U.S. Army
Corps of Engineers

New England District
Concord, Massachusetts

FINAL BASIS OF DESIGN DOCUMENT

1.5-Mile Reach Removal Action: Phase 1

DCN: GE-050302-AAZK

May 2002

Site-Specific Environmental Remediation Contract
General Electric (GE)/Housatonic River Project
Pittsfield, Massachusetts

Contract No. DACW33-00-D-0006
Task Order 0001

02P-0805

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SITE-SPECIFIC ENVIRONMENTAL REMEDIATION CONTRACT
GENERAL ELECTRIC (GE)/HOUSATONIC RIVER PROJECT
PITTSFIELD, MASSACHUSETTS

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LIST OF ACRONYMS

BBL	Blasland, Bouck and Lee, Inc.
BD	Basis of Design
CD	Consent Decree
CENAE	U.S. Army Corps of Engineers, New England District
cfs	cubic feet per second
cy	cubic yards
EE/CA	Engineering Evaluation/Cost Analysis
EM	Engineering Manual
EPA	U.S. Environmental Protection Agency
EREs	Environmental Restrictions and Easements
F/S	Farnham/Sandwash
FEMA	Federal Emergency Management Agency
FSP	Field Sampling Plan
ft	feet
GE	General Electric Company
gpm	gallons per minute
Hart Crowser	Hart Crowser, Inc.
HDPE	high-density polyethylene
HEC-RAS	USACE Hydrologic Engineering Center River Analysis System
L	length
LOE	limit of excavation
LPIII	Log Pearson III
MDEP	Massachusetts Department of Environmental Protection
mm	millimeters
NAAQS	National Ambient Air Quality Standards
NAPL	non-aqueous phase liquid
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NTU	nephelometric turbidity units
OPCAs	On-Plant Consolidation Areas
PCBs	polychlorinated biphenyls
pcf	per cubic foot
ppm	part per million
ppv	peak particle velocities

LIST OF ACRONYMS
(Continued)

psf	per square foot
RCRA	Resource Conservation and Recovery Act
S/S	Sacket/ Sykes
SPTs	standard penetration tests
TM	Technical Manual
TSCA	Toxic Substances Control Act
TSS	total suspended solids
TWA	time weighted average
UCL	upper confidence limit
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
Vavg	average velocity
Vss	side slope velocity
WESTON®	Roy F. Weston, Inc.
Woodlot	Woodlot Alternatives, Inc.
WSEL	water surface elevation
WTS	water treatment system
YB	Yokun Brook

1. INTRODUCTION

1.1 BACKGROUND

This Basis of Design document describes the technical approach developed by Roy F. Weston, Inc. (WESTON®) and its design subcontractors, Hart Crowser, Inc. (Hart Crowser) and Woodlot Alternatives, Inc. (Woodlot) to complete the design for Phase 1 of construction of the 1.5-Mile Reach Removal Action for the General Electric Company (GE)/Housatonic River Site in Pittsfield, Massachusetts. The Basis of Design document describes the engineering analysis and decision making conducted to develop the proposed construction activities, and provides appropriate background, context, and explanation for the final drawings and specifications intended to guide the Phase 1 construction activities. This Basis of Design also serves as a reference for future design activities to be conducted in support of the 1.5-Mile Reach Removal Action. This work is being performed under Contract No. DACW33-00-D-0006, Task Order No. 1, for the U.S. Army Corps of Engineers, New England District (CENAE).

The GE/Housatonic River Site consists of the GE facility, Silver Lake, Allendale School, former oxbows, the Upper ½-Mile Reach, the 1.5-Mile Reach, and the remainder of river between the confluence of the East and West Branches down to the Connecticut border and beyond. On May 26, 1998, due to high levels of polychlorinated biphenyls (PCBs) and the presence of other hazardous substances in the riverbanks and sediment, the U.S. Environmental Protection Agency (EPA) issued a Combined Action and Engineering Evaluation/Cost Analysis (EE/CA) Approval Memorandum documenting the need for a removal action in both the Upper ½-Mile Reach and the 1.5-Mile Reach (the "Combined Action and EE/CA Approval Memo") (EPA, 1998, 00-0158).

The Upper ½-Mile Reach consists of an approximate ½-mile section of the East Branch of the Housatonic River and its riverbanks from Newell Street to Lyman Street. The 1.5-Mile Reach consists of the following sections of the East Branch of the Housatonic River: Lyman Street to Elm Street (0.5 mile), Elm Street to Dawes Avenue (approximately 0.4 mile), and Dawes Avenue to the confluence of the East and West Branches (approximately 0.6 mile).

The Combined Action and EE/CA Approval Memo specified certain source control actions and riverbank and riverbed excavation in the Upper ½-Mile Reach. The Combined Action and EE/CA Approval Memo also authorized EPA to conduct an EE/CA to determine the appropriate removal action activities for the 1.5-Mile Reach.

Based on the Consent Decree (the CD) (United States of America, et al. vs. General Electric Company, 1999, 00-0388, 00-0389, 00-0390) lodged in Federal District Court on October 7, 1999, and entered in District Court in October 2000, GE is responsible for the cleanup of the GE facility, Silver Lake, Allendale School, the former oxbows, and the Upper ½-Mile Reach. The Consent Decree also specifies that the EPA and GE will jointly finance, and EPA will perform, the required removal action activities for the sediment and riverbanks in the 1.5-Mile Reach. GE is responsible for the conducting removal actions on the non-bank portions of the 1.5-Mile Reach. The Housatonic River downstream of the confluence of the East and West Branches (the "Rest of River") is subject to additional studies and there is a decision-making process spelled out in the Consent Decree with regard to potential remediation.

In the Combined Action and EE/CA Approval Memorandum, EPA demonstrated, through evaluation of human health and ecological risks posed by the Upper ½-Mile Reach and 1.5-Mile Reach, that actual or threatened releases of hazardous substances may present an imminent and substantial danger to public health or welfare or to the environment. High levels of PCBs were detected in surficial sediments, bank soils, and floodplain samples throughout the subject area. The concentrations of PCBs exceed cleanup levels considered protective of human health, including the 1 part per million (ppm) preliminary remediation goal for residential areas specified in EPA OSWER Directive 9355.4-01; EPA PCB Spill Cleanup Policy, 40 CFR Part 761 (10 ppm in residential areas—if capped, 25 ppm in industrial areas); and the Massachusetts Department of Environmental Protection (MDEP) default (Method 1) cleanup standard for residential and industrial soils of 2 ppm. In addition, the *Upper Reach – Housatonic River Ecological Risk Assessment* (WESTON, 1998, 99-0085) identified numerous exceedances of ambient water quality criteria and various sediment benchmarks and guidelines.

In accordance with EPA guidance (*Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA,* 1993, 99-0012), the Combined Action and EE/CA Approval Memorandum

required the completion of an EE/CA to evaluate remediation alternatives for the 1.5-Mile Reach. The Final EE/CA Report (WESTON, 2000, 07-0030), exclusive of the preferred alternative, was issued on February 11, 2000, to solicit public input. In July 2000, EPA completed the EE/CA and issued a proposed plan (WESTON, 07-0033) detailing EPA's preferred alternative. A formal public comment period was held from July 17, 2000, until the end of August 2000. Concurrent to the public comment period, EPA performed additional investigations in the 1.5-Mile Reach and summarized these results in an October 4, 2000 EE/CA Report Addendum (WESTON, 07-0058).

Based on the public comments, the EE/CA and the EE/CA Addendum, EPA issued an Action Memorandum for the 1.5-Mile Reach on November 21, 2000 (07-0036). The Action Memorandum stated that the removal action will consist of the excavation and disposal of approximately 95,000 cubic yards (cy) of contaminated bank soil and sediment. The excavated areas will be backfilled with clean material. Disposal will consist of the consolidation of 50,000 cy of contaminated soil and sediment at the GE On-Plant Consolidation Areas (OPCAs) with off-site disposal of the excess material.

1.2 REMOVAL ACTION OBJECTIVES

Based on EPA guidance, the following removal action objectives were established in the EE/CA and were incorporated into the November 21, 2000 Action Memorandum:

- Remove, treat, and/or manage PCB-contaminated river sediments to prevent human exposures exceeding risk-based levels by the dermal adsorption and incidental ingestion routes.
- Remove, treat, and/or manage PCB-contaminated river sediments to prevent ecological exposures exceeding risk-based levels.
- Remove, treat, and/or manage PCB-contaminated soils to prevent human exposures exceeding risk-based levels by the dermal adsorption and incidental ingestion routes.
- Remove, treat, and/or manage PCB-contaminated riverbank soils to prevent ecological exposures exceeding risk-based levels.
- Eliminate or mitigate existing riverbank soil and sediment sources of contamination to the 1.5-Mile Reach of the Housatonic River.

- Prevent recontamination of previously remediated areas and further contamination of other areas.
- Prevent the downstream migration of contaminated sediments and bank soils.
- Minimize long- and short-term impacts on wetland and floodplain areas.
- Enhance habitat (riparian and aquatic) in a manner consistent with the above objectives.

1.3 HABITAT RESTORATION OBJECTIVES

In addition, the EE/CA and November 21, 2000 Action Memorandum established the following habitat restoration objectives. These habitat restoration objectives are similar to those established by the natural resource trustees for Connecticut and Massachusetts, the U.S. Fish and Wildlife Service (USFWS), and the National Oceanic and Atmospheric Administration (NOAA) [the "Natural Resource Trustees"] for the Upper ½-Mile Reach.

- Implement the Removal Action for the 1.5-Mile Reach as approved by EPA.
- Perform the restoration, including the enhancement of the river sediment and bank habitat in accordance with the Consent Decree (00-0388), to increase the diversity and productivity of the biological community in this reach.
- Restore the riverbank to provide overlying cover, in accordance with the Consent Decree (00-0388), and to enhance the bank vegetation by reestablishing plantings using native species.
- Minimize the potential for erosion of residual PCB-containing bank soils and river sediments that would result in recontamination of river sediments or transport of PCBs, and which could impair the river restoration by adversely impacting the ecological receptors.

1.4 REPORT ORGANIZATION

Section 1, Introduction, presents an overview of the project background, removal action and habitat restoration objectives, and report organization. Section 2, Design Elements, describes the design criteria for and development of the design elements for Phase 1 of the 1.5-Mile Reach Removal Action to meet the project objectives outlined in the November 21, 2000 Action Memorandum and applicable sections of the EE/CA and EE/CA Addendum Reports. The following appendices are included in this report:

- Appendix A—Detailed Volume Calculations
- Appendix B—Hydrology Analysis Backup
- Appendix C—Hydraulics Analysis Backup
- Appendix D—Bed and Bank Protection Analysis Backup
- Appendix E—HEC-RAS Modeling Outputs
- Appendix F—Riverbank Armor Elevation Backup
- Appendix G—Summary Tables of Proposed Riverbank Grades and Stabilization Method
- Appendix H—Design Considerations of Bioengineering Methods
- Appendix I—Design Calculations for Wing Deflectors
- Appendix J—Boulder Stability Calculations
- Appendix K—Wing Deflector Scour Analyses
- Appendix L—Sheet Pile Design Calculations

2. DESIGN ELEMENTS

2.1 ANCILLARY OUT-OF-RIVER WORK

This section describes the underlying assumptions and major components of each of the main design elements for Phase 1 of the 1.5-Mile Reach Removal Action. Phase 1 of the Removal Action begins approximately 5 feet (ft) upstream of the Lyman Street Bridge and extends approximately 1400 ft downstream of the Lyman Street Bridge (see Figure 2-1).

2.1.1 Site Preparation

2.1.1.1 Utility Relocation

Both permanent and temporary relocations of utilities are required to complete Phase 1 of construction. Relocation and placement underground of electrical and phone lines is necessary on Lot I9-4-201 to obtain access to the riverbank, and relocation/replacement of existing transformers at the laundromat on Lot I8-23-6 is necessary to obtain the necessary power supply (480 Volt, 600 Amp) for the water treatment plant, which is to be sited on Lot I8-23-6. These electric power/telecommunications utility relocations/replacements will be conducted before the river-related construction begins.

In addition to the electrical/telecommunications utility relocations, temporary rerouting of certain outfalls will be necessary during construction, and permanent extension of the Silver Lake outfall will be completed as part of construction.

2.1.1.2 Site Grading

The grading design requirements for the access roads and staging areas at the site have been based on minimizing the disturbance and/or removal of existing soils. Access roads have been designed to be built on top of existing soils wherever possible. Staging areas have been designed in the same way, with additional measures (placement of liners) to be taken to maintain separation between existing soils and any construction related stockpiles. If cuts are necessary to maintain workable grades for truck traffic or other purposes, then material removed is to be

handled in accordance with project applicable or relevant and appropriate requirements (ARARs, Appendix C of the EE/CA), and final disposition of the material must be consistent with overall project objectives, including cleanup objectives for remediation areas of the properties adjacent to the 1.5-Mile Removal Action construction area or on the GE facility itself.

2.1.1.3 Drainage Swale Crossing and Retention Structure

To minimize the transport of contaminated sediments from the existing drainage swale on lots I8-23-6 and I9-5-1 to the Housatonic River (near Station 504+00), a pre-cast retention basin will be installed within the drainage swale. The drainage swale water will flow into the retention basin and exit through two 48-inch reinforced concrete pipes. This will allow additional settling of solids before runoff water flows through the pipes.

The flow will then discharge into the remediated portion of the drainage swale and discharge into the Housatonic River. Based on the area that the drainage swale drains and the known storm drain pipes entering the drainage swale area, flows within the swale are not anticipated to exceed the capacity of the two 48-inch pipes. Therefore, the retention structure and the two 48-inch reinforced concrete pipes are not expected to cause increased flooding of the adjacent areas.

To haul contaminated materials from the excavation cells along the south/east side of the river to the GE facility, this drainage swale will need to be crossed. The crossing will occur over the two 48-inch reinforced concrete pipes discussed above. A temporary earth embankment will be installed across the drainage ditch and the two 48-inch pipes at a location approximately 150 ft from the river. The crossing will be constructed of an earth embankment sloped on the sides at 2H:1V. Filter fabric and riprap will be placed on the slopes of the embankment to stabilize it. Drainage swale water will be conveyed through the two 48-inch reinforced concrete pipes running beneath the embankment. No significant modification of the drainage ditch cross-section is anticipated (except at the crossing and the retention structure). During high flow events, the Housatonic River elevation increases enough to affect the elevation and flow of water in the drainage ditch a considerable distance up the drainage ditch. Therefore, it is anticipated that as the floodwaters from the Housatonic River increase in elevation, they will flood the retention structure area. During very high flow events, floodwater from the river will likely pass around and over the embankment, which is located in the floodplain. However, the installation of the

this structure will have minimal, if any, impact on the amount of flooding during high flow events because of its small volume relative to the flood storage volume of the surrounding floodplain.

2.1.1.4 Restoration of Support Areas

Support areas will be restored in accordance with Consent Decree requirements and negotiations to be completed with the individual property owners. Typical restoration activities may include removal of fencing and gravel roadways/areas, pavement repair, installation, and eventual removal, of temporary erosion control measures, and loaming/seeding/revegetation. Repaving of paved areas on the GE property used for staging of contaminated materials is not anticipated.

