

Alternative Feasibility—Transporting Liquid Residual by Barge from Washington Aqueduct to Blue Plains on the Potomac River

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INTRODUCTION

Currently, liquid residual waste from the Washington Aqueduct Water Treatment Plant is discharged into the Potomac River. As it is necessary to discontinue this practice, the feasibility of transporting the liquid residual by barge via Georgetown Channel, an approximate distance of 9.7 nm (nautical miles) on the Potomac River from the Washington Aqueduct Water Treatment Plant to the Blue Plains Wastewater Treatment Plant has been investigated. The analysis of this method of handling the liquid residual required the review of a current NOAA navigational chart and the U.S. Coast Pilot for this portion of the Potomac River as well as discussions with various regulatory agencies and marine contractors regarding the operation. Specifically, personnel from the Corps of Engineers, Baltimore District, the Coast Guard 5th District Waterways Management Office, Norfolk Dredging Company, and Precon Marine Company were contacted. This report and associated drawings describe several key factors affecting the technical and economical feasibility of this operation. Those factors include determination of limiting water depths, horizontal and vertical bridge clearances, and bottom conditions along the route as well as adverse weather conditions and facility constraints at each end of the route that will certainly impact the viability of this operation.

LIQUID RESIDUAL TRANSPORT REQUIREMENT

The volume of liquid residual to transport was given at 885,000 gallons per day, occurring on the five work days of each week. This is a volume of 118,325 cf or 7.46 million lbs of residual (3,730 tons or 3,330 long tons) based on a weight density of 63 pcf. It was estimated that the loading and unloading from two or more barges at each end of the route could be accomplished at a rate of 9,000 gpm.

TRANSPORT BARGE OPERATIONAL SCENARIOS

Two barge operation scenarios were investigated. The first concept involved specifying a standard size barge for a two-barge operation that would be large enough to handle each day's volume of liquid residual, permitting loading and unloading operations at the up-river and down-river locations simultaneously. The second concept evaluated how many barges were required to handle the daily volume of residual liquid considering the navigational constraints of the Potomac River over a 6.5 nm stretch from the Francis Scott Key Bridge (referred to subsequently as Key Bridge) and Marbury Pt., the location of the Blue Plains plant.

Regardless of which operation is considered, navigation between the Washington Aqueduct and Key Bridge is not feasible for several reasons detailed below.

NAVIGATIONAL RESTRICTIONS AND WEATHER CONCERNS

Portions of NOAA Chart 12285 Potomac River have been compiled on Sheets 1 and 2 in Appendix A. These drawings identify key landmarks and bridges along the proposed barge route and describe local water depths, bottom conditions, and tide, current, and weather conditions as given in the U.S. Coast Pilot, Atlantic Coast. The primary navigational constraints on any barge transport operation are identified as follows:

- Arlington Memorial Bridge: clear width of 80 ft with vertical clearance of 30 ft;
- 14th St. Bridge Complex: clear width of 104 ft with vertical clearance of 18 ft above Mean High Water (MHW) resulting in maximum air draft of 14 to 16 ft for barge/pushboat operation;
- Obstructions (old stone bridge piers) at 10 feet below Mean Low Water (MLW) just north of Key Bridge;
- Strong currents, irregular water depths and bottom conditions, numerous rocks and shallows north of Key Bridge to Washington Aqueduct;
- Minimum water depth of 10 feet below MLW resulting in maximum water draft of 7 ft for barge/pushboat operation between Key Bridge and Marbury Pt.;
- Transit distance of 6.5 nm with maximum speed of 5 knots for 4.1 nm from Key Bridge to Hains Pt. and 8 knots for 2.4 nm from Hains Pt. to the Blue Plains plant at Marbury Pt.;
- One-way transit time estimated to range from 1.5 to 2.5 hours for small barge/push boat operation making only 2.5 knots against the current;
- Average ebb and flood currents of approx. 0.6 knots from Key Bridge to Hains Pt. and up to 1 knot from Hains Pt. to Marbury Pt.; and
- Transit above Key Bridge to the Washington Aqueduct facility, a distance of 3.2 nm, is unsafe for navigation for all but very limited recreational craft such as kayaks and canoes, conditions permitting, and emergency response vessels.

