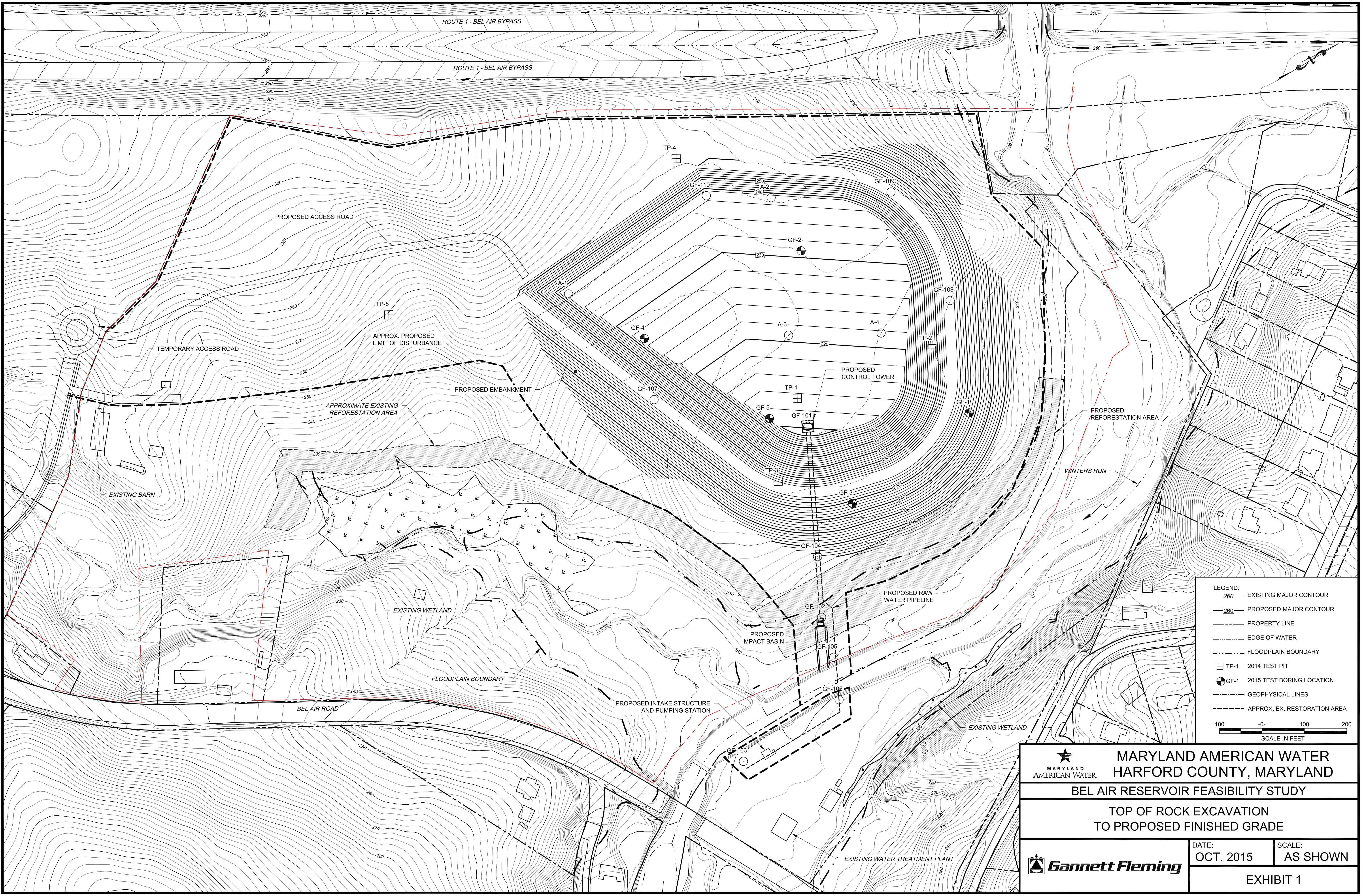
Photo 10 (08-23-2015)
View of improvements to Old Joppa Road near the Edgely Grove barn. View is southeast.

Photo 11 (08-23-2015)
View of the driveway and road improvements adjacent to the Edgely Grove barn. View is northeast.

Photo 12 (08-23-2015)
View of the agricultural field and proposed project area in the distance. View is north from the driveway in front of the Edgely Grove barn.

ENCLOSURE 4

CONCEPTUAL PROJECT LAYOUT PLAN



MARYLAND AMERICAN WATER

MARYLAND AMERICAN WATER
HARFORD COUNTY, MARYLAND

BEL AIR RESERVOIR FEASIBILITY STUDY

TOP OF ROCK EXCAVATION
TO PROPOSED FINISHED GRADE

Gannett Fleming

DATE: OCT. 2015

SCALE: AS SHOWN

EXHIBIT 1

S:\DIV-4\059267 - MAWC Reservoir Study\05 Working\CADD\Design Set\Site Access.dwg
Plot Date: 11/12/2015 3:07 PM, Plotted By: Trautman, Todd

ENCLOSURE 5

LIST OF FEDERAL AND STATE AGENCY PERMITS AND AUTHORIZATIONS

List of Federal and State Agency Permits and Authorizations

Permit/Authorization	Issuing Authority
Water Appropriations and Use Permit	Maryland Department of the Environment
Surface Water Discharge Permit	Maryland Department of the Environment
Joint Permit Application	Maryland Department of the Environment & U.S. Army Corp of Engineers
Forest Conservation	Harford County
Dam Safety Application	Maryland Department of the Environment
Stormwater Management Approval	Harford County
Grading/Sediment & Erosion Control Approval	Harford County
Building Permit	Harford County
Water and Sewerage Construction	Maryland Department of the Environment
National Pollution Discharge Elimination System (NPDES)/Notice of Intent (NOI)	Maryland Department of the Environment

7014 1200 0002 0474 0402

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Street, Apt. No.; or PO Box No. 100 Community Place
City, State, ZIP+4 Crownsville, MD 21032

PS Form 3800, August 2006 See Reverse for Instructions

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- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Mr. Jonathan Sager
Maryland Historic Trust
100 Community Place
Crownsville, MD 21032

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X Bonnie Baden ☒ Agent ☐ Addressee

B. Received by *(Printed Name)* Bonnie Baden

C. Date of Delivery 11/20/15

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☒ No

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4. Restricted Delivery? *(Extra Fee)* ☐ Yes

2. Article Number *(Transfer from service label)* 7014 1200 0002 0474 0402

PS Form **3811**, July 2013 Domestic Return Receipt