2.2 SOIL AND SEDIMENT CHARACTERIZATION AND DISPOSAL

2.2.1 Site Characterization

In support of the EE/CA, an extensive program of site characterization was carried out to assess bank soil and riverbed sediment contamination in the 1.5-Mile Reach. The details and results of the EE/CA site investigation work are provided in Section 2 of the Final EE/CA and EE/CA Addendum. Since the completion of the EE/CA, and in support of the removal action design, additional bank soil and sediment sampling has been conducted in the area of the 1.5-Mile Reach between Lyman Street Bridge and Elm Street Bridge. Results of these additional sampling efforts are summarized in the following memoranda:

- Drainage Swale DS-1 Sampling Report, DCN GE-111400-AAEX, November 14, 2000 (WESTON, 07-0035).
- Top of Bank Sampling Report, DCN GE-051601-AAKY, May 16, 2001 (WESTON, 07-0059).
- Supplemental Sampling Report – Aggrading Bar and Additional Bank Samples, DCN GE-082701-AAQA, August 27, 2001 (WESTON, 07-0069).

Figure 2-2.1 is a stack bar map depicting the total PCB analysis results from samples obtained within the Phase 1 area of the 1.5-Mile Reach. These results are the data set used to develop the excavation areas and depths for Phase 1. These data were also used to classify material as Toxic

Substances Control Act (TSCA) and non-TSCA material as discussed later in this section. Figure 2-2.2 is the same stack bar map with the TSCA/non-TSCA designated areas and depths superimposed.

2.2.2 Criteria for Determining Extent of Excavation

The process for determining the extent of excavation of soil and sediments was begun by adopting removal action objectives prior to development of the EE/CA. These removal action objectives are described in the Final EE/CA and the November 2000 Action Memorandum and are provided in Section 1 of this document.

The cleanup criteria for total PCBs in bank soils in the 1.5-Mile Reach based on human and ecological exposure exceeding risk-based levels are documented in the November 21, 2000 Action Memorandum (EPA, 2000, 07-0036) and are as follows:

- Riverbank soils adjacent to recreational or commercial properties are classified as recreational use. The recreational use criteria will be 10 ppm in the top 12 inches and 10 ppm in the next 2 ft. In areas where there is a potential for future exposures that are inconsistent with recreational use (i.e., future residential use) or where exposures may occur at depths greater than 3 ft, Environmental Restrictions and Easements (EREs) will be obtained.
- Riverbanks on residential properties will be remediated to the residential criterion of 2 ppm to a depth of 3 ft and to an average of 10 ppm, with a not-to-exceed of 50 ppm, below 3 ft to a maximum of 15 ft or to the groundwater table, whichever is less.

Non-PCB hazardous substances, which are referred to as Appendix IX compounds, are also present in the 1.5-Mile Reach. The results of Appendix IX sampling are summarized in the EE/CA and EE/CA Addendum. The Consent Decree sets forth an agreed-upon procedure GE must follow for evaluating and removing Appendix IX contamination in soils. Since GE is responsible for cleanup actions beyond the banks in the 1.5-Mile Reach, for consistency, a similar approach was also applied for the 1.5-Mile Reach banks and sediments. Where Appendix IX contamination is not co-located with PCB contamination, the limits of the excavation will be extended to remove exceedances for the Appendix IX contaminants.

EPA set an action level (also referred to a cleanup goal) of 1 ppm for PCBs in sediment. The 1 ppm action level, coupled with the replacement of contaminated sediments with clean backfill, is

expected to result in PCB levels that are protective of human health and the environment. The November 21, 2000 Action Memorandum, with its attachments, further describe EPA's rationale for selecting the 1 ppm action level for sediments. The Action Memorandum also describes the process used to evaluate Appendix IX contamination in sediments. Sediment is defined as the material below the mean annual high-water line. Above the mean annual high-water line, the soils are defined as riverbank soils.

Based on the cleanup goals provided above, an overall process was developed during the completion of the EE/CA for evaluating the sampling data and determining the necessary excavation depths to meet the removal action objectives. Two distinct processes were developed for evaluating sediment and bank soil data, respectively; and for background purposes, these processes are described below. Tables referred to below are presented in the EE/CA Report, and a more detailed explanation of this process is found in the EE/CA.

2.2.2.1 Sediment Excavation Limits Determination from EE/CA

The limits of sediment excavation were established during development of the EE/CA on a subreach basis (see subreach map provided in EE/CA; the Phase 1 construction area includes Subreaches 3-8 and 3-9 from the EE/CA). The method used to determine the depth of excavation for sediments was a direct comparison of the 95% upper confidence limit (UCL) of the mean PCB concentration to the cleanup criterion. The cleanup goal (1 ppm) was compared to the calculated 95% UCL of the mean for each 1-ft depth interval for each subreach. In general, areas where the 95% UCL of the mean PCB concentration exceeded the cleanup level for the corresponding depth interval were determined to require excavation. The depth to which sediment removal is required in each subreach to meet the cleanup criterion is generally 2 to 3 ft, and is depicted in Figure 3.4-1 of the EE/CA. The volume of sediment impacted within each subreach is presented in Table 3.4-1 of the EE/CA. The 95% UCL of the mean PCB concentration for sediment below the proposed excavation depths is presented in Table 3.4-3 of the EE/CA in 1-ft depth intervals. The data presented in Table 3.4-3 of the EE/CA confirm that the proposed excavation depths are adequately protective. In addition, Appendix IX constituents exceeding applicable standards are co-located with areas already requiring excavation based on PCB results.

The supplemental sampling contained in the EE/CA Addendum indicated that additional sediment excavation was warranted in areas where aggrading bars are present. The EE/CA estimates that an additional 1834 cy of sediments will need to be excavated to meet the cleanup goals in aggrading bars.

For Phase 1 of the removal action, the EE/CA and EE/CA Addendum specify the following excavation depths:

- From station 500+00 to 508+00, the sediment excavation depth is 3 ft.
- From station 508+00 to 514+00, the sediment excavation depth is 2 ft.

2.2.2.2 Riverbank Soil Excavation Limits Determination from EE/CA

In the EE/CA, the limits of riverbank soils excavation were established using a 3-tiered approach. The logic for this approach is presented as a flow chart in Figure 3.4-2 of the EE/CA. Initially, a direct comparison of the 95% UCL of the mean PCB concentration to the cleanup criteria was conducted on a subreach basis. This initial tier of the analysis was conducted by comparing the 95% UCL of the mean PCB concentration for various depth intervals to the cleanup criteria (see Table 2.3-2 of EE/CA). Because the cleanup criteria vary based on land use (residential versus recreational), the data were compiled based on the land use within each subreach.

The second tier of analysis consisted of examining the riverbank soil data on a non-subreach basis to determine if there were areas within a subreach or crossing a subreach boundary that did not require removal. Table 3.4-4 of the EE/CA presents the results of this analysis. One additional area not requiring complete removal was identified as a result of this analysis.

The third tier of evaluating the riverbank soils data involved further analysis of the subreaches and depth intervals that have fewer than 25% of the samples exceeding the cleanup criteria (see Table 2.3-1 of the EE/CA).

In addition to the PCB data evaluation described above, the Appendix IX data were evaluated to determine if areas not slated for excavation based on PCB concentrations would require excavation for Appendix IX exceedances. Based on the evaluation, three subreaches (4-2 West Bank, 4-3 East Bank, and 4-5B East Bank) were identified where Appendix IX exceedances

were present in areas where excavation for PCB removal was not required. Due to the relatively sparse nature of Appendix IX data, an Appendix IX exceedance was conservatively assumed to require excavation for the full bank height for the subreach and to the depth where the exceedance was located, unless additional data points were present showing no Appendix IX exceedance for a given depth interval and bank area within that subreach.

Table 3.4-2 of the EE/CA provides a summary of the proposed excavation areas and associated depths to meet the PCB cleanup criteria for riverbank soils on a subreach basis. The locations of these areas and the depth of excavation in each area are shown in Figure 3.4-3 of the EE/CA. The volume of riverbank soil impacted within each subreach is presented in Table 3.4-1 of the EE/CA. The data presented in Tables 2.3-2, 3.4-4, and 3.4-5 of the EE/CA demonstrate that in all recreational bank areas, soil PCB concentrations will meet the bank cleanup goal (10 ppm for 0 to 3 ft).

Subsequent to the completion of the Final EE/CA in February 2000, EPA modified the cleanup level for PCBs in residential properties. The modification included a PCB cleanup level of an average of 10 ppm, with a not-to-exceed of 50 ppm, for depths from 3 ft to a maximum of 15 ft or to the groundwater table, whichever is less. The July 2000 preferred alternative and the EE/CA Addendum both summarize the increase in excavation volumes attributable to the revised residential cleanup level. This resulted in an increase of 3,740 cubic yards of material, which in addition to the 46,507 cy given in Appendix O of the Draft Final EE/CA (February 2000) brought the total estimated volume of riverbank soils to be excavated to 50,247 cy. This is the volume specified in the EE/CA Addendum and the Action Memorandum.

For Phase 1 of the Removal Action, the EE/CA and EE/CA Addendum specify the following excavation depths:

- South (east) bank: From station 500+00 to 503+00, no excavation (bank excavation performed by GE pursuant to residential fill program). From station 503+00 to 514+00, 3 ft of excavation from the toe of the slope all the way to the top of the bank.
- North (west) bank: From station 500+00 to 514+00, 3 ft of excavation from the toe of the slope all the way to the top of the bank.

2.2.2.3 Delineation of the Top of the Bank or Limit of Excavation

The Consent Decree states that GE is required to perform removal action on non-bank portions of the 1.5-Mile Reach and that the riverbanks will be included in the 1.5-Mile Reach. The EPA demarcated, in the field with a survey flag, where they believed the top of the bank was located. On November 30, 2000, representatives of GE and EPA walked both sides of the riverbank from Lyman Street and Elm Street to inspect the proposed top of bank, or the limit of excavation line. GE's representative agreed with the proposed limit of excavation line. Subsequent to this site walk, WESTON surveyed the limit of excavation line, and this was the basis for the limits shown in the final plans and specifications.

2.2.2.4 Revised Excavation Limits Criteria for the Phase 1 Design

As part of design development for Phase 1, the limits of excavation of bank soil and sediment were modified from those presented in the EE/CA and EE/CA Addendum. Slight modifications were also made to the limit of excavation line agreed upon by EPA and GE.

These Phase 1 excavation limits were revised as follows:

- Sediment volume includes additional sediment to excavate to 4 ft in aggrading bar locations at approximately Station 509+00 to 510+00. This is based on samples collected in May 2001 from two aggrading bar locations. These results are summarized in a report entitled, Supplemental Sampling Report, Aggrading Bar and Additional Bank Samples (WESTON, 2001, 07-0069). The November 21, 2000 Action Memorandum (page 27) states that if additional aggrading bars are identified during the implementation of the removal action, then additional excavation in these areas may be performed.

- A slight reduction in the top of bank limit of excavation on the north (west) bank between Stations 512+00 and 514+00. The limit of excavation is now aligned closely with the 980-ft contour as opposed to the limit of excavation line. EPA determined that there was insufficient sampling data between the top-of-bank samples in the EE/CA and the actual top of bank/limit of excavation in this area. Two additional rounds of sampling were performed. The first round of sampling was conducted at approximately the 980-ft contour. The results of this sampling indicated the PCB cleanup levels were met for all depths at this contour. These data are summarized in a report entitled Top of Bank Sampling Report (WESTON, 2001, 07-0059). Additional sampling was performed in May 2001 to see if the excavation limit could be lowered to the 977-ft contour (results are summarized in a report entitled *Supplemental Sampling Report – Aggrading Bar and Additional Bank Samples*, 27 August 2001,

[WESTON, 07-0069]). The results of this sampling indicated that cleanup levels were not met; therefore, the excavation limit was set at approximately the 980-ft contour.

- Slight movement of the limit of excavation up the bank in some areas, up to a maximum of 9.3 ft (laterally), to allow for adequately stable restored slopes. See Sections 2.9.1.3 and 2.9.1.4 and Appendix G.

- Additional sediment and soil excavation volume from within drainage swale DS-1 (i.e., the drainage swale located on lot I8-23-6). Specifically, based on recent data collection, excavation to depths of 2 to 3 ft is planned on the DS-1 banks and in the channel for a distance of 150 ft from the confluence of DS-1 with the river (see final drawings for details). The sampling data and the rationale for the proposed excavation depths are included in the following reports: Drainage Swale DS-1 Sampling Report (WESTON, 2000) and Top of Bank Sampling Report (WESTON, 2001).

- Delineation of a configuration for the excavation in the vicinity of the Silver Lake Outfall. In this area (the cove-like area around the outfall), sediment is to be excavated to a depth of 3 ft, and bank soils are to be excavated to an extent to allow 3 ft of clean cover after backfilling in the area where the outfall is to be extended and filling of the area around the outfall extension occurs. Delineation details of the excavation and backfilling configuration around the outfall extension are provided in the final design submittal.

The changes in excavation areas and depths described above are represented in the excavation area drawings included in the final design submittal (WESTON, 2001, 07-0073).

For Phase 1, EPA determined that all excavated soil and sediment would be consolidated in the GE OPCAs. This decision was made to streamline the Phase 1 construction process by allowing a simpler construction traffic pattern, with less travel of construction vehicles on public roads and less consequential disruption of local residents.

2.2.2.5 Baseline River Survey Elevations

The baseline survey elevations to be used for the removal action will be the elevations determined by the U.S. Army Corps of Engineers (USACE) survey conducted in 1998, verified and supplemented by a riverbed survey conducted during August 2001 by WESTON. The 1998 USACE survey was conducted along transects located at 50-ft intervals. Typically, three to five survey points were established on each bank and in the river channel during this survey. The 2001 survey conducted by WESTON and its subcontractors supplemented the original 1998 USACE survey by establishing a grid of points in the river channel on a general 25-ft spacing.

Additional points were obtained during the 2001 survey for localized bathymetric features such as pools. Each transect across the river had at a minimum a point at each bank, one in the center of the river, and two in between the center and the bank. The 2001 survey extended up the bank a sufficient distance to define lower bank topography.

Using the original 1998 USACE survey data, supplemented by the 2001 survey data, as the baseline elevations allows for the best temporal alignment between the topography/bathymetry and the EE/CA sample analysis data used to determine excavation limits. The 1998 riverbed survey data provides the bathymetric elevations that were used in the plans and specifications for determining the bottom of the proposed excavation for Phase 1. Because the 1998 data consisted solely of survey points located at the centerline of the river approximately every 50 ft, additional survey data were needed to determine if changes in bathymetry occurred between 1998 and the time at which remediation activities were to occur in a given excavation cell. Based on observations of the Upper ½-Mile Reach, natural changes in the river bathymetry occurring over time, combined with bathymetric changes caused by active remediation, could significantly alter the river channel from its 1998 conditions. Therefore, an additional bathymetric survey was conducted during low flow conditions in 2001. The survey consisted of transects every 25 ft with additional survey points being taking for localized features such as pools. This survey was extended up the lower bank to gather additional information on the configuration for the toe of slope. In addition, a subsequent survey was performed in 2001 at the same centerline riverbed locations that were surveyed in 1998. This information will be used to estimate the changes in bathymetry from 1998 to 2001.

During construction, each excavation cell will be surveyed after dewatering and prior to excavation. If the surveyed elevations in a cell at the time of construction vary from those provided by the 1998/2001 survey data, the depth of excavation will be correspondingly increased or decreased, so that the elevation of the bottom of the excavation will correspond to that specified in the final design drawings.

2.2.2.6 TSCA/Non-TSCA Delineation for Purposes of On-Site Consolidation

Materials not regulated under the Toxic Substances Control Act (TSCA) or classified as hazardous waste under Resource Conservation and Recovery Act (RCRA) regulations may be

placed in the former Hill 78 landfill OPCA. The Building 71 OPCA can receive both TSCA- and RCRA-regulated remediation wastes. Full or partially filled drums, intact capacitors, or related equipment that could potentially contain PCBs, liquids, or free product cannot be placed in the Building 71 OPCA or the Hill 78 OPCA and, if excavated, will be sent to an off-site treatment/disposal facility. Based on the Consent Decree, GE has agreed to reserve a total capacity of 50,000 cy of material for the 1.5-Mile Reach Removal Action in the OPCAs. For purposes of on-site consolidation, existing soil and sediment PCB data for Phase 1 of the 1.5-Mile Reach were evaluated to allow designation for consolidation in either the Building 71 OPCA or the Hill 78 OPCA. This evaluation process is described below.