The barge operation between Key Bridge and Marbury Pt. may also be affected by seasonal adverse weather conditions including ice on the river in the coldest winter months, higher than normal water levels, flooding and swift currents caused by rapid snow and ice melt, heavy rains, or tropical storm activity along the Atlantic coast. The occurrence or passing of one or more of these events may temporarily halt a barge operation on the river for several days at a time. Refer to Sheet 1 for additional detailed information regarding navigation and weather concerns.

DUAL BARGE OPERATIONAL SCENARIO

It was estimated that a single hopper barge with dimensions of 260 ft long by 52 ft wide by 9 ft draft can hold 885,000 gallons of liquid residual corresponding to a load of 7.46 million lbs (3,730 tons or 3,330 long tons). However, the beam and draft of this size barge are considered unsafe for navigation based on limiting water depths and bridge clearances along the route. In addition, small pushboats capable of operating within the water depth and bridge clearance limitations identified will likely not have enough power to maneuver the barges effectively and safely. Moran Towing, the largest towing company on the east coast indicated that their tugs do not operate in this area of the Potomac River due to minimum air and water draft requirements of 45 and 15 feet, respectively.

MULTIPLE BARGE OPERATIONAL SCENARIO

It was estimated that at least three smaller single hopper barges with minimum dimensions of 150 ft long by 40 ft wide by 7 ft draft would be required to handle the daily load of liquid residual. Each barge could hold on the order of 295,000 gallons of liquid residual corresponding to a load of 2.48 million lbs (1,250 tons or 1,110 long tons). Based only on the information available on the NOAA Chart and contained in the U.S. Coast Pilot, the small barge dimensions would be considered safe for navigation under most conditions normally experienced on the Potomac River between Key Bridge and Marbury Pt. A marine contractor from Chesapeake, Virginia, has indicated that small pushboats, properly powered, are capable of operating within the water depth and bridge clearance limitations identified and would be able to safely and effectively maneuver the barges. Other considerations impacting the feasibility of the multiple barge operational scenario are as follows:

- Difficult coordination and scheduling and significant manpower and facility requirements for loading, unloading, and transit of three barges in each 24-hour period, five days per week;
- Locations in the river to safely stand-down one or more barges to allow opposing barge traffic to pass would have to be identified;
- Facilities at each end of the transit route would have to accommodate at least two barges for weekends and periods when environmental conditions make the river unnavigable for this operation; and
- Alternate means of handling or storing the liquid residual would be required during periods when environmental conditions make the river unnavigable for this operation.

Phonecon with Precon Marine, Chesapeake, Virginia (POC: Joe Anson, 757-545-4400)

Precon could support this operation with the small barges using small pushboats that have radar equipment set at low elevation and by folding down communications antennas. They can provide pushboats with 5 or 6 feet of draft to move barges. This company was involved in a similar operation on the Schuylkill River, Philadelphia, PA. Precon Marine has also worked in and around the 14th St. Bridge Complex, so they are familiar with this part of the Potomac River, bridge clearances, and water depth issues. Barge freeboard is not a problem under bridges. They identified water depths as the most significant limit to an efficient operation. Self-propelled barges are normally not well controlled and not used for an operation such as this. Self-propelled barges are designed more for operating in one local area for small personnel, equipment or fuel shuttle or transfer tasks.

Phonecon with Norfolk Dredging Co., Norfolk, VA (POC: Mike Haverty, 757-547-9391)

In his opinion, there is no question that establishing a pipeline/pumping operation for the 6.5 nm or longer route would be more cost effective than any sort of barge operation, particularly given the limitations with bridge clearances and navigational water depth. His company would have or could acquire small pushboats that would maneuver the smaller barges at speeds slower than 5 knots. He thinks the biggest limitation is the 18 ft clearance at the 14th St. Bridge Complex. He suggests that the labor associated with handling and re-handling the liquid residual will be costly compared to an operation strictly involving a pipeline/pumping operation because unloading/loading/transit requires an operator, a mate, an engineer, and a deckhand to secure barge at each end of route. Norfolk Dredging Co. (NDC) has pumped slurry 60,000 feet, nearly 10 nm, using pipeline and two booster pumps. NDC suggests that a this would be much more efficient and less costly than barging the liquid residual product. NDC further suggests calling GIW Co. in Georgia, (POC: Ben

Hagler, 706-738-0303), for information regarding the specification and engineering requirements for a pipeline/pumping operation.