The primary criterion for assigning material between the two OPCAs is whether the average PCB concentration is above or below 50 ppm. Material with average PCB concentrations above 50 ppm is designated for disposal at the Building 71 OPCA, and material with average concentrations below 50 ppm PCBs is designated for disposal at the Hill 78 OPCA. In the evaluation made for Phase 1, PCB analytical results were generally averaged at each sample location, using data down to the proposed depth of excavation. However, in certain cases where anomalously high concentrations were observed at a discrete sample depth, such as at the surface, these data were evaluated separately and not averaged with the remainder of the data at that location. The area represented by each average PCB concentration was then designated as TSCA or non-TSCA. The area was generally defined as a rectangle centered upon the sample location and extending to the mid-point to adjacent sample locations. The designations for on-site consolidation, referred to as TSCA (Building 71) and non-TSCA (Hill 78), are shown on drawings 9 and 10 of the final design submittal for Phase 1.

TCLP sampling results obtained during the EE/CA did not indicate that any soil or sediment within Phase 1 would be classified as RCRA hazardous. As discussed in Section 2.3.7 of the EE/CA report, 28 samples were collected and analyzed for TCLP. Of the samples, only one sample failed TCLP for lead. This sample is located at Transect 172 and is not located within Phase 1. Based on this information, it has been determined that no RCRA wastes are present in the Phase 1 area.

Although the disposal location of the majority of the material generated in Phase 1 will be based on existing data, there may be a need to collect additional data to properly characterize certain material. The same rationale will apply to any material sampled during Phase 1 of the removal action. Material with average PCB concentrations greater than 50 ppm will be disposed of at the Building 71 OPCA, and material with average concentrations less than 50 ppm will be disposed of at the Hill 78 OPCA.

2.2.2.7 Criteria for Wood and Debris Handling

Trees and brush that have not come in contact with the ground surface or the river will be chipped into box trailers and hauled for disposal at an approved off-site disposal facility. Some of the chips may be used as mulch on-site as part of site restoration activities. Chips shall not be used as mulch at off-site locations.

Logs, stumps, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations that have come into contact with the ground surface will be stockpiled in the designated stump stockpile areas, sliced or chipped to a maximum 6-inch size, and disposed of at the GE OPCA.

Concrete and small quantities of metal debris generated during the clearing and grubbing and excavation activities will be stockpiled, crushed, sampled for PCBs and Appendix IX compounds, and disposed in the GE OPCAs based on classification as TSCA or non-TSCA regulated. If significant quantities of metal debris are generated, the debris will be staged and decontaminated for off-site disposal as scrap.

2.3 MONITORING ACTIVITIES

Monitoring is required to determine potential environmental impacts from construction activities on the local population, nearby structures, and the river, and to comply with project ARARs. Required monitoring activities are specified in Specification Section 01410 in the final design submittal. Brief descriptions of the monitoring activities to be conducted during construction are presented in the following subsections.

2.3.1 Air

Air monitoring requirements are based on the need to address potential risks posed by exposure to airborne PCBs in areas adjacent to the construction activities. The requirements for air monitoring include daily particulate matter - 10 microns or less (PM_{10}) monitoring of ambient air for particulates, and monthly ambient air sampling for PCBs. The means and methods for conducting this monitoring are described in Specification Section 01410. Ambient air monitoring during construction will be conducted at a number of locations around and near the construction area while construction activities are occurring. The exact number and location of the monitoring points will vary as construction moves down the river but will typically include two locations on each side of the river and one background location. Sampling locations will be placed at the work perimeter.

The following concentrations of PCBs and particulates in ambient air are to be used as notification/action levels:

PCBs	Notification Level [time weighted average (TWA)] – 0.05 $\mu g/m^3$ (24 hr) Action Level (TWA) – 0.1 $\mu g/m^3$ (24 hr)
Particulates (PM_{10})	Notification Level (TWA) – 120 $\mu g/m^3$ (10 hr) Action Level (TWA) – 150 $\mu g/m^3$ (10 hr)

The PM_{10} notification levels are slightly more conservative than the National Ambient Air Quality Standards (NAAQS) for PM_{10} to allow for notification to the Government before action levels are exceeded. If action levels are exceeded for either PM_{10} or PCBs, the Government will be notified immediately, and an evaluation of construction activities will be conducted to determine potential corrective measures.

2.3.2 Water

Water column monitoring will be conducted at four locations on the river during construction. Details of the water column monitoring program are provided in Specification Section 01410 and the Monitoring Plan. The following table summarizes the water column monitoring plan:

Water Column Monitoring Program Summary

Location	PCBs (total and dissolved)	TSS	Temperature	Turbidity	Stage
Newell	Monthly + 5 events	Monthly + 5 events	Monthly + 5 events		Twice Monthly + 5 events
Lyman	Twice Monthly + 5 events	Twice Monthly + 5 events	Twice Monthly + 5 events	Daily	
Elm				Daily	
Pomeroy	Twice Monthly + 5 events	Twice Monthly + 5 events	Twice Monthly + 5 events		Twice Monthly + 5 events

In addition, monitoring will be performed at the Newell Street, Lyman Street, and Pomeroy Avenue monitoring stations for total and dissolved PCBs and TSS during approximately five specific events. For example, monitoring will be performed during the following: a high flow event, an excavation of non-aqueous phase liquid (NAPL) impacted sediments, sheet pile installation, sheet pile removal, etc. Stage measurements will also be taken during each of the specific events.

Water column monitoring will be conducted in accordance with the Project Field Sampling Plan (FSP) (WESTON, 2000, 00-0476).

The following action levels will be used for PCBs and turbidity in the water column:

- Total PCBs: Downstream (Pomeroy Avenue) ≥ Upstream (Lyman Street) + 5 µg/L
- Turbidity: Downstream (Elm Street) ≥ Upstream (Lyman Street) + 50 nephelometric turbidity units (NTU)

Readings indicating exceedances of these limits will be reported immediately to EPA, and an evaluation of construction activities will be conducted to determine potential corrective measures.

This water column monitoring protocol is based on recommendations made by the Peer Review Panel empanelled to review the Modeling Framework Document generated by the EPA Rest of River project team. If GE terminates or modifies its current monitoring program for the Rest of

River program, then EPA may supplement its monitoring activities to address concerns raised by the Peer Review Panel.

2.3.3 Vibration

Vibration monitoring will be conducted in accordance with Specification Section 01410. Vibration monitoring will be conducted at one location: Lyman Street Bridge. Vibration monitoring will commence when GE's removal action activities reach within 200 ft of Lyman Street Bridge, and will continue until the 1.5-mile construction activities progress to a point more than 200 ft downstream of Lyman Street Bridge.

The vibration monitoring device(s) will be installed at the Lyman Street Bridge to monitor the peak particle velocities (PPV) of ground vibration due to the sheet pile installation and extraction work being conducted by GE. The monitoring device will be capable of continuous monitoring of PPV during sheet pile installation/extraction. Based on the evaluation of a weekly data download, if the monitored PPV are shown to have exceeded 2 inches/second at any time, EPA/CENAE will be notified immediately.

2.3.4 Settlement

Settlement monitoring will be performed in accordance with Specification Section 01410. Settlement monitoring will involve surveying the elevations of certain structures near construction activities both before construction work starts and after construction work is completed. The two surveys will be compared, along with evaluation of other monitoring data and conditions, to determine potential impacts to structures that have resulted from the construction work.

Three survey points shall be established on each of the following structures:

- Building A: 10 Lyman Street
- Building B: 55 Root Place
- Building F: 103 Elm Street, Elm Street Laundromat
- Building G: 14 Hathaway Street, Residence and In-Ground Pool
- Lyman Street Bridge

2.3.5 Conditions Monitoring (Videotaping)

Conditions monitoring will be conducted prior to construction and after construction is completed, in accordance with the requirements of Specification Section 01410. The conditions monitoring survey will involve videotaping foundations, structures, windows, doors, and walls to document evidence of warping, cracking, or other types of failure.

The following buildings/structures are to be included for conditions monitoring surveys:

- Building A: 10 Lyman Street
- Building B: 55 Root Place
- Building F: 103 Elm Street, Elm Street Laundromat
- Building G: 14 Hathaway Street, Residence and In-Ground Pool
- Lyman Street Bridge

In addition, videotaping will be performed on the east and west banks of the Housatonic River from the Lyman Street Bridge to the Elm Street Bridge.

2.4 WATER TREATMENT AND CONVEYANCE

2.4.1 Cell Dewatering

For cell dewatering an approach similar to that used in the Upper 1/2-Mile Removal Action will be used. A series of small pumps will be used to dewater specific areas within the containment cells, pumping seepage to larger sumps/pumps. The larger pumps will feed the conveyance lines that deliver water to the treatment system. A pumping capacity of approximately 400 gallons per minute (gpm) is estimated for the dewatering system.

In the event the pumping capacity is exceeded, “t” and “x” fittings will be installed at approximately 100-ft intervals along the centerline sheet pile walls to accept intermediate cross-walls, shortening the containment cells and decreasing their surface area. This will result in a decreased volume of seepage to be removed from the containment cells.

2.4.2 Water Conveyance

Water pumped from the active excavation cell will be conveyed by high-density polyethylene (HDPE) or other suitable piping starting at the discharge line from the main dewatering pump and ending at the water treatment system storage tank. Based on an anticipated flow rate of 400 gpm, the distances to be pumped, and the elevation change, a 6-inch HDPE pipe is anticipated. The pipe will be installed along the inside of the south (east) access road between the top of bank and roadway footprint. It is anticipated that heavy equipment will have to work around and over the pipe. A 12-inch steel sleeve will be installed beneath the access road to allow the HDPE pipe to cross beneath the roadway at the treatment plant. As the cell excavation progresses, the HDPE pipe will be reconfigured by cutting and fusion welding at appropriate locations as necessary. At the discharge point into the river, appropriate energy dissipation materials will be installed to mitigate erosion impacts.

2.4.3 Water Treatment System Performance Requirements

A water treatment system (WTS) will be required for treatment of water that drains out of stockpiled soils and sediments, water that is pumped out of the active excavations, and water from decontamination activities. The water treatment system will be designed to treat up to 400 gpm. Temporary initial storage of influent will be provided by one 500,000-gallon equalization/settling tank. This Basis of Design and the plans and specifications assume that this tank will be provided by GE. If this turns out to be incorrect, a tank that provides an equivalent amount of storage will be obtained. From this tank, water will flow to a treatment system incorporating non-aqueous phase liquid (NAPL) removal, solids removal, and treatment for organic and inorganic contaminants as necessary to meet the discharge requirements. Specification Section 11800 provides a detailed description of the performance requirements and discharge limitations for the system. Discharge limitations have been established in accordance with project ARARs and standard requirements typically imposed by EPA for National Pollution Discharge Elimination System (NPDES) Permit Exclusions for surface water discharges associated with construction.

Treatment residuals will be collected, sampled, and disposed of as follows:

- Settled solids– GE OPCAs.
- NAPL, NAPL-saturated solids, and spent carbon–Off-site disposal in accordance with applicable regulations and ARARs.

2.5 SEDIMENT AND SOIL REMOVAL

2.5.1 Channel Sediment and Bank Soil Volume Estimates

2.5.1.1 Excavation and Backfill Volume Estimates

The following discussion summarizes the calculations performed for estimating the volume of excavation and backfill based on the proposed restoration plan in the Phase 1 design submittal. Tables 2-5.1a, 2-5.1b, and 2-5.2 summarize the final estimated excavation and backfill volumes, respectively, using the proposed restoration plan included in the final design submittal. The volume calculations consist of the following steps:

- Use cross-sections generated by Woodlot Alternatives showing existing grade and proposed final grade at approximately 50-ft intervals.
- Using AutoCAD, calculate the cross-sectional area for the proposed excavation (between existing grade and proposed excavation invert) and the proposed backfill (from proposed excavation invert to final grade) at each station.
- Calculate the volume by using the average end area method used in the EE/CA for calculation volume of excavation and backfill. The calculations basically involve taking the average of the two end areas for a given river section; the volume is calculated by multiplying the averaged area by the length of the river section between the subject cross-sections. Calculations are performed using MS Excel.

Table 2-5.1a includes the estimated in-place excavation volumes and the excavation volumes with a 10% overexcavation factor added. Detailed calculations along the river are presented in Appendix A (see Table A-1 for the East Bank, Table A-2 for the River Sediment, and Table A-3 for the West Bank). Detailed calculations for the drainage swale area are presented in Table A-4. Calculations presented in the Appendix A tables are “in place” volumes. A comparison of the currently estimated excavation volumes and those calculated in the EE/CA is presented in Section 2.10.2.

2.5.1.2 TSCA and Non-TSCA Volume Estimates

Table 2-5.1a and the previous section include the total volume to be excavated within Phase 1. The excavated material is designated as either TSCA or non-TSCA material. The TSCA volume calculations, summarized in this section, estimate the quantity of contaminated material that is designated as TSCA regulated for purposes of on-site consolidation in the OPCAs. The following steps were taken to calculate this volume:

- Using the drawings, obtain locations and depths of TSCA-designated material.
- Using the plan view on drawing sheets 9 and 10, calculate the surface area of each TSCA-designated section. The surface area is calculated by obtaining the projected horizontal area (using AutoCAD) and then multiplying by an adjustment factor to account for the existing slope.
- Calculate TSCA volume for each TSCA section by multiplying the surface areas by the depth of each TSCA-designated section as shown on sheets 9 and 10.
- Calculate total TSCA volume by adding volumes from all TSCA-designated sections.

Within Phase 1, the total estimated TSCA regulated material is 3,200 cy (with 10% overexcavation factor), approximately 16% of the total excavated volume. The remaining 16,500 cy (with 10% overexcavation factor) of excavated materials (19,700 – 3,200 = 16,500) are classified as non-TSCA. These quantities are summarized in Table 2-5.1b.

2.5.2 Bank Soil and Channel Sediment Removal

The following presents the proposed sequence for the removal of the bank soil and channel sediment for Phase 1. The criteria for and extent of the soil and sediment designated for removal are described in Section 2.2.2 and Section 2.5.1.

Section 2.2.2 provides the rationale and criteria for the excavation depths shown on the plan drawings, and Section 2.5.1 presents the limits of the in-water excavation and describes the division of the bank soil and channel sediment. The removal of bank and channel materials is part of the overall construction sequence, which includes the following:

- Install sheet piles to form containment cells.
- Dewater containment cells.

- Remove bank soil and channel sediment.
- Backfill and armor the bank and channel.
- Restore/enhance the riverbank and riverbed (e.g., bank plantings and aquatic structures designed to improve habitat and flow).
- Remove sheet piles.

A detailed description of the construction elements, including the sequencing for the removal of the bank soil and channel sediment, is presented in Appendix 02464-A of the Specifications. As described in the plans and specifications, the downstream sheet piles of Cells J3 and I3 from the Upper ½-Mile Reach may be used for Cells 1 and 3 instead of the proposed jersey barriers. If the Engineer determines the sheet piles from Cells J3 and I3 are suitable, the removal sequence presented in the specifications may be modified as approved by the Government. In addition, if refusal is met while attempting to push the sheet piles to the mudline (i.e., the temporary condition), the sheet piles will be pulled and redriven. Alternatively, the removal sequence may be modified in the field to provide flexibility and cost-effectiveness.