Phonecon with U.S. Army Corps of Engineers, Baltimore District (POC: George Harrison, 410-962-6002)

The Corps performs maintenance dredging in the Anacostia and Washington Channels and directly across from Bowling Air Force Base, essentially from Hains Pt. to Marbury Pt. The Corps does not maintain the Georgetown Channel where the majority of the barge traffic route would be. Any required dredging within the Georgetown Channel would require extensive coordination between regulatory agencies for permitting approval. There would also likely be significant opposition by businesses and residential communities along both sides of the Georgetown Channel to this entire barge transport operation. He suggests calling local Coast Guard about navigation rules/restrictions north of Hains Pt.

Phonecon with U.S. Coast Guard Sector Baltimore, Waterways Management Branch (POC: Ron Houck, 410-576-2674)

The Coast Guard generally leaves control and response for this area of the Potomac River to the Washington D.C Marine Police. It was confirmed that only two aids to navigation are found marking the Georgetown Channel between Hains Pt. and the 14th St. Bridge Complex. The lack of navigation aids will require careful attention to pilotage of the barges for most of the route between Hains Pt. and Key Bridge and increases the risk of grounding the barges at various locations along the route.

Phonecon with Harbormaster, Washington D.C. Marine Police (POC: Lt. Al Durham, 202-727-4582)

The marine police respond to emergencies and security concerns on the Potomac River adjacent to the District. Because there is no maintenance dredging of Georgetown Channel nor aids to navigation, mariners are responsible to manage their vessels within the waterway using latest available navigation charts and ancillary navigation equipment onboard their vessels. The harbormaster emphasized that navigating above Key Bridge is very dangerous due to strong and variable currents and irregularity of water depths and bottom conditions including rocks, shoals, and numerous obstructions. The marine police respond to emergencies above Key Bridge via 24-ft Boston Whaler with draft of about 1 ft. Because of the treacherous conditions, regulations require that all boaters on the river above Key Bridge wear personal flotation devices (PFDs) at all times. The marine police would likely oppose any sort of barge operation above Key Bridge.

MAJOR OBSTACLES TO THE BARGE OPERATION

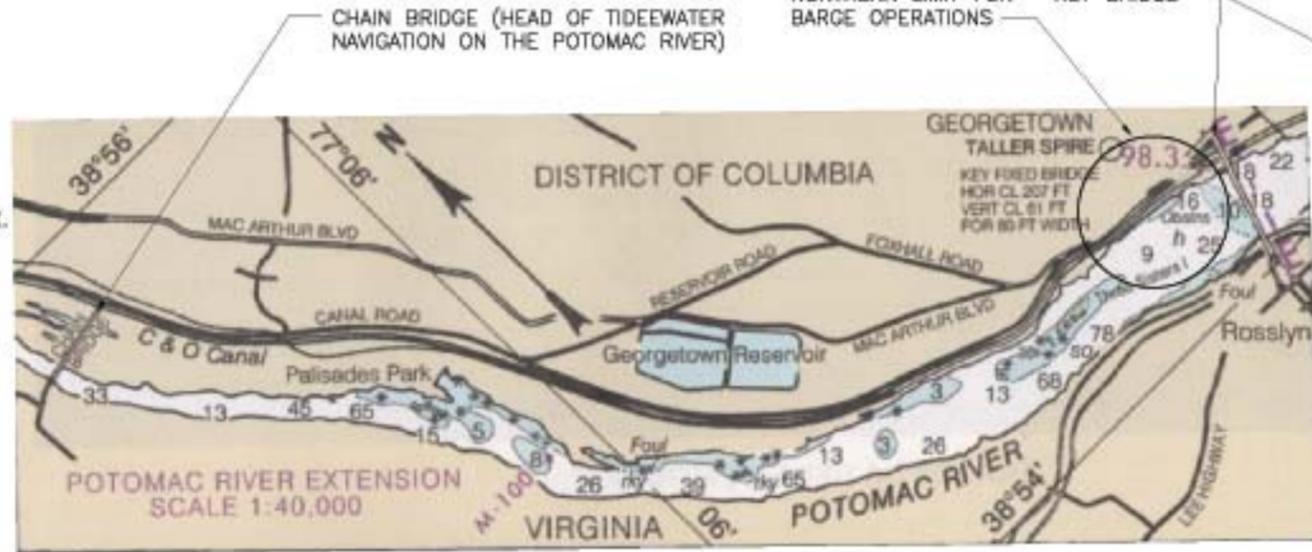
- No navigable access from Key Bridge to the Washington Aqueduct facility. Because operation is only feasible from Key Bridge to Marbury Pt., getting the liquid residual from the Washington Aqueduct facility to the Key Bridge or privately owned commercial wharves at Georgetown still must be addressed. Note: a privately owned commercial wharf at Georgetown, just north of Rock Creek, was known to be operational in 1980, receiving sand and gravel and stone shipped by barge.
- Potential for initial dredging and periodic maintenance dredging requirements to maintain navigable waterway for this type of operation.
- Periods when barge operations may be shut down due to weather requiring storage or other means of handling liquid residual.
- Whether the transport operation is owned and operated by the respective facilities or the service is contracted, the entire operation requires significant capital investment and

annual spending for facilities, equipment, and personnel at each end of the route and operations and maintenance of same.

APPENDIX A

Sheet 1	Potomac River – Hains Pt. to Chain Bridge
Sheet 2	Potomac River – Marbury Pt. to Hains Pt.

TO WASHINGTON
AQUEDUCT (APPROX.
0.5 NM ABOVE
CHAIN BRIDGE)

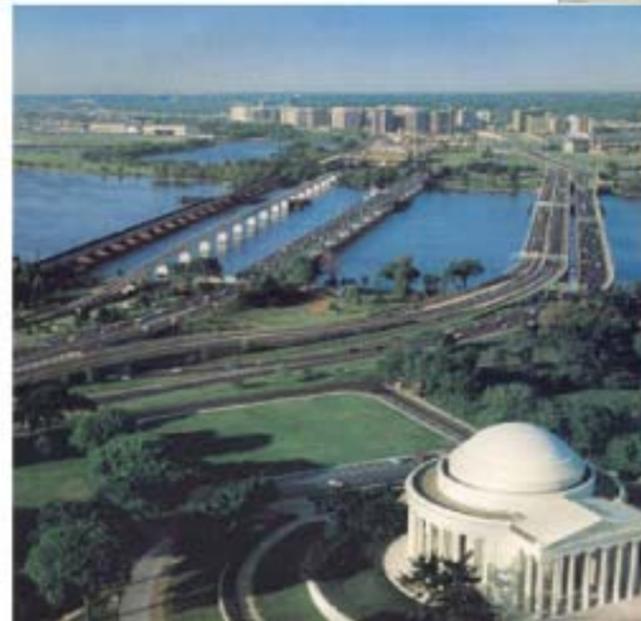


PLAN: CHAIN BRIDGE TO KEY BRIDGE

NOTES:

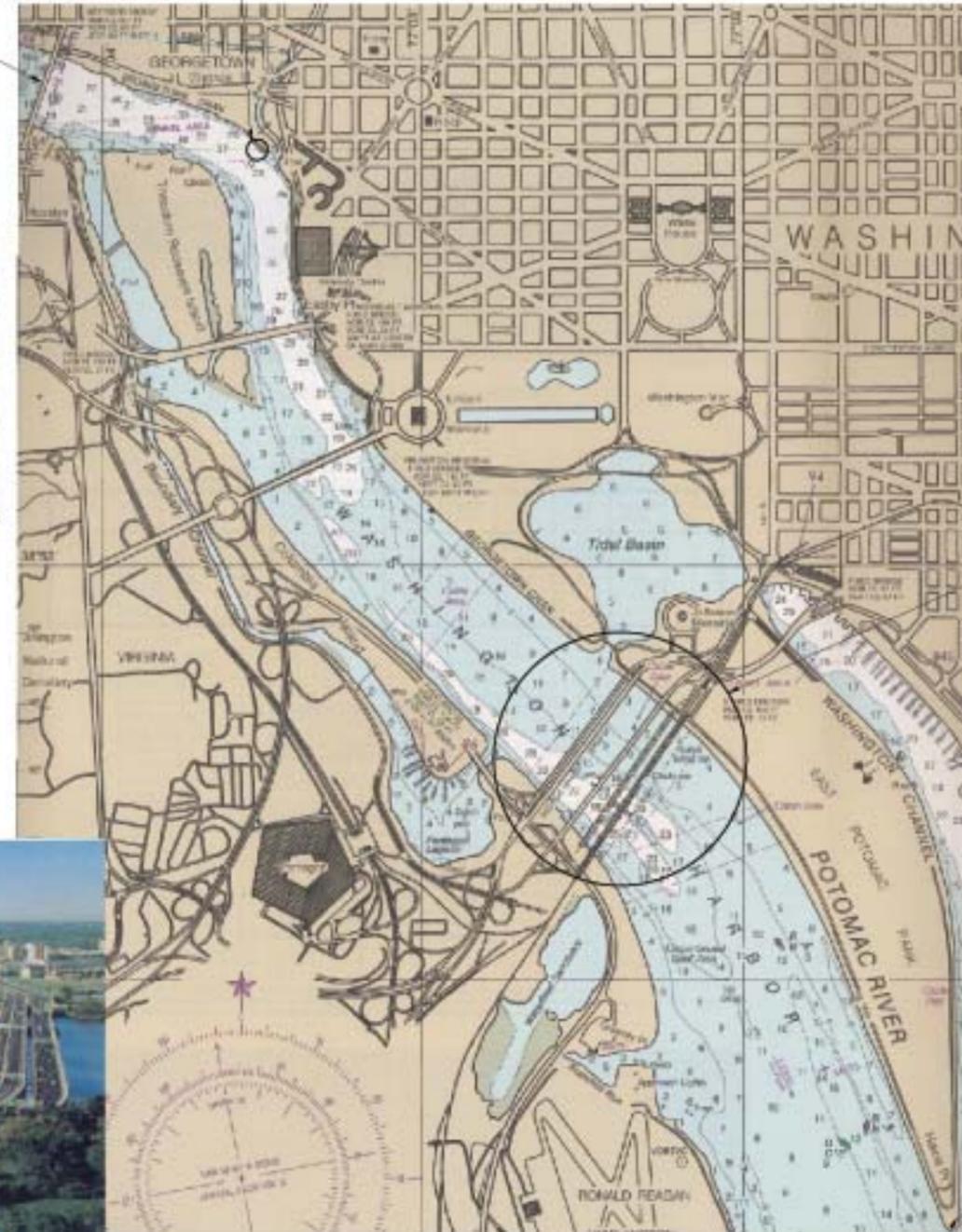
- REFERENCES:
 - A. UNITED STATES COAST PILOT, ATLANTIC COAST: SANDY HOOK TO CAPE HENRY, 2002 (35TH) EDITION, CHAPTER 12: CHESAPEAKE BAY, POTOMAC RIVER.
 - B. NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA) CHART 12285 POTOMAC RIVER, 35TH EDITION, JANUARY 2003.
- NAVIGATION REGULATIONS AND NOTES:
 - A. THE DISTRICT OF COLUMBIA HARBORMASTER, HARBOR PRECINCT OF THE METROPOLITAN POLICE DEPARTMENT, REGULATES THE OPERATION, NAVIGATION, MOORING, AND ANCHORING OF ALL VESSELS WITHIN THE WATERS OF THE DISTRICT OF COLUMBIA.
 - B. COMMERCIAL TUG SERVICE IS NOT AVAILABLE FOR HIRE AT ALEXANDRIA OR WASHINGTON D.C.
 - C. SPEED LIMIT IS 10 MPH (8.7 KNOTS) WHEN PASSING THE WHARF AREA OF ALEXANDRIA, EXCEPT FOR EMERGENCIES.
 - D. SPEED LIMIT IS 6 MPH (5.2 KNOTS) NORTH OF HAINS PT.
 - E. A PRIVATELY BUOYED CHANNEL WITH REPORTED DEPTHS OF APPROXIMATELY 12 FEET LEADS TO MARBURY POINT. THE BLUE PLAINS ADVANCED WASTEWATER TREATMENT PLANT IS JUST NORTH OF MARBURY POINT.
 - F. A GOVERNMENT PIER AT THE NAVAL RESEARCH LAB, ABOUT 0.4 MILES NORTH OF MARBURY POINT, EXTENDS OUT TO DEEP WATER WITH USE RESTRICTED TO GOVERNMENT VESSELS.
 - G. GEORGETOWN CHANNEL EXTENDS FROM HAINS PT. TO JUST ABOVE CHAIN BRIDGE. VESSEL TRAFFIC SHOULD NOT ATTEMPT TO PASS BETWEEN THEODORE ROOSEVELT ISLAND AND THE VIRGINIA SHORE.