The production rates for construction elements presented above are as follows:

- The estimated installation and removal rate for the sheet piles is 650 and 1000 square feet per day, respectively. This rate is conservative and assumes the contractor will need to relocate the crane 9 or more times during the project.
- Initial dewatering of the containment cells is estimated to take 1 day assuming 300 gpm.
- The production rate for excavating riverbed and riverbank materials is estimated based on previous experience on similar projects. Production rates that GE has achieved in the Upper ½-Mile Reach Removal Action were also considered. The excavation rate is estimated to be between 125 and 150 cy per day for riverbank soils and between 90 and 115 cy per day for riverbed sediments.
- The production rates for backfilling are based on engineering and contractor estimates. For the riverbed and the riverbank, the backfill rates were assumed to be 300 and 200 cy per day, respectively.
- Restoration rates for the riverbed and riverbank are presented in Section 2.9.

2.5.3 Environmental Controls

Environmental controls implemented during installation of the sheet pile cells and excavation within the cells will generally be consistent with those applied during the implementation of the Upper ½-Mile Reach Removal Action and Project ARARs. The main objective of environmental controls is to minimize the amount of mobilization and transport of PCBs from the construction area either into ambient air or downstream via resuspension in the water column. In addition, impacts to adjacent structures in terms of settlement or structural damage are to be monitored. Construction activities will be conducted to minimize the potential for mobilization of PCBs in the river water or ambient air. To mitigate potential scour and resuspension of PCB-contaminated sediment in the vicinity of the sheet pile cell walls, temporary erosion control measures will be implemented consisting of placement of riprap or concrete mats adjacent to portions of the wall most susceptible to scour (see Section 2.5.5). In addition, monitoring of ambient air and the river water column will be conducted during construction activities, as well as selective monitoring of adjacent structures for settlement or damage. If air or water column sampling results exceed thresholds identified in the specifications, the Government will be notified and evaluation of construction activities will be conducted to determine potential corrective measures.

2.5.4 Sheet Pile Containment Cell Design

Geotechnical and structural design analysis leading to development of the sheet pile cell design specifications was conducted as part of the 65%, 95%, and final design iterations for Phase 1. The final design sheet length based on this analysis was determined to be 43 ft, with an embedment depth of 35 ft. After completing the final design in November 2001, additional borings were installed to augment the subsurface data at elevations lower than approximately 20 ft below the riverbed. A primary driver for this additional investigation was concern about potential high till and/or bedrock that would present difficult driving conditions for the sheets. After receipt of the new boring data in February 2002, WESTON initiated a reevaluation of subsurface conditions in Phase 1 and a redesign of the sheet piling. The reevaluation and redesign activities and the resulting revised final design parameter values are described in this subsection.

WESTON completed the final design of the temporary cantilevered steel sheet piling to be used to complete excavation of contaminated river bottom sediments within Phase 1. To facilitate the excavation of these sediments, the sheet piling will initially be installed along the approximate centerline of the river channel to the required minimum embedment depth as measured from the base of the to-be-excavated sediments. Perpendicular segments of sheet piling will also be installed from the endpoints of the centerline alignment to an intersection with the bank of the river channel. In this manner, that portion of the river channel within the perimeter of the sheeted area will be isolated. In addition, river flow will be automatically diverted into the open half of the channel cross-section by the construction. The isolated area can then be dewatered and the river bottom sediments excavated to the targeted completion depths. These activities will be followed by backfill of the excavated areas to the original grades with clean, well-compacted fill. Following completion of this work, sheeting will be removed and reused in a downstream portion of the river channel in essentially the same manner.

The cantilevered steel sheet piling was designed consistent with the subsurface conditions encountered in river bottom Borings 112, 124, 125, and 128, which are located within these subreaches as shown in Figure 2-5.1. These borings encountered predominantly granular soils to the completion depths of the boreholes (i.e., 20 ft below the channel bottom elevation for Borings 112, 124, and 125, and 15 ft below the channel bottom elevation for Boring 128). The subsurface conditions at deeper elevations were determined from Borings A through G located at the top of the riverbank. These borings are presented on Figure 2-5.1 and summarized in Table 2-5.3.

The steel sheet piling design was completed consistent with the analysis/design procedures presented in the *Pile Buck® Steel Sheet Piling Design Manual* (Pile Buck, Inc., 1987, 99-0655) under the section entitled "Cantilever Sheet Piling in Granular Soil." Designs were completed for two excavation/free water head scenarios as shown below:

Scenario	Maximum Permissible Excavation Depth Below Original Channel Bottom Elevation	Maximum Permissible Free Water Height Above Original Channel Bottom Elevation
I	3 ft (normal condition)	8 ft
II	5 ft (localized worst-case condition)	8 ft

A complete set of calculations for each design is presented in Appendix L. The first page of each calculation set documents the assumed subsurface stratigraphic profile used in the analysis along with the average Standard Penetration Resistance (N) value and corresponding angle of internal friction (ϕ) for each granular soil layer in the profile. The analysis allows for a maximum permissible free water height of 8 ft above the original channel bottom elevation. This height is equivalent to a top of sheet elevation of 976 ft AMSL. This elevation was determined to be the most cost-effective in terms of reducing the number of lost workdays due to overtopping during high-flow conditions while maintaining a feasible sheet pile embedment depth. The paragraph entitled "Overtopping Frequency" within Subsection 2.7.2.4 provides additional details regarding the basis for the 976-ft elevation.

The results of the two sheet pile designs are presented in Table 2-5.4. The minimum required Section Modulus values for the two scenarios as presented in the table are consistent with the assumption that ASTM A-572, Grade 50 steel, which has a minimum yield strength of 50 Ksi, will be used in the manufacture of the sheeting. AZ-26 steel sheet piling as marketed by the Skyline Steel Company (Section Modulus = 48.4 in^3/ft), or structurally equivalent steel sheet piling with hot rolled interlocks for proper water retention, is acceptable for the construction under both excavation scenarios.

As shown in Table 2-5.4, 30-ft-long sheet piling will provide an acceptable factor of safety on embedment of 1.2 for the 3-ft excavation depth scenario. This same length of sheeting, however, will provide a factor of safety of only 1.00 (i.e., the incipient failure condition in which the sheeting can be expected to lean excessively, or possibly collapse, toward the excavation) for a 17 foot embedment depth corresponding to the 5-ft excavation depth scenario. Increasing the sheeting purchase length to 35 ft will provide 22 ft of embedment and will increase the factor of safety on embedment to an acceptable value of 1.29. However, because these 5-ft deep excavations are expected to be localized and somewhat anomalous, the added and significant expense of purchasing 5 additional feet of sheeting length for a large quantity of steel appears to be excessive and unnecessary. Instead, it has been determined that the 30-ft-long sheets can be used for the 5-ft excavation depth scenario as long as the following construction requirements are satisfied:

- No localized 5-ft deep excavations shall be completed unless the depth of free water behind the sheet piling is 5 ft or less during the entire time period that the localized excavation is open.
- The 5-ft-deep, localized excavations shall be backfilled immediately following their completion to at least the 3-ft excavation elevation with controlled, well-compacted, clean granular fill soils. No 5-ft-deep excavations shall remain open over night.

A hydraulic piping analysis was also completed consistent with the two sheet pile designs to investigate whether the upward seepage flow created by the imbalance in water head between the back and front of the sheet piling can potentially "fluidize" the near-surface soils at the base of the river bottom sediment excavations. These calculations are also presented in Appendix L. Consistent with conventional geotechnical practice in which a minimum required Factor of Safety against piping failure of 4 to 5 is desirable, the 3-ft-deep excavation scenario yielded an acceptable factor of safety value of 5.59. In contrast, the Factor of Safety value for the 5-ft-deep excavation scenario was an acceptable but marginal value of 4.33, which further reinforces the need to complete these localized excavations only when the conditions and restrictions discussed in the above paragraph are satisfied.

2.5.5 Short-Term, In-River Erosion Control During Construction

Short-term, in-river erosion control consists of use of soil surface erosion and sediment control materials, storm water control materials, and storm water pollution prevention control materials including silt fence, straw bale barriers, armoring, and miscellaneous related work. Diversion dikes and/or berms will be used only where there are no practical alternatives. Government approval will be required before installation of these structures. Other short-term erosion controls include temporary protection around the containment cells and rock outlet protection. These short-term in-river erosion control components are described in Specification Section 02370 - Storm Water and Erosion Control: In-River Work.

Areas requiring storm water and temporary erosion control protection include:

- Riverbanks after restoration at elevations above the top-of-armor (riprap).
- The work area within the containment cells.
- Areas around the containment cells as shown on the Plans.

- Areas where riverbank overtopping may occur because of local increases in river stage associated with flow constriction caused by the containment cells.
- Areas where overland flow into the river from areas outside the top of the riverbanks has resulted in local erosion.
- The area that receives the discharge from storm water outfalls that terminate in the work area.

2.5.5.1 Silt Fences

Silt fences provide a temporary structure to minimize erosion and sediment runoff. Silt fences retain sediment in areas where erosion would occur in the form of sheet and rill erosion (e.g., clearing and grubbing, excavation, embankment, and grading).

2.5.5.2 Straw Bales

Straw bales are placed to retain sediment after completing each phase of work (e.g., clearing and grubbing, excavation, embankment, and grading) in each independent runoff area (e.g., after clearing and grubbing in an area between a ridge and drain, bales shall be placed as work progresses, bales shall be removed/replaced/relocated as needed for work to progress in the drainage area). Rows of bales of straw are placed in areas such as:

- Along the downhill perimeter edge of disturbed areas.
- Along the top of the slope or top bank of drainage ditches, channels, or swales that traverse disturbed areas.
- Along the toe of all cut slopes and fill slopes of the construction areas.
- Perpendicular to the flow in the bottom of existing drainage ditches, channels, or swales that traverse disturbed areas or carry runoff from disturbed areas.
- Perpendicular to the flow in the bottom of new drainage ditches, channels, and swales.
- At the entrance to culverts that receive runoff from disturbed areas.

2.5.5.3 Diversion Dikes

Diversion dikes provide a temporary structure to reroute minor surface flows during construction. Diversion dikes will be used only where there are no practical alternatives, and Government approval is required prior to installation. The diversion dikes have a minimum height of 18 inches with a minimum top width of 2 ft and a maximum channel slope of 2%. The Contractor shall use clean, off-site material for construction of the diversion dikes. To prevent contact with existing soils, a layer of geotextile shall be placed under the diversion dikes.

2.5.5.4 Temporary Erosion Controls

Temporary erosion controls may be placed in specific areas around the containment cells where erosion has typically been observed in the Upper ½-Mile Reach Removal Action being conducted by GE. The area of the river opposite the containment cells is subject to increased flow velocity because of the constriction posed by the containment cell. As discussed in Section 2.7.2.4, Results/Sheet Pile Scour Analysis, hydraulic modeling predicts approximately 3 to 4 ft of erosion in unprotected areas in the river channel and banks for given flows, due to the constriction posed by the containment cells. Erosion has been observed around containment cells in the Upper ½-Mile project.

The temporary erosion controls will be used to minimize the scour and erosion of riverbed material during construction.

Two types of temporary erosion controls were considered for the project:

- Placement of a riprap layer around areas prone to scour as shown on the Plans. This includes installing the riprap on the side of the sheet pile with river flow, excavating and restoring the dry cell, removing the existing cut-off walls and installing them on the opposite side of the river, and then removing and pressure washing the riprap so that it can be reused; and/or

- Placement of articulated concrete mats. This includes installing the articulated concrete mats on the side of the sheet pile with river flow, removing the existing cut-off walls and installing them on the opposite side of the river, and then removing the articulated concrete mats, and pressure-washing the articulated concrete mats so that the articulated concrete mats can be reused.

Riprap is the preferred method because it provides flexibility in placement and the ability to adjust in response to observed erosion. Articulated concrete mats can be used if removing and cleaning the riprap becomes problematic.

2.5.5.5 Rock Outlet Protection

Rock outlet protection is a temporary structure consisting of riprap that is used to minimize downstream erosion by reducing the velocity and energy of concentrated water flow, as it is discharged into the river. Rock outlet protection is required for existing and rerouted stormwater outfalls, and for the containment cell dewatering outlet at locations adjacent to the containment cells.

2.5.5.6 Out-of-River Stormflow Sources

Areas of the banks, as well as existing outfalls, have been identified within Phase 1 as being potential sources of storm flows that could impact the river and the containment cells during construction. In general, surface in-flow and movement of associated solids into the river from banks and adjacent areas will be controlled using hay bales and silt fences as necessary. Swale-type areas along the banks will be addressed as necessary with placement of filter fabric and rock for stabilization during and after construction. Swales and areas of significant erosion within the proposed area will be excavated to the required depths and backfilled with filter fabric and 18-inch riprap. Outfalls will be individually addressed as they intersect the construction area (sheet pile cells) through collection and rerouting of flows away from the containment cell areas.

2.6 GEOTECHNICAL ANALYSIS

Geotechnical analyses included evaluation of existing subsurface geotechnical information (Section 2.6.1) and slope stability analyses (Section 2.6.2). Evaluation and analyses results are presented in the following sections. Documentation of the final selection of slope configurations is provided in Section 2.9.1 and Appendix G.

2.6.1 Assessment of Subsurface Geotechnical Information

This section summarizes the existing subsurface geotechnical information. Geotechnical information was used in the design for: (1) the sheet pile containment cells, and (2) the analyses of temporary and permanent slope stability for Phase 1.

A brief summary of the information collected during the geotechnical subsurface exploration program performed as part of the EE/CA and the results of the investigation are presented in Section 2.6.1.1. Groundwater conditions in the vicinity of the site are described in Section 2.6.1.2. Sections 2.6.1.3 and 2.6.1.4 include the assessment of available geotechnical data for the detailed and final design of in-river sheet pile containment cells and the analyses of temporary and permanent slope stability of the riverbanks along the river.

2.6.1.1 Geotechnical Boring Program

Between Transect 64 and Transect 96 (Sta. 500+00 to 516+30), 14 geotechnical borings were performed as part of the original (EE/CA) and supplemental (Addendum to EE/CA) field investigations. Geotechnical borings were drilled using either hollow stem auger or rotary wash in cased holes with standard penetration tests (SPTs) performed at a set interval. Field locations of these 14 borings were included on figures in the EE/CA and EE/CA Addendum. Table 2-6.1 summarizes the approximate locations and depths of these 14 geotechnical borings.

During the initial May 1999 field program, which included borings BH000097 and BH000098, SPTs were performed at 2-ft intervals for the entire depth of the boring. At the remaining 12 boring locations, which were part of the supplemental field program conducted in June and July 2000, SPTs were performed at 5- to 10-ft intervals. The geotechnical borings generally terminate at a maximum depth of 20 ft below the riverbed, at approximately El. 948 ft, or until “refusal” based on blow counts. Rock cores were not obtained from any of the original 14 geotechnical borings from the EE/CA.

In January 2002, a supplemental field program was conducted to collect additional subsurface information at seven locations on either side of the river between the Lyman Street Bridge and the Elm Street Bridge. The intent of this exploration program was to collect additional

geotechnical information from the embedment zone to reassess the sheet pile embedment depths and their constructability. These borings were generally drilled to depths of 50 to 62 ft. Table 2-5.3 summarizes each boring. Boring logs are available upon request. This new information was used in the final sheet pile cell design.

Based on the geologic setting described in the EE/CA and the recent boring data, the project area is dominated by glacial deposits and more recent natural and manmade deposits related to the Housatonic River as well as the re-channelization of the river in the 1940s. The subsurface profile typically consists of the following four strata overlying the bedrock:

- **Manmade fill**: wide range of materials.
- **Recent alluvium**: generally sand and gravel with small amounts of silt and clay
- **Glacial-fluvial deposits**: generally sand and gravel with small amounts of silt and clay
- **Till**: typically gray to dark brown, medium to very dense with varying amounts of sand, gravel, and cobbles in a fine-grained (silt and/or clay) matrix.

Most of the samples can be described as fine to coarse gravel and sand, fine to medium sand, silt and sand, and clayey silt. The blow counts are generally between 2 to 20 within 20 to 25 feet of the surface with occasional zones where high blow counts were recorded. These grain-size distributions and blow counts are typical for manmade fill, recent alluvium, and glacial fluvial deposits. At depths below 20 to 25 feet, a significant increase in blow counts (to the mid-thirties to mid-eighties) occurs, reflecting the presence of the medium to very dense till stratum. The subsurface profile obtained from the field investigation program appears to be consistent with the general geologic setting for this area.

Because soil encountered at the original EE/CA boring locations was generally cohesionless materials, laboratory tests included water content, Atterberg limits, grain-size analysis, specific gravity, and organic content.

2.6.1.2 Groundwater Conditions

Two observation wells (BH000141 and BH000116) were installed within the Phase 1 area as a part of the supplemental field program. According to two sets of readings obtained on July 8,

2000 and July 27, 2000, the groundwater levels at these two locations are at approximately El. 971 ft to El. 973 ft.

In addition to these two observation wells, groundwater information was reviewed for two adjacent properties:

- Phase II Comprehensive Site Investigation, Mobil Service Station located on Elm Street adjacent to the Elm Street Car Wash, Report by Groundwater Technology, Inc., July 1991 (06-0116). [East bank, near Station 517+50]
- Additional Hydrogeologic Assessment and Short-Term Measure Evaluation and Proposal at the Lyman Street Parking Lot (Oxbow Area D), report by Golder Associates, January 1992 (01-0231). [West bank, north of Lyman Street Bridge].

Based on the information in these reports, groundwater elevations at these properties were in the same range as those measured in the wells installed by WESTON.

2.6.1.3 Geotechnical Conditions Assessment for Design of Sheet Pile Containment Cells

As discussed in this document and presented on the design drawings, removal of existing river sediments and placement of backfill will generally be accomplished in the dry within sheet pile containment cells installed in-river. Based on the layout submitted as part of the final design, 6 pairs of steel "I"-shaped sheet pile containment cells with occasional sub-cells are proposed within the design subreach from Lyman Street Bridge to approximately Station 514+00. Each steel sheet pile containment cell spans about half the river width and extends for 300 to 350 ft of the river length. The proposed layout of the containment cells is shown on the Plans.

The subsurface conditions encountered between Lyman Street Bridge and Elm Street Bridge are summarized in Figure 2-5.1. As summarized in Section 2.6.1.1, four in-river borings were originally performed along the river centerline within Phase 1 as part of the EE/CA.

Figure 2-6.1 shows the original subsurface profile based on the four in-river borings. This profile was revised in March 2002 (see Figure 2-5.1) based on reanalysis of the in-river boring data and incorporation of deeper data from the seven borings advanced in January and February 2002.

2.6.1.4 Assessment of Geotechnical Parameters Used for Preliminary Analysis of Temporary and Permanent Slope Stability

The preliminary temporary and permanent slope stability analyses presented in Appendix N of the EE/CA assume various slope steepness, slope height, and a homogeneous deposit of soil with a total unit weight, γ_t, of 120 pcf; cohesive shear strength, c, of 30 pound per square foot (psf); and internal friction angle, ϕ, of 32 degrees.

The assumed soil strength parameters are based on an average N value of 10 blows per foot and an average adjusted N value of 15 blows per foot. Results are summarized in Appendix N of the EE/CA. The final draft of the EE/CA was published in February 2000. The EE/CA slope stability analyses were based on information obtained from the original subsurface investigation performed in 1999.

Plots of critical failure surfaces for each scenario were also presented in Appendix N. The plots of critical failure surfaces indicate that the critical failure surfaces are generally relatively shallow. The deepest portion of the surface is at or within 5 ft below the average elevation of the riverbed. The average elevation of the riverbed is estimated at approximately El. 968 ft.

Riverbank borings used in the slope stability analyses are summarized in Table 2-6.2. Due to the depth of the critical failure surface, evaluation and comparison of the blow counts are focused on SPT samples obtained above El. 968 ft, the approximate riverbed elevation.

All of the SPT samples from the west bank had an uncorrected N value less than, or equal to, 10 blows per foot with an average of 4.5 blows per foot, approximately 50% less than the assumed N value of 10 used in the EE/CA calculations.

The SPT samples obtained from the east bank, on the other hand, had a larger scatter in the blow counts as follows:

- 18 percent with N less than or equal to 10 blows per foot.
- 50 percent with N between 10 and 20 blows per foot.
- 32 percent with N greater than 20 blows per foot.

The above results in an average N value for the east bank of 22 blows per foot. If samples with N greater than 20 blows per foot are omitted, a typical approach that tends to adjust blow counts to account for anomalous conditions, e.g., the tip of the spoon impacting on a cobble, the average for east bank samples is reduced to 12 blows per foot, slightly above the selected design value of 10 blows per foot.

This simple comparison of blow counts seems to indicate that soils from different sides of the riverbank exhibit different properties. Based on existing boring data, bank soil from the west bank appears to exhibit lower strength than east bank soil. This difference changes the assumed soil parameters used in the slope stability analyses and consequently alters the results of the slope stability analyses.

Note: Flood control map (see page A6 of the memo titled Summary of Structural Conditions and Utility Survey from Lyman Street Bridge to Elm Street Bridge, September 28, 2000 [Hart Crowser, 06-0126], revised on April 23, 2001), identifies areas of fill as part of the re-channelization effort. Based on this drawing, the area of fill appears to be more extensive along the east bank than the west bank.

2.6.2 Slope Stability Analyses

This section summarizes the series of slope stability analyses performed for the Phase 1 design. The intent of the analyses was to provide guidelines for detailed design of slope restoration. Background information, soil properties, analyses sets, and results are presented in the following sections. Results of the preliminary analyses conducted as part of the EE/CA are presented in Appendix N of the EE/CA, and are summarized below. The additional analyses presented in the following subsections were performed by Hart Crowser to evaluate the applicability of the findings from the EE/CA stage and provide the necessary information for the restoration design. A brief summary of the approach performed in the EE/CA is presented in Section 2.6.2.1. Revised soil properties are presented in Section 2.6.2.2. Sections 2.6.2.3 to 2.6.2.6 summarize the four sets of slope stability analyses performed iteratively as part of the design process to develop the slope restoration plan along the river and the drainage swale.

2.6.2.1 Background Information: EE/CA Analyses

Appendix N of the EE/CA presents the preliminary bank stability evaluation that was conducted for the EE/CA. This evaluation included evaluation of three stability scenarios:

- **Long-term** post-construction stability using drained soil strength under **static** conditions. A water depth of 3 ft is assumed. The minimum factor of safety of 1.5 is used in accordance with conventional geotechnical engineering practice
- **Long-term** post-construction stability using drained soil strength under **dynamic** conditions. A water depth of 3 ft is assumed. The minimum factor of safety of 1.0 is used in accordance with conventional geotechnical engineering practice. The seismic coefficient of 0.10g is assumed for both the horizontal and vertical directions
- **Short-term** stability using drained soil strength under **static** conditions. The river is assumed to be dry and a surcharge at the top of the slope, accounting for construction traffic, is also assumed. The minimum factors of safety of 1.2 (with surcharge) and 1.3 (without surcharge) are used in accordance with conventional geotechnical engineering practice.

Summary tables of the results as well as plots of critical surfaces are presented in Appendix N of the EE/CA.

The analyses presented in Appendix N of the EE/CA assumed a total unit weight of 120 pcf, cohesion of 30 psf, and a friction angle of 32 degrees (assuming an uncorrected N value of 10 blows per foot). Water level in the river was assumed to be at 3 ft above the riverbed, and the groundwater level within the bank is assumed to be at 1 ft above the in-river water level (i.e. 9 ft above the bedrock). Based on the evaluation of boring results presented in Section 2.6.1.4, changes in the assumed soil properties were determined by Hart Crowser to be warranted, especially for the west bank. Revised soil properties along the west and east banks, which were used in the slope stability analyses conducted by Hart Crowser as part of the Phase 1 design, are presented in the next section.

2.6.2.2 Soil Properties Along the West and East Banks

Based on blow counts and soil samples obtained along the west bank, three strata are assumed to overlie the bedrock. The assumed soil strata and corresponding parameters for the west bank are summarized in Table 2-6.3. Assumed properties for the east bank are also included in Table

2-6.3. These properties were used in the Phase 1 design analyses presented in the following sections. Note that the assumed properties deviate from the values used in the preliminary slope stability analyses presented in the EE/CA.

2.6.2.3 Parametric Analyses for Evaluating Slope Stability

Considering the revised parameters presented in Table 2-6.3, several sets of slope stability analyses were performed as part of the design process to evaluate the impacts of the following factors:

- Friction angle for the soil (west bank: varies from 28 to 30 degrees versus 32 degrees in the EE/CA).
- Cohesion for the soil (current assumption of 0 psf versus 30 psf in the EE/CA).
- Additional support provided by bioengineering.
- Impact of placement of riprap on the slope.

Evaluation of the impacts of these parameters allowed for determining and assessing the applicability of EE/CA results as part of the final design as well as the significance of certain assumptions. Effects of other factors such as water level in the river, seismic loading, and surcharge at the top of slope are addressed in Section 2.6.2.6.

For each parameter listed above, four bank slopes (3H:1V, 2H:1V, 1.5H:1V, and 1H:1V) with three slope heights, 10, 15, and 20 ft, for a total of 12 analyses were considered in these revised analyses. Figure 2-6.2 illustrates the basic setup of the slope stability analyses. Similar to the EE/CA, the slope stability analyses were performed using commercially available code Slope/W by Geo-Slope.

In addition to the geometric setup illustrated in Figure 2-6.2, all the analyses also include a 1.5 ft thick layer of riprap covering the lower portion of the riverbank from El. 975 ft downward and the entire riverbed. The slope stability analyses were completed to provide information for the restoration design. These analyses were performed prior to finalizing the riprap thickness. At the time of the slope stability analyses, a thickness of 1.5 ft was considered the minimum thickness for the riprap, and was assumed in all the analyses with riprap. Riprap properties assumed in the

EE/CA included a unit weight of 140 pcf, friction angle of 40 degrees, and cohesion of 100 psf. For this design, the riprap layer was assumed to be 1.5 ft thick with total unit weight, γ_t, of 140 pcf; friction angle, ϕ', of 38 degrees; and cohesion, c, of 30 psf. Figure 2-6.3 illustrates the typical riprap location and Slope/W problem setup.

Based on the assumed groundwater elevation level (at riverbed), the problem setup is very similar to the short-term condition defined in the EE/CA. Because surcharge is not applied in this set of analyses, a design factor of safety of 1.3 appears to be appropriate for this preliminary assessment. Results from this parametric study are summarized below.

A. Friction Angle

The first set of analyses examined the impact of changes in the assumed friction angle of the soil. In the initial EE/CA analyses, the friction angle is assumed to be equal to 32 degrees. Preliminary assessment of soil properties along the west bank indicated a friction angle in the range of 28 to 30 degrees (see Table 2-6.3).

Three sets of analyses were performed to evaluate the impact of changes in friction angle:

- **Case A1** – Assuming preliminary properties along the west bank (Table 2-6.3).
- **Case A2** – Assuming a friction angle of 32 degrees down to El. 951.
- **Case A3** – Assuming a friction angle of 34 degrees down to El. 951.

The cohesion of the soil is assumed to be 0 pound per square foot with the following exception: for 1H:1V slope, results from cohesion =10 pounds per square foot are presented instead.

For each friction angle listed above, a set of slope stability analyses was performed. Each set of analyses consists of 9 to 12 slope stability analyses looking at slope varying from 1H:1V to 3H:1V and slope height of 10 to 20 ft.

Friction Results and Observations

Results of the analyses, in terms of factor of safety, are presented on Figure 2-6.4. As illustrated on Figure 2-6.4, the following trends were observed:

- At any given friction angle, the factor of safety decreases as the slope height increases.
- At any given friction angle, the factor of safety decreases as the steepness of the slope increases.
- For a given slope height and slope steepness, each degree increase in friction angle translates to approximately a 3 to 4% increase in factor of safety.

B. Cohesion

The second set of analyses examined the impact of changes in the assumed cohesion of the soil. In the initial EE/CA analyses, the cohesion was assumed to be equal to 30 psf. Preliminary assessment of soil properties at west bank indicated a cohesion of 0 psf (Table 2-6.3). To evaluate the impact of this cohesion value, additional analyses were performed. The analyses focus on 1H:1V slope only with slope height varying from 10 to 20 ft and consist of the following friction angle and cohesion value combinations:

- **Case B1** – Case A1 (west bank, without bioengineering) + cohesion = 10, 30, 50, 70, and 100 psf.
- **Case B2** – Case A2 ($\phi'=32^o$, without bioengineering) + cohesion = 10, 30, 50, 70, and 100 psf.
- **Case B3** – Case C1, (west bank, with bioengineering) + cohesion = 10, 30, 50, 70, and 100 psf.
- **Case B4** – Case C2 ($\phi'=32^o$, with bioengineering) + cohesion = 10, 30, 50, 70, and 100 psf.

Cases C1 and C2 are described in Subsection C below.

Cohesion Results and Observations

Based on the results presented on Figure 2-6.5, the following trends were observed:

For a given case and slope height, an increase in cohesion results in an increase in the factor of safety. For cases without bioengineering (B1 and B2), each unit increase in cohesion (in pounds per square foot) results in a 0.5 to 0.7% increase in factor of safety. For cases with

bioengineering (B3 and B4), each unit increase in cohesion (in pounds per square foot) results in a 0.4 to 0.5% increase in factor of safety.

For cases without bioengineering (B1 and B2), the same factor of safety is obtained for c = 0 psf regardless of the slope height. In this case (c = 0, without bioengineering), plots of critical failure surfaces indicate surface slough.

C. Bioengineering

The third set of analyses examined the impact of the use of bioengineering above riprap. Based on previous submittals, for slopes steeper than 2.25H:1V, bioengineering was assumed. For this preliminary assessment of slope stability, the bioengineering was assumed to have the following properties: total unit weight, γ_t, of 115 pcf; friction angle, ϕ', of 33 degrees; and cohesion, c, of 100 psf. The bioengineering is assumed to be 3 ft thick extending from the top of slope to the edge of riverbed (i.e., 1.5 ft thick below the riprap). Figure 2-6.6 illustrates the typical Slope/W analyses setup.

To evaluate the impact of the presence of this bioengineering, an additional two sets of analyses were performed:

- **Case C1** – Use west bank properties with bioengineering.
- **Case C2** – Use ϕ' of 32 degrees with bioengineering.

Bioengineering Results and Observations

Figure 2-6.7 shows the comparison between Cases A1 and C1; and Figure 2-6.8 shows the comparison between Cases A2 and C2. As illustrated on Figures 2-6.7 and 2-6.8, the following trends are observed:

- For slopes flatter than 3H:1V, the benefit of bioengineering appears to be negligible with approximately a 1 to 1.5% increase in factor of safety with bioengineering.
- For 2H:1V slopes, the presence of bioengineering increases the factor of safety by 7 to 9% for both soil profiles (west bank profile and ϕ' of 32 degrees).
- For slopes steeper than 2H:1V, the relative benefit of bioengineering appears to be higher for slopes with lower height than higher slopes. For a slope height of 10 ft, the

presence of bioengineering increases the factor of safety by more than 20%. For a slope height of 20 ft, the presence of bioengineering increases the factor of safety by approximately 10%.