 - H. DISTANCE FROM MARBURY POINT TO THE WASHINGTON AQUEDUCT JUST NORTH OF FRANCIS SCOTT KEY BRIDGE IS APPROXIMATELY 8.5 NAUTICAL MILES. STONE PIERS OF THE FORMER AQUEDUCT BRIDGE, JUST NORTH OF KEY BRIDGE, HAVE BEEN REMOVED TO A DEPTH OF 10 FEET EXCEPT FOR THE ONE NEAREST THE VIRGINIA SHORE, WHICH IS 9 FEET ABOVE WATER.
 - I. CONTROL WATER DEPTH AT MID-CHANNEL IN THE GEORGETOWN CHANNEL RANGES FROM 12 FEET BETWEEN HAINS PT. AND BUOY 4, THEN 11 FEET TO 0.4 MILES BELOW ARLINGTON MEMORIAL BRIDGE, THEN 14 FEET TO THE FRANCIS SCOTT KEY BRIDGE. ABOVE KEY BRIDGE, WATER DEPTHS VARY WITH SHOALS AND ROCKS. CONTROL DEPTHS ARE NOT GIVEN FOR THE CHANNEL BETWEEN MARBURY PT. AND HAINS PT. THE CHART SUGGESTS A MINIMUM WATER DEPTH OF 23 FEET FOR THIS AREA. THESE WATER DEPTHS ARE RELATIVE TO MEAN LOWER LOW WATER (MLLW).
 - J. ABOVE KEY BRIDGE AND BEYOND CHAIN BRIDGE TO THE WASHINGTON AQUEDUCT FACILITY, WATER DEPTHS AND BOTTOM CONDITIONS ARE HIGHLY IRREGULAR AND DANGEROUS AND NOT CONSIDERED SAFE FOR NAVIGATION. USE OF THIS PORTION OF THE RIVER IS LIMITED TO RECREATIONAL PURSUITS. CHAIN BRIDGE IS CONSIDERED THE HEAD OF TIDEWATER FOR NAVIGATION ON THE POTOMAC RIVER.
- TIDES, CURRENT, AND WEATHER:
 - A. THE MEAN TIDE RANGE IS 2.9 FEET FROM MEAN LOW WATER (MLW) TO MEAN HIGH WATER (MHW).
 - B. CURRENTS VARY AND USUALLY RUN IN THE DIRECTIONS OF THE CHANNELS. AVERAGE EBB AND FLOOD CURRENTS ARE ON THE ORDER OF 0.8 KNOTS FROM HAINS PT. TO KEY BRIDGE AND AS MUCH AS 1 KNOT SOUTH OF HAINS PT. TO MARBURY PT.
 - C. THE CHANNEL NORTH OF KEY BRIDGE TO CHAIN BRIDGE, APPROXIMATELY 2.7 MILES, HAS UNPREDICTABLE CURRENTS AND NUMEROUS SHOALS AND ROCKS. THIS PART OF THE CHANNEL IS USED BY SMALL CRAFT WITH LOCAL KNOWLEDGE; MARINERS ARE ADVISED TO EXERCISE CAUTION.
 - D. DURING COLD WINTERS, ICE MAY DEVELOP ON THE RIVER CAUSING FLOODING IN THE SPRING FROM ICE PIECES BREAKING UP. OCCASIONAL OVERFLOWS FROM THE POTOMAC RIVER RESULT FROM HEAVY RAIN OVER THE BASIN AND/OR MELTING SNOW. THERE IS LITTLE OR NO FLOOD CURRENT DURING HEAVY RAINS OR TIMES OF RAPID ICE/SNOW MELT.
 - E. THE POTOMAC RIVER CAN ALSO EXPERIENCE ABOVE NORMAL TIDES WITH FLOODING ASSOCIATED WITH HURRICANE OR SEVERE STORMS ALONG THE COAST.
- BRIDGE CLEARANCES:
 - A. GEORGETOWN CHANNEL IS CROSSED BY EIGHT BRIDGES BETWEEN HAINS PT. AND CHAIN BRIDGE. ALL BRIDGES HAVE FIXED SPANS OR DRAWSPANS FIXED IN THE CLOSED POSITION. THE TABLE BELOW PROVIDES THE VERTICAL AND HORIZONTAL BRIDGE STRUCTURE CLEARANCES.

POTOMAC RIVER FIXED BRIDGE	HORIZONTAL CLEARANCE (FEET)	VERTICAL CLEARANCE (FEET ABOVE MHW)
RAILROAD	104	18
WMATA METROVAL	104	18
14TH STREET NORTHBOUND	104	18
14TH STREET EXPRESS	104	18
14TH STREET SOUTHBOUND	104	18
ARLINGTON MEMORIAL	80	30
ROOSEVELT MEMORIAL	198	24
FRANCIS SCOTT KEY	80	61



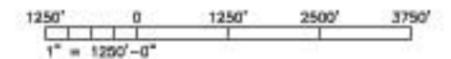
14TH ST. BRIDGE COMPLEX

PRIVATELY OWNED
COMMERCIAL WHARVES



PLAN: KEY BRIDGE TO HAINS PT.

14TH ST. BRIDGE
COMPLEX (SEE PHOTO
LOOKING SOUTH)



PRELIMINARY

NOT FOR
CONSTRUCTION

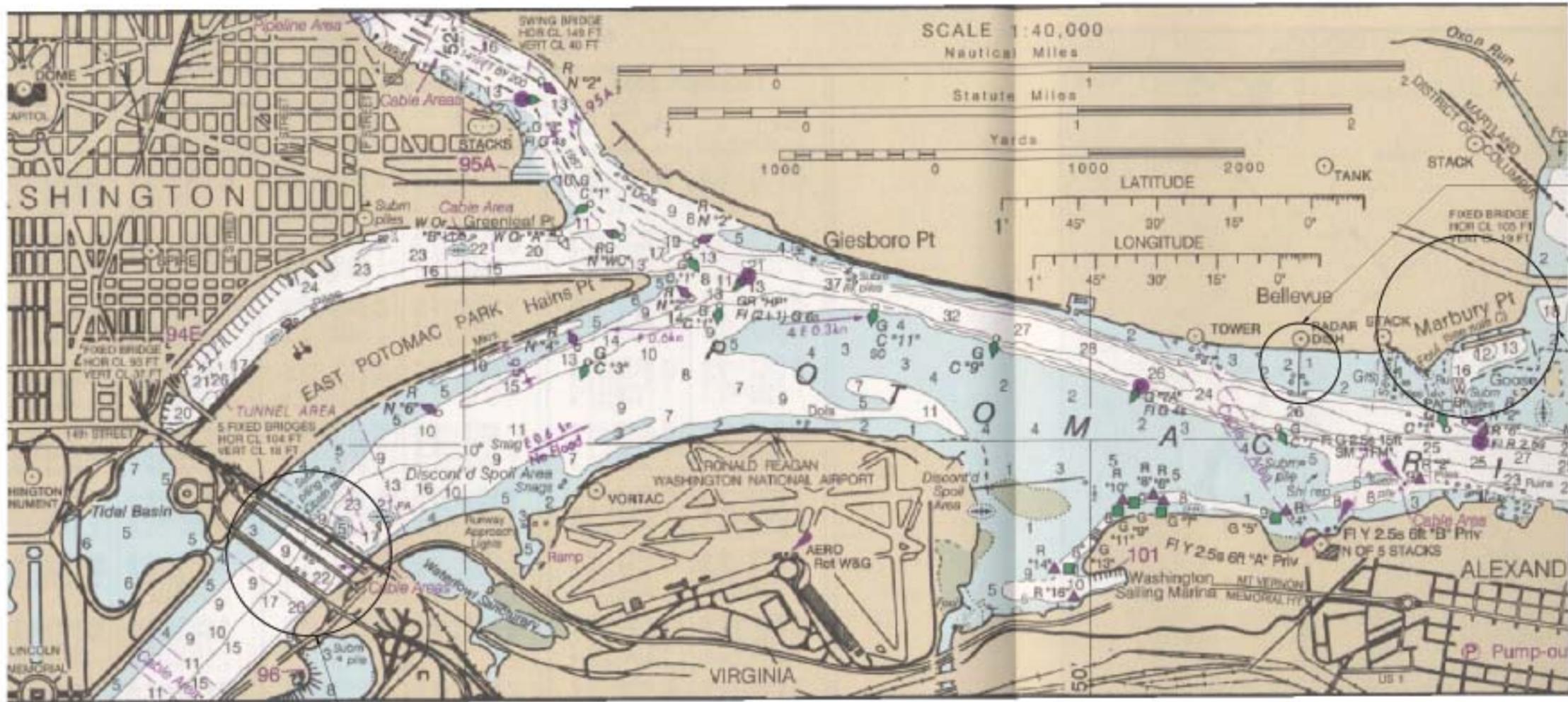
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CSK				
APVD				

VERIFY SCALE
BAR IS ONE INCH ON
ORIGINAL DRAWING.
IF NOT ONE INCH ON
THIS SHEET, ADJUST
SCALES ACCORDINGLY.

CH2MHILL
ONE HARVARD CIRCLE
WEST PALM BEACH, FLORIDA 33409
LB 0002934 AA C000696

POTOMAC RIVER - HAINS PT. TO CHAIN BRIDGE
RESIDUAL TRANSPORT BY BARGE ALTERNATIVE

SHEET 1
DWG 186970-1
DATE 03/10/04
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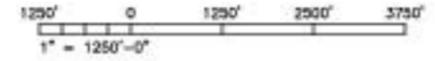


NRL PIER (GOVERNMENT USE)

BLUE PLAINS PLANT AND PRIVATE PIER WITH ACCESS CHANNEL

PLAN: MARBURY PT. TO HAINS PT.

14TH ST. BRIDGE COMPLEX



- NOTES:
- SEE SHEET 1 FOR NOTES APPLICABLE TO THE PORTION OF THE POTOMAC RIVER FROM MARBURY PT. TO HAINS PT.

CH2M HILL PROJECTS FOR CH2M HILL POTOMAC RIVER MARBURY PT. TO HAINS PT. 3/17/2004 4:49 pm By: arba Model Plot Scale: 1:40000 Xref: Dwg's

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POTOMAC RIVER - MARBURY PT. TO HAINS PT.
 RESIDUAL TRANSPORT BY BARGE ALTERNATIVE

SHEET	2
DWG	186970-2
DATE	03/10/04
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