D. Riprap Slope

The fourth set of analyses examined the impact of the riprap slope. In previous analyses, the portion of the bank slope with riprap was assumed to be the same as the remaining portion of the bank slope. In this set of analyses, two riprap slopes were assumed (1H:1V and 2H:1V) with the remaining portion of the bank slope allowed to vary from 1H:1V to 3H:1V. Two cases were considered in this set of analyses. Both cases focused on west bank profile with bioengineering (i.e. variations of group C1 analyses):

- **Case D1** – Riprap slope of 1H:1V.
- **Case D2** – Riprap slope of 2H:1V.

Figures 2-6. 9 and 2-6.10 illustrate the Slope/W setup for these two cases as well as the geometry of these "composite" slopes.

Riprap Slope Results and Observations

The results, shown in Figure 2-6.11, present the following trends:

- If the riprap slope is steeper than the slope above, a lower factor of safety is obtained.
- If the riprap slope is flatter than the slope above, a higher factor of safety is obtained.
- The magnitude of the benefit appears to be slightly dependent on the slope height.

Conclusions – Parametric Analyses

The purpose of the previous calculations was to provide a preliminary assessment of the impacts of soil strength (friction angle and cohesion), the presence of bioengineering, and riprap slope on the overall slope stability and to evaluate the applicability of the EE/CA analyses results. Based on the analyses, increases in the friction angle and/or cohesion of the soil can increase the factor of safety for a given slope geometry. The presence of bioengineering is beneficial for steeper slopes. For slopes at or flatter than 3H:1V, the benefit of bioengineering is negligible. The relative steepness of the riprap slope determines its benefit on overall slope stability. If the riprap slope is steeper than the upper portion of the bank slope, a lower factor of safety is typically

realized. However, if the riprap portion is flatter than the upper portion of the slope, an increase in the factor of safety can be realized.

As illustrated in the parametric analyses, changes in friction angle and cohesion factor can alter the factor of safety significantly. For example, using the current assessment of west bank soil properties (i.e., ϕ' of 28 degrees and c equal to 0 psf), for a 1H:1V slope with a slope height of 10 ft and with bioengineering, the factor of safety is 0.98. For the same slope geometry but using EE/CA soil properties (i.e., ϕ' of 32 degrees and c equal to 30 psf), the factor of safety is 1.21, a 23% increase. This difference is significant and critical for the overall design of slopes within Phase 1. In light of the differences observed in the blow counts obtained from the east bank and west bank borings and the significance of the assumed soil properties on the slope stability, the results from the EE/CA evaluation were considered applicable for the east bank but were not applied for the west bank.

2.6.2.4 Existing Slope Geometry and Slope Stability

This section summarizes the second round of slope stability analyses performed for the Phase 1 final design submittal. The first round of analyses, presented in Section 2.6.2.3, consisted of parametric analyses evaluating the impacts of friction angle, cohesion of the soil, presence of bioengineering, and magnitude of the riprap slope.

The intent of this analysis was to summarize the existing slope layout from Lyman Street Bridge to Station 514+00 and to assess/recommend possible restoration configurations and/or alternatives. Using the existing condition plan, the toe of the bank slope is at approximately El. 970 to 971 ft. The top of the slope varies depending on the limit of excavation. All the analyses assumed that the top of bank armor is at El. 975 ft and the toe of the slope is at El. 970 ft with a river centerline at El. 968 ft and approximately 30 ft (laterally) from the toe.

Analyses performed in this calculation consisted of the following steps:

- At every 50-ft interval, obtain slope toe elevation (Elev. A), top of bank (at limit of excavation) elevation (Elev. B), and horizontal distance of the slope based on a topographic map of existing condition.

- Based on the bank height (Elev. B – Elev. A) and the horizontal slope length (L), estimate average slope.
- Given the existing average slope, assess the restoration alternative for the given slope (revegetation, bioengineering, or shift of limit of excavation).
- Review each cross-section to verify if the use of average slope is representative of the given section. If yes, the analysis is completed; if no, an additional analysis is performed with a composite slope that consists of two different slope grades (one within the riprap zone and another slope for the remaining section of the slope).

Results of the analyses are summarized below.

Existing Slope Configuration

The elevations of the toe of slope and the limit of excavation as well as the horizontal length of the slope are summarized in Tables 2-6.4 and 2-6.5. Figure 2-6.12 shows the values tabulated in these tables. These tables summarize the geometry/configuration of the existing slope by summarizing the slope height and horizontal slope length. These two values provide an indication of the size of the existing slope as well as the available area for slope restoration. Along the west bank, the slope height varies from 4 to 13 ft with slopes from 0.9H:1V to over 4H:1V (average slope height of 8.6 ft and slope of 2.4H:1V). Along the east bank, the slope height varies from 6 to 14 ft with slopes from 1.1H:1V to over 4H:1V (average slope height of 10.2 ft and an average slope of 2.6H:1V).

The assumptions and loading conditions for this set of slope stability analyses include the following:

- River water level is at the riverbed.
- Top of till at El. 951; top of bedrock at El. 940.
- No surcharge.
- 1.5-ft thick riprap along riverbed and along river bank up to El. 975.
- Constant slope from limit of excavation down to toe of the riverbank.
- For soil above El. 951 on West Bank, $\phi' = 28$ degrees; on East Bank, $\phi' = 32$ degrees.
- Properties for bioengineering and riprap are the same as those assumed in the parametric analyses presented in the previous section.

Slope/W Analyses

To evaluate and assess restoration options within Phase 1 (from Lyman Street Bridge to Station 514+00), additional slope stability analyses (using Slope/W) were performed. The additional analyses are classified as one of the four categories illustrated in Table 2-6.6 and summarized below.

Figures 2-6.13 and 2-6.14 illustrate the slope configurations analyzed in Slope/W. Results from Groups E to H are presented as Figures 2-6.15 and 2-6.16.

- Group E: West Bank Properties—Assuming revegetation with top of riprap at El. 975 ft and the same slope is maintained from the toe to the limit of excavation.
- Group F: West Bank Properties—Assuming bioengineering with top of riprap at El. 975 ft and the same slope is maintained from the toe to the limit of excavation.
- Group G: East Bank Properties—Assuming revegetation with top of riprap at El. 975 ft and the same slope is maintained from the toe to the limit of excavation.
- Group H: East Bank Properties—Assuming bioengineering with top of riprap at El. 975 ft and the same slope is maintained from the toe to the limit of excavation.

The analyses included in this calculation address only one loading condition. Given that the loading condition analyzed here may not be the constraining condition, a slightly more conservative design factor of safety was used. The desired factor of safety for the assumed loading condition used in this calculation was set at 1.5.

Restoration Options

Using results generated from Groups E to H, the preliminary assessment of restoration options in Phase 1 at 50-ft intervals are summarized as Table 2-6.7 (West Bank) and Table 2-6.8 (East Bank).

For simplicity, the slope stability analyses described above assume that the slope is constant (i.e., using average slope). To verify the validity of the assumption, each cross-section was examined to determine if using the average slope was appropriate. Sections that deviated from the average slope assumption were flagged and noted for additional slope stability analyses using the composite-slope approach (see below). Sections that exhibited a constant slope were evaluated

and recommended restoration alternatives were provided. The restoration recommendations included: (1) existing slope configuration is acceptable; (2) existing slope configuration is acceptable only if bioengineering is used; and (3) slope needs to be flattened (generally requiring shift in limit of excavation).

Additional Analyses (Composite Slopes)

Additional slope stability analyses were performed using specific slopes for the riprap with the overall bank slope generally terminating at the limit of excavation. At locations where a satisfactory factor of safety could not be achieved using the available slope area (i.e., existing horizontal slope distance) or the existing slope configuration deviated from the average slope assumption, additional analyses were performed to determine the stability of the slope and the required shift in limit of excavation, if any, to achieve the desired factor of safety. Table 2-6.9 summarizes the desired riprap slope at the given stations as well as resulting restoration slope configurations based on results obtained from the analyses of composite slopes.

Along the East Bank from Station 512+00 to 514+00, additional analyses were performed in an attempt to determine a restoration configuration that would yield similar slopes in this area for aesthetic reasons and minimize the shift in the limit of excavation in this area. Based on existing slope dimensions, there was not enough room to construct a "stable" slope at Stations 512+00, 513+50, and 514+00. Additional analyses were completed to determine how much the limit of excavation must be extended.

Given these constraints, three options were examined that yielded an acceptable factor of safety (for slope stability):

- Option 1 – Riprap with a slope of 1.5H:1V and the remaining slope (bioengineering) at 2H:1.
- Option 2 – Riprap with a slope of 1.5H:1V and the first 3 vertical ft of bioengineering with a slope of 1.5H:1V with the remaining slope at 2.3H:1V.
- Option 3 – Riprap with a slope of 1.5H:1V and the first 3 vertical ft of bioengineering with a slope of 2.2H:1V with the remaining slope at 1.8H:1V.

The results are shown in Table 2-6.10. The final slope configurations used for the final design were determined based on consideration of the results of these geotechnical analyses in

conjunction with the restoration design parameters, and these final slope and restoration configurations are described in Section 2.9.1 and Appendix G.

Additional Analyses along West Bank from Station 507+00 to 510+00 (All Riprap)

Based on the focus group meeting (restoration group and hydraulics group) held on April 3, 2001, it was recommended that the armor height along the West Bank from Station 507+00 to Station 510+00 be adjusted from El. 975 ft to top of bank (see Section 2.9.1.2, Riverbank Armor). Table 2-6.11 summarizes the existing bank height and horizontal distance between the limit of excavation (top of bank) and the toe of the slope as the well as restoration options based on the results of the slope stability analyses.

As indicated in Table 2-6.11, within this region of the West Bank, the existing slope height varies from 4 to 7.5 ft. At Station 509+50, the elevation at the limit of excavation/top of bank is actually 1 ft below the required armor elevation of El. 975 ft. Adjustments in this bank height during restoration may be warranted.

If the armor slope were allowed to vary in this region, the riprap slope can vary from 1.3H:1V (for slope height of 4 ft) to 2.2H:1V (for slope height of 7.5 ft). If a constant slope were to be maintained, then the restored slope should be 2.2H:1V. The required shifts in the limit of excavation to accommodate the restored slope are also tabulated in Table 2-6.11. The required shift in the limit of excavation varies from 0 to 9.5 ft (Note: negative distance indicates that the existing area is greater than restoration requirement—the limit of excavation was not relocated where negative distance was indicated.)

Conclusion

The results presented in this section represent the second round of analyses that focused on assessing the stability of the existing slope and providing slope restoration options. The results were provided to Woodlot Alternatives as guidelines for finalizing the slope restoration plan. In cases where an existing slope needed alteration, more than one alternative was generally provided to Woodlot Alternatives to provide some flexibility in the final layout of the restoration plan. Therefore, the final selection of restoration options at each cross-section was based on a

combination of slope stability and restoration considerations. The slope stability results presented here were used as guidelines.

2.6.2.5 Assessment of Slope Stability Along Drainage Swale

This section summarizes the third set of slope stability analyses performed for Phase 1 for the final design submittal. The first round of analyses consisted of parametric analyses evaluating the impacts of friction angle, the cohesion of the soil, the presence of bioengineering, and the magnitude of the riprap slope. The second round of analyses present restoration recommendations along the river from Lyman Street Bridge to Station 514+00.

The intent of this third set of analyses was to summarize the existing slope layout within the drainage swale area and to assess/recommend possible restoration configurations and/or alternatives. All the analyses assumed that the top of bank armor is at El. 975 ft. Slope stability analyses were performed using Slope/W at drainage swale Stations 0+50, 1+00, and 1+50 as provided by Woodlot.

An approach similar to that used previously was adopted for the analyses at the drainage swale. Analyses performed for this iteration included the following steps:

- At every 50-ft interval, obtain the slope toe elevation (near centerline of drainage swale), top of bank (at limit of excavation) elevation (Elev. B), and horizontal distance of the slope based on a topographic map of existing condition.
- Based on the bank height (Elev. B – Elev. A) and the horizontal slope length (L), estimate average slope.
- Given the existing average slope, assess the restoration alternative for the given slope (revegetation, bioengineering, or shift of limit of excavation).
- Perform additional slope stability analyses if necessary.

The results of the analyses are summarized below.

Existing Slope Configuration Along the Drainage Swale

The elevations of the toe of slope and limit of excavation as well as the horizontal length of the slope are summarized in Table 2-6.12. Figure 2-6.17 shows the parameters summarized in the

table. Table 2-6.12 summarizes the geometry/configuration of the existing slope within the drainage swale by summarizing the slope height and slope horizontal distance. Because the drainage swale is located along the east bank of the river, soil parameters for east bank are used in the slope stability analyses.

Figure 2-6.18 shows the actual cross-sections as well as the cross-sections assumed in the Slope/W analyses. This figure illustrates that within the drainage swale, the slope is relatively constant from the centerline to the limit of excavation.

Assumptions for the slope stability analyses included:

- River water level at riverbed.
- Top of till at El. 951; top of bedrock at El. 940.
- No surcharge.
- 1.5 ft thick riprap along riverbed and along river bank up to El. 975.
- Constant slope from limit of excavation down to toe of the riverbank.
- For soil above El. 951 ϕ' = 32 degrees.

Restoration Options along the Drainage Swale

Because the slope remains relatively constant within the riprap zone and the remaining bank slope, the results presented in Figure 2-6.15 of the second set of slope stability analyses from Section 2.6.2.4 can be used. Along the north shore of the drainage swale, the slopes are generally shallower than 3H:1V and the slope heights are generally below 9 ft. Given this configuration and previous parametric analyses, revegetation with riprap up to El. 975 ft along the north shore of the drainage swale is appropriate.

Along the south shore, constant slope can also be maintained within the riprap zone and the remaining slope section. Although the slope height calculated based on the limit of excavation shows a slope height below 14 ft, at three sections (0+50, 1+00, and 1+50), the existing slope actually extends beyond the limit of excavation. To verify that the additional slope height beyond the limit of excavation will not impact the overall slope stability adversely, three slope stability analyses were performed to evaluate each section along the south bank. Based on the results, the south bank can also be restored using revegetation with armor up to El. 975 ft. Restoration options and restored slope configurations are summarized in Table 2-6.13.

2.6.2.6 Evaluation of Impacts of Other Loading Cases on Slope Stability

This section summarizes the final set of slope stability analyses performed for Phase 1. The first round of analyses, presented in Section 2.6.2.3, consisted of parametric analyses evaluating the impacts of friction angle, the cohesion of the soil, the presence of bioengineering, and the magnitude of the riprap slope. The second round of analyses, presented in Section 2.6.2.4, provided restoration recommendations along the Phase 1 area. The third set of analyses, presented in Section 2.6.2.5, summarized the existing slope layout within the drainage swale area and assessed/recommended possible restoration configurations and/or alternatives. This section evaluates the impact of seismic loads and changes in groundwater and river water levels on the factors of safety presented earlier (thus considering other loading cases).

Analyses Performed and Results

In the first three sets of analyses (Sections 2.6.2.3 to 2.6.2.5), one loading case was considered. Based on the EE/CA definition, this loading case can be classified as short-term with a required factor of safety of 1.3; however, the results presented in the first three sets of analyses (Sections 2.6.2.3 to 2.6.2.5), a design factor of safety of 1.5 was used. This higher value was used because it was uncertain if this assumed loading condition is indeed the constraining case. The intent of this set of analyses is to evaluate other loading cases and to verify if the recommendations require revision. Analyses performed for this iteration included the following steps:

The most critical slope configuration (combination of high slope and steep slope) from each bank was selected. The logic is that if the most critical slope can sustain other loading cases with an acceptable factor of safety, the remaining slope should be also be acceptable under other loading conditions. Three specific slope locations were selected:

- Station 512+50 (east bank, revegetation).
- Station 514+00 (east bank, bioengineering).
- Station 505+50 (west bank, revegetation).

At each location, the cross-section dimensions were based on cross-section drawings developed jointly by Hart Crowser and Woodlot. Those cross–sections are included in the drawings. Table 2-6.14 summarizes the slope geometry.

At each section, the following cases are considered:

- **Case A** – No water in river with steady state flow in river (far field water elevation of 973-ft) – Long-term condition ($FS_{required} > 1.5$).
- **Case B** – Case A with surcharge of 300 psf at the top of bank – Short-term condition ($FS_{required} > 1.2$).
- **Case C** – Case A with seismic load with coefficient of 0.10 – Long-term dynamic ($FS_{required} > 1.0$).
- **Case D** – No water in river with elevated groundwater in bank (rapid drawdown, El. 975-ft) – Short-term condition ($FS_{required} > 1.2$).
- **Case E** – Case D with surcharge of 300 psf at the top of bank – Short-term condition ($FS_{required} > 1.2$).
- **Case F** – River water level at El. 975 – temporary flood condition ($FS_{required} > 1.2$).
- **Case G** – River water level at El. 971 (3-ft above bottom of river – El. 968-ft) – Long-term condition ($FS_{required} > 1.5$).

Figure 2-6.19 shows the problem setup for cases A, B, and C; Figure 2-6.20 shows problem setup for cases D and E; Figure 2-6.21 shows the problem setup for Case F; and Figure 2-6.22 shows problem setup for Case G. The assumed soil properties are summarized in Table 2-6.15. The results of analyses outlined above are summarized in Table 2-6.16. Overall, the three selected critical slope locations yielded an acceptable factor of safety under all loading conditions.

2.6.2.7 Slope Stability Analyses - Conclusions

Four sets of slope stability analyses were performed as part of the final design to provide guidelines for the restoration plan. The first set of analyses, presented in Section 2.6.2.3, consisted of parametric analyses evaluating the respective impacts of friction angle, the cohesion of the soil, the presence of bioengineering, and the magnitude of the riprap slope. The results from this analysis indicate that the combination of the assumed soil friction angle and cohesion will have a significant impact on the factor of safety. The boring results indicated differences in the soil bank properties along the east and west bank. The weaker soil encountered along west bank was incorporated in the slope stability analyses (along the west bank). The parametric

analyses also revealed that the use of bioengineering is beneficial only for steeper slopes. For slopes flatter than 3H:1V, the benefit of bioengineering is negligible. The results also suggest that the EE/CA slope stability analyses results are more applicable to east bank slopes and were therefore not used to evaluate slopes located along the west bank.

The second round of analyses, presented in Section 2.6.2.4, provided restoration recommendations along the river from Lyman Street Bridge to Station 514+00. The existing slope geometry along the river, the slope stability, and restoration recommendations are presented in Section 2.6.2.4. Restoration options included: (1) maintain existing slope with revegetation, (2) maintain existing slope with bioengineering, and (3) alter slope with possible change in limits excavation.

In general, all the restoration options from a slope stability point of view were included to allow some flexibility in the design and layout of the restoration plan.

The third set of analyses, presented in Section 2.6.2.5, summarized the existing slope layout within the drainage swale area and assessed/recommended possible restoration configurations and/or alternatives. In general, within the drainage swale area, revegetation and maintaining the existing slope will achieve an acceptable factor of safety in terms of slope stability.

The last set of analyses, presented in Section 2.6.2.6, examined the slope stability of other loading conditions by evaluating the impact of seismic loads and changes in groundwater and river water levels. The first three sets of analyses (Sections 2.6.2.3 to 2.6.2.5) assumed one loading condition – short-term condition. In those analyses, the recommended restoration options have a factor of safety of 1.5, approximately 15% higher than the required factor of safety of 1.3. A higher factor of safety was used in the first three sets of analyses because only one load case was considered and it was unclear if this one case was the constraining case. In the fourth set of analyses, seven loadings were considered. Three critical slopes were selected on the basis of slope height and slope steepness along the east and west banks. Analyses indicate that these three critical slopes achieve the required factor of safety under all seven load cases. Based on this result, the remaining slopes should be acceptable as well under all loading conditions.

Upon completion of the geotechnical analyses described above, the design team developed final slope configurations to be used in the design based on consideration of the geotechnical analysis results and restoration requirements. This process and the final slope configurations used for the design are described in Section 2.9.1 and Appendix G.

2.7 HYDRAULICS ANALYSIS

Hart Crowser performed hydraulic modeling to provide technical support for the Phase 1 design. The model of the river was developed using the USACE Hydrologic Engineering Center River Analysis System (HEC-RAS) software. The model was used to estimate hydraulic conditions (e.g., stage, velocity) for use in construction methods analysis and channel design.

Four appendices, Appendices B, C, D and E, provide backup information for the hydraulics design analyses. These appendices are referenced specifically in the discussion that follows.

2.7.1 Hydrology

2.7.1.1 Goal of Analysis

To model hydraulic conditions in support of the 1.5-Mile Reach remediation design, it was necessary to estimate the hydrologic input to the system. Flow rates were estimated for a number of defined flow conditions ranging from the average annual flow up to the 100-year flood to represent both low-flow and flooding conditions. Because of the scale of modeling, it was also necessary to determine the distribution of runoff and tributary input to the system. In addition, the duration of individual floods had to be evaluated to support the sheet pile cost comparison.

2.7.1.2 Data Sources

Data were collected from a variety of government and private sources to evaluate hydrology. Sources included:

- U.S. Geological Survey (USGS) stream flow annual peaks at Coltsville, Massachusetts (USGS, 2000, 99-0654). Data set included the peak flow rate for each year.

- USGS quad maps of the Housatonic River drainage area in the vicinity of Phase 1 (USGS, 1984, 99-0651; 1987, 00-0149; 1988, 99-0652; 1991, 00-0153; 1997, 00-0148; 1997, 99-0653) were used to estimate tributary drainage areas.

- Blasland, Bouck and Lee, Inc. (BBL) HEC-2 hydraulic model and accompanying reports (BBL, 1991, 99-0625; 1992, 02-0038; 1996, 04-0004; 2000, 99-0626; 2000, 08-0097). Flow rates used in the model were based on the hydrologic evaluation described in the reports.

- Federal Emergency Management Agency (FEMA) Flood Insurance Study (FEMA, 1987, 00-0350) of the Housatonic River at Pittsfield contained estimates of peak flows.

- EPA provided hourly flow rates recorded at the Coltsville gaging station from 1988 to 1998 (EPA, 2001, 99-0647).

2.7.1.3 Methods of Analysis

To evaluate flow rates, two general methods were used. They were Log Pearson III analysis of annual series data and partial duration series of hourly data.

The annual series data from the Coltsville station (USGS, 2000) were used to estimate the return interval for the larger floods. The Log Pearson III (LPIII) method estimates the probable return interval associated with a specific flow rate based on statistical analysis of the data set. The accuracy of the LPIII method decreases substantially for floods with a 1-year return interval and cannot be used to estimate return intervals less than 1 year.

To evaluate the more frequent floods, a partial duration analysis of the hourly flow data recorded for 1988 to 1998 was performed. Instead of evaluating only the peak flood in a year, a statistical evaluation was performed for all events having flow rates above a specified threshold. The tabulated data were ranked, and return intervals were estimated based on a statistical analysis of occurrence frequency.

Tributary inputs along the river were evaluated by comparing drainage areas. A qualitative assessment of the watershed down to Woods Pond Dam seemed to show a consistent drainage pattern with higher elevation lakes feeding tributaries that flowed to the river. Flow contributions from drainage areas that did not fit this pattern were evaluated individually.

Drainage areas were determined by mapping drainage units on USGS topographic maps of the area (USGS, 1984, 1987, 1988, 1991, 1997, 00-0148; 1997, 99-0653).

Flow increment factors (ratio of drainage areas) at tributary input locations were compared against those used in the BBL HEC-2 model. In addition, the locations of tributary inputs in the BBL model were verified (BBL, 2000, 99-0626; 2000, 08-0097). Available data in the FEMA study (1987) were also used to estimate flow rates. The flow rates estimated from LPIII and partial duration analyses represent flow at the Coltsville gauging station located approximately 2 to 3 miles upstream of Phase 1. The BBL HEC-2 model incorporated flow increases from tributary input along the river by assigning incremental flow increase locations throughout the model (BBL, 2000, 99-0626; 2000, 08-0097). The flow increase at each location was estimated by comparing the drainage area of the river at the increase location with the drainage area at the Coltsville gauging station.

The durations of flows associated with storm events were estimated from water year hydrographs plotted from the hourly flow record at the Coltsville gauging station (period of record 1987 to 1998). Threshold values were set, and flow duration was recorded for each flood that exceeded that threshold. Duration was estimated from the width of the flood peak at the given threshold value. An initial estimate of 500 cubic feet per second (cfs) was used. The choice of a threshold value is generally an iterative process. Ideally, the threshold value is less than the lowest flow rate of interest so that return frequency is interpolated, not extrapolated, from the data set. Average duration was estimated for flows of 200, 400, 600, and 800 cfs to generate a table of flow rate vs. duration for use in evaluating overtopping costs. Duration was estimated from the width of the flood peak at a given flow rate.

2.7.1.4 Results

Peak Flows

Peak flows for floods ranging from an annual average to the 100-year flood are listed in Table 2-7.1. Floods having return interval of 2 years or greater were estimated based on the LPIII analysis of annual series data. Flows ranged from 1,686 cfs for the 2-year flood to 7,180 cfs for the 100-year flood. Details of the LPIII analysis are in Appendix B, Table B-1.

Partial duration series analysis was used to estimate flows for the 0.125-year, 0.25-year, 0.5-year, and 0.75-year floods. The lowest flow rate of interest (0.125-year flood) was estimated at about 380 cfs, which is slightly lower than the 500 cfs threshold value used in the analysis. Although it is generally preferred to have the threshold below the smallest flow rate of interest, the estimate was assumed to be close enough not to require reevaluating all the floods using a lower threshold value. Details of the partial duration series analysis are in Appendix B, Table B-2.

The 1-year and the 1.5-year floods were estimated from both partial duration and annual series results because both methods are suspect at those return intervals. The 1.5-year flood was calculated as a weighted average of the results from each method. The 1-year flood was estimated as the average of the 0.75-year flood and the 1.5-year flood. Partial duration is applicable for these return intervals, but with just 11 years of data, only 11 data points are available to estimate the 1-year flood. For the annual series, there is little confidence at these return intervals. The method is most accurate near the 2-year flood, and the accuracy is greatly reduced approaching the 1-year flood. The method underpredicts flow rate at these return intervals.

Flow Increase Increments

Flow increment ratios and drainage areas calculated for this analysis are listed in Appendix B, Table B-3. The area between tributaries was assumed to contribute flow at the next downstream confluence.

Drainage areas were designated as follows:

- The East Branch Housatonic River at Coltsville.
- Upstream of Lyman Bridge (just upstream of Phase 1).
- Confluence with the West Branch Housatonic River.
- Confluence with Sacket/ Sykes (S/S) tributaries.
- Confluence with Farnham/Sandwash (F/S) tributaries.
- Confluence with Yokun Brook (YB) tributary.
- Woods Pond.

Estimated flow rates and flow increment ratios were compared against values used in the BBL HEC-2 models (BBL, 2000, 99-0626; 2000, 08-0097). Flow estimates and increment ratios calculated for this analysis appeared to be in general agreement with those used in the HEC-2

study (see Appendix B, Table B-4.1). The Design Team assumed that this comparison justified the use of a linear relationship between flow rate and area. However, a review of the FEMA study showed estimated input for the 100-year flood from the West Branch tributary was about 60% of the estimate based on areal analysis (see Appendix B, Table B-4.2). Qualitatively, the Design Team determined that this difference may be a result of higher potential for attenuation in the West Branch drainage system. There are two large lakes in the lower part of the West Branch drainage area that may act to attenuate peak flows. Lakes are generally higher in the East Branch drainage area and would not provide the same attenuation. It was, therefore, assumed that the FEMA estimate was more representative of the West Branch input, and the flow increase increment at the West Branch was reduced accordingly. Subsequent increments were also decreased to reflect the decreased input from the West Branch.

Potential Work Suspension Duration

Estimates of work suspension duration by water year are contained in Appendix B, Table B-5. These estimates represent the probable period of work suspension during floods. Flow duration ranged from approximately 1 to 4 days for flow rates from 800 (4 per year) to 200 cfs (12 per year), respectively. It is important to recognize that these estimates represent average conditions. Events recorded in the hourly flow data included floods where a flow rate of 800 cfs was maintained or exceeded for nearly three days, and floods where a flow rate of 200 cfs was maintained or exceeded for over a month.

Resulting Flow Estimates for HEC-RAS Input

Based on the analysis performed above, the hydrologic flow estimates developed for the HEC-RAS modeling are presented in Table 2-7.1. Peak flow estimates for the desired return events and stations along the Housatonic River are used as input for the HEC-RAS model, which is described in Section 2.7.2.3.

2.7.2 Hydraulics

2.7.2.1 Goal of Analysis

In support of remediation design efforts, hydraulic modeling was performed to evaluate the impacts of construction methods and final design on flood stage and frequency. In addition, parameters for use in the design of bed and bank protection were evaluated based on hydraulic conditions.

2.7.2.2 Data Sources

Data were collected from a variety of government and private sources to evaluate hydraulics. Sources included:

- BBL HEC-2 hydraulic model and accompanying reports (BBL, 1991, 1992, 1996, 2000, 99-0626; 2000, 08-0097) that described channel and bridge geometry and reported flood stage for two models—a large-scale model, and a design-scale model.
- FEMA Flood Insurance Study (FEMA, 1987) of the Housatonic River at Pittsfield included elevation estimates of top and bottom of bridges, and estimates of flood stage. It also included calculated water surface elevation (WSEL) for the 10-, 50-, 100-, and 500-year floods using SCS WSP2 water-surface profile computer program, a one-dimensional hydraulic model.
- Bridge plans obtained in 2000 from the City of Pittsfield for Lyman Street, Elm Street, Dawes Avenue, and the upstream Pomeroy Avenue bridges. Plans included top and bottom elevation of bridges plus bridge opening geometry.
- Estimates of flow in the river were developed as described in the Hydrologic Analysis section.

2.7.2.3 Methods of Analysis

HEC-RAS requires two types of data input: hydrologic data (peak flow estimates for the desired return events) and geometry data to characterize channel cross-sections and bridges. Once these values have been input into the software program, a “plan” is created and executed to determine the hydraulic conditions (e.g., water surface elevations, velocity) for different flow events.

A large-scale model and a design-scale model were developed. Plans were developed within the design-scale model to estimate flood stage and other parameters required to assess scour around sheet pile walls and to estimate hydraulic parameters to design the bed and bank armor.

Model Development

The HEC-RAS model was developed using historical river data and precipitation data, previously developed HEC-2 models of the river, and recent bathymetric survey and monitoring data of the river throughout the 1.5-Mile Reach.

Assessment of Existing HEC-2 Models

BBL developed two HEC-2 models for the Housatonic River. One was a large-scale model of the Housatonic River covering the segment of the river from a gauging station at Coltsville to the spillway of the Woods Pond Dam. The other model was a design-scale model representative of the Upper ½-Mile Reach. The electronic files, output and associated reports were reviewed to obtain data regarding the HEC-2 model (BBL, 1991, 1992, 1996, 2000, 99-0626; 2000, 08-0097).

A 1.5-Mile Reach design-scale model was necessary as a predictive tool for design, to evaluate Housatonic River flow on a scale appropriate for design. The aforementioned large-scale model was based on cross-sections that were spaced appropriately for a large-scale model, but too widely to provide sufficient resolution for the 1.5-Mile Reach. The Upper ½-Mile Reach design-scale model was apparently intended for use in the Upper ½-Mile Reach remedial design and therefore does not cover the 1.5-Mile Reach.

The assessment of the models included the following:

- Verification of cross-section data using existing topographic maps.
- Validation of the geometry of bridges.
- Review of boundary conditions used in each model to identify hydraulic control points.
- Review of channel roughness coefficients.

Cross-Sections

The cross-section spacing and location were checked against USGS quad maps to assess adequate representation of the river. For the large-scale model, cross-sections that incorporated abutments at bridges were taken from the HEC-2 data. For the design-scale model, the new survey data was used to develop the cross-sections at Elm Street and Lyman Street bridges.

Because of model assumptions and limitations within HEC-RAS, it is important to accurately characterize the river floodplain. Where floodplain geometry is not fully represented, the predicted stage may be overestimated due to limited section conveyance or underestimated because of a lower overall roughness coefficient. In addition, inclusion of floodplain area where development has occurred could introduce significant error because flow around large roughness elements (i.e., buildings) is a more complex condition than HEC-RAS was designed to consider. The Design Team assumed that available cross-section data was adequate if (1) it extended beyond the 100-year flood width (as modeled by HEC-RAS), or (2) the addition of floodplain area would not improve model accuracy. Reaches with cross-sections not meeting these criteria were assessed individually.

Bridge Details

The modeled values for top of road and bridge bottom chord were compared against the FEMA study assumptions (FEMA, 1987) and against the bridge dimensions on plans obtained from the City of Pittsfield (City of Pittsfield, 1986, 06-0125; 1911, 01-0465; 1992, 07-0072; 1996, 07-0071). Table C-1 in Appendix C presents the bridge geometry data. When necessary, bridge details in the existing model were adjusted to match the dimensions shown on plans. If there was a discrepancy between reported bridge geometry that could not be verified against bridge plans, the more conservative values were used; i.e., the lowest elevation for bridge bottom chord and the highest elevation for bridge top.

At bridges, contraction and expansion are important components of hydraulic conditions. Energy is lost in the process where water contracts to go through the bridge opening and then expands to refill the channel. Two components in the model are used to describe the energy loss associated

with this transition. These components are contraction/expansion length and contraction/ expansion coefficients.

Contraction and expansion lengths are the approximate lengths over which water adjusts to pass through the bridge and then return to normal flow within the channel. They correspond with the lengths of eddies or backwater along the bank upstream and downstream of a bridge. Lengths were based on ratios reported in Appendix B of the HEC-RAS 2.2 instruction manual (USACE, 1998, 99-0644). The ratio for each bridge is based on slope, Manning's 'n' for overbank versus channel, and bank width versus floodplain width. An expansion ratio of 2:1 was chosen for all bridges because it was near the average for the study, and the values from the table were closest to this value. For the contraction ratio, 1.2 to 1.4 was used based on table values.

Contraction and expansion coefficients were used to calculate head loss at the bridge. Appendix B of the HEC-RAS instruction manual suggests that for the study, most bridges had a contraction coefficient of 0.1. Average of expansion coefficients from the table appear to be between 0.1 and 0.3. The main section of the manual suggests that for smooth transitions, the coefficient of contraction be 0.1 and the coefficient of expansion be 0.3. These values were used in the bridge analysis, since they appeared to represent the bridge conditions. The river reach appeared to be fairly well confined, and most bridges are entrenched with little side constriction, suggesting that transitions would be rather smooth.

To incorporate these effects into the model, ineffective flow areas were set and the contraction/expansion coefficients were set. The ineffective flow areas function to exclude flow from a certain block of the cross-section until flow reaches a certain stage. This way, the eddy areas along the contraction or expansion length can be represented when flow is confined to the channel; then, once flow begins to go by the bridge, these areas begin to carry flow.

Boundary Conditions

Establishing boundary conditions is important to the accuracy of the model. The large-scale model was initially evaluated to verify its control point. Once validated, the large-scale model was used to simplify and focus the design-scale model by choosing a control point that was closer to Phase 1.

For the large-scale model, the boundary condition is critical depth at the Woods Pond Dam spillway. Critical depth calculations and the reported elevation of the spillway were checked (Appendix C, Table C-2). For the design-scale model, a probable control point was chosen just downstream of the Holmes Road Bridge. Cross-sections downstream of that point were removed from the model. If the stage at that section in the design-scale model matched that in the large-scale model, then that section was used as the downstream end of the design-scale model. If not, a new location, farther downstream, was evaluated until there was reasonable agreement in stage values.

Roughness Characteristics

The evaluation of roughness coefficient was based on a comparison against tabulated values (see Chow, 1959, 99-0219) for specific channel and floodplain types and by calculating a Manning's 'n' for the reported bed material using the following equations:

- Strickler equation: $n = D_{90}^{1/6}/26$, D_{90} in meters.
- USACE equation: $n = 0.036*D_{90}^{1/6}$, D_{90} in ft.

If the values used in the BBL HEC-2 model were similar to tabulated and calculated values, they were assumed to be representative and were used in the HEC-RAS analysis. If substantially different, they were replaced by tabulated or calculated values.

Validation of HEC-RAS

Once developed from HEC-2, the models in HEC-RAS were validated by comparing them with stage reported by FEMA, and BBL and on the construction detail drawings. In addition, information collected during a site visit by Hart Crowser staff and notes regarding previous instances of flooding were used to evaluate the modeling results.

Sheet Pile Cell Overtopping Frequency, Flood Stage, and Hydraulic Loading

The conceptual design strategy for the proposed cleanup action incorporates a series of "cells" constructed of sheet pile walls to isolate the active work area from the flowing river. Cleanup activities will proceed continuously throughout the year and will be subject to fluctuating river flows. To properly design the cells and prepare for potential effects on hydraulic conditions, the

HEC-RAS model was used to evaluate overtopping frequency, flood stage associated with cell placement, and hydraulic loading on the cell walls.

Overtopping Frequency

One of the key design elements involves specifying the elevation of the top of the sheet pile walls that form each "cell." Three primary factors influence the determination of the sheet pile wall top elevation. These factors include feasibility limits, construction costs for the walls, and delay costs associated with flood events that overtop the walls.

Feasibility Limits

The ability to drive piles and the ultimate drive depth may be limited by geology. Similarly, the feasibility of installing cantilevered sheet pile walls depends on soil conditions and ultimate drive depth. Feasibility is discussed in more detail in Sections 2.5.4 and 2.6.

Wall Costs

The wall will cost more as its height is increased. Similarly, the cost of the wall will increase substantially if it must be structurally supported with shoring braces. Secondary cost impacts may result from decreased efficiency working around shoring braces as well as increased dewatering costs.

Flood Stage Potential

Because sheet pile cells in the river may cause an increase in river stage, the extent and possible locations of flood stage increase were assessed. The potential for an increase in flood stage was evaluated by comparing flood stage with cells in place against the original river condition. A map of the project area was reviewed to determine where increased flood stage might be a problem.

Hydraulic Loading

To evaluate sheet pile design parameters, it was necessary to determine the static and dynamic load to which the sheet pile would be subjected. Static load was estimated from the flow depth. Load estimates were evaluated at the corner of the upstream face and the centerline sheet pile walls. At this location, static head is greatest (maximum depth) and dynamic head is greatest because there is no shielding effect of upstream deadwater. The combined load was represented in terms of equivalent static head, or water depth, at the sheet pile wall.

The static load component was calculated by subtracting the minimum channel invert from the flow stage. Dynamic load was calculated as a specific force and converted to an equivalent static depth of water. Specific force is a representation of the dynamic force associated with a cross-section of flowing water. Based on the principle of conservation of momentum, the specific force applied to upstream sheet pile wall is the difference in specific force at cross-sections just upstream and downstream of that wall. Specific force, in units of cubic feet of water, was converted to an equivalent head by dividing by upstream wall area.

This estimate assumes dynamic force is evenly distributed across the upstream sheet pile face. Although more of the force may be applied to the upstream corner, it was assumed that with the centerline wall and upstream face connected, the force would be distributed. In addition, the assumption is conservative for this evaluation because the sheet pile cells were designed with cantilever walls. If more of the force is applied to the braced corner section that would tend to reduce the load on the cantilever sections near the bank.

Sheet Pile Cell Scour Analysis

Parameters required for scour analysis around the sheet pile cells were also determined. Scour at a hydraulic structure can be related to a variety of processes including general scour, local scour, contraction scour, or abutment scour. General scour, the long-term decrease in bed elevation, was assumed to be negligible because there appeared to be a grade control of non-erodable bed material at the downstream end of Phase 1 (under Elm Street Bridge). Local scour, the decrease in bed elevation related to local hydraulic control, such as tidal outflow or dam drawdown, was

also assumed to be negligible because there did not appear to be any such condition near Phase 1. Only contraction scour and abutment scour were evaluated around the sheet pile cells.

Contraction scour is the decrease in bed elevation associated with channel constriction. It was calculated using the Laursen equation, which estimates scour depth by comparing the flow rate, channel width, and depth in the contracted and the upstream sections. Flow width was measured from HEC-RAS geometry and hydraulic analysis data. As stage exceeded the top of sheet pile, it was assumed that the quantity of flow passing through the contraction decreased. The Design Team represented this decrease by assuming that a portion of the flow spilled over the sheet pile wall. Because the sheet pile cells fill quickly once overtopped, this assumption will overestimate the quantity of water that bypasses the contraction and may underestimate potential scour depth. This was assumed a reasonable simplification because the intent of the analysis was to determine if significant scour potential existed, not necessarily to predict a specific scour depth. The analysis was performed for the sheet pile cell at Station 503+50, and upstream conditions were represented by parameters at Station 502+50.

Abutment scour occurs at hydraulic structures due to the increased turbulence generated along the structure wall. This type of scour occurs in addition to contraction scour and occurs right at the abutment wall. To evaluate abutment scour, the Liu, Laursen, and Froelich equations were used. These equations were developed for bridge abutments, but it was assumed that the sheet pile wall would be similar to the abutment. In addition, the equations are empirical and were developed for abutments in a sand bed. The results should be fairly accurate to slightly conservative because Phase 1 has bed material ranging from sands to gravels.

Parameters for Channel Armor Design

The main hydraulic parameters to be evaluated for armor design were velocity and depth. Other armor-design parameters are discussed in the Bed and Bank Protection section. Phase 1 was modeled using HEC-RAS, and velocity and depth were summarized. Because the results of the HEC-RAS model show that bridges tend to control water surface elevations through much of the river reach, the design was evaluated assuming that the Elm Street Bridge might be modified during the life of the project. The velocity and flow depth parameters were tabulated for three HEC-RAS modeling scenarios:

- Analysis based on current conditions.
- Analysis assumed that the Elm Street Bridge was removed. Within the HEC-RAS model, the bridge structure was represented by inputting bridge deck information, and the abutment structure was represented by a river cross-section with vertical banks. This scenario represented removal of the bridge deck and abutments by deleting the bridge deck information, ineffective flow areas, and the cross-sections at the bridge.
- Analysis assumed that the Elm Street catch point was removed. The river cross-sections in the vicinity of Elm Street are constricted and have a fairly flat slope compared to other sections (see Appendix C, Figure C-2). To evaluate the conditions if this control were removed, cross-sections from 300 ft upstream to 700 ft downstream of Elm Street were deleted from the model. This represents a condition wherein the channel is allowed to widen in the vicinity of Elm Street and scour to a bed slope similar to the general slope upstream and downstream of the catch point.

2.7.2.4 Results

Development of 1.5-Mile Reach HEC-RAS Model

Conversion of HEC-2 Models to HEC-RAS Models

Both the large-scale and Upper ½-Mile Reach design-scale models were successfully converted from HEC-2 models to HEC-RAS models. The large-scale model was used to assess boundary conditions for the 1.5-Mile Reach design-scale model. The Upper ½-Mile Reach design-scale model served as a starting point for the 1.5-Mile Reach design-scale model. Appendix E includes the model outputs.

Cross-Section

For the large-scale model, the cross-sections appeared to adequately represent the channel for the intended use of the model. There were approximately three cross-sections per mile of river between Phase 1 and the Woods Pond Dam. The cross-sections were checked against a USGS quad map, and the sections appeared to be good approximations of the local topography. They also appeared to represent the general character of the reach as they were located at a variety of sections including straight and meandering reaches, wide floodplains, and narrow valleys. The EE/CA report (WESTON, 2000, 07-0030) indicated the morphology of the river has changed very little since a dam was removed in the 1960s.

For the large-scale model, the predicted 100-year flood stage did not exceed the highest point in most of the cross-section. This was not the case for three sets of cross-sections. From evaluation of these cross-sections, it appeared that additional floodplain data would not improve model accuracy for the design reach. One set was not further evaluated because it was upstream of the design reach. A second set was in the vicinity of the Holmes Road and Pomeroy Avenue bridges where the cross-sections were at least as wide as the 100-year flood way (FEMA, 1987). This suggested that the cross-sections extended to where development encroached on the floodplain. Cross-sections in the third set, downstream toward Woods Pond, were already very wide (800 to 3000 ft). The Design Team assumed that addition of floodplain data to such wide sections would not significantly improve model accuracy.

For the design-scale model, the HEC-2 design-scale model was used as a starting point since the detailed set of cross-sections were upstream of the 1.5-Mile Reach. Detailed cross-sectional data were obtained for the 1.5-Mile Reach and entered into the design-scale model. Cross-section data at approximately 50-ft intervals throughout the 1.5-Mile Reach were input into the model. These survey data were obtained from an optical survey performed by the USACE in 1998.

For the design-scale model, the lateral extent of geometric data for many of the cross-sections was limited. However, they appeared to be adequate for the goals of the analysis. For the Phase 1 Design Reach, cross-sections extended into regions where development encroached on the floodplain. Additional floodplain data for the cross-sections down to Pomeroy Avenue Bridge may have improved accuracy within that reach. However, it would likely have had limited effect on results within the design reach, since HEC-RAS modeling results suggest that the Elm Street Bridge is a dominant hydraulic control point.

Initial comparison showed that the location of West Branch/East Branch confluence had a significant effect on flood stage elevation, because of limited model definition. The confluence is within an 800-ft reach, defined by only three cross-sections, where channel invert elevation decreases by nearly 4 ft. The location was measured from a topographic map of the area. Because there was not a surveyed cross-section at the mapped location, an interpolated cross-section was developed at that location from nearby surveyed cross-sections.

Bridge

Preliminary modeling results suggested that at higher flows the bridges generally controlled water surface elevation. The stage at each bridge was a function of the head loss across it as well as the water surface elevation just downstream of the bridge. Much of the water surface profile is backwater from the bridges. As a result, the hydraulic effects of bridges were carefully reviewed to incorporate their effects as accurately as possible. Bridge geometry data are contained in Appendix C, Table C-1.

Boundary

For the large-scale model, the downstream control point used in the HEC-2 model was confirmed by the Design Team review to be correct. The reported invert of the Woods Pond Dam spillway, and the calculated critical depth for the BBL model were verified.

For the design-scale model, the chosen downstream control point was normal depth at 400 ft downstream of Holmes Road Bridge. Water surface elevations, calculated for the 2-, 10-, 50-, and 100-year floods using the large-scale and design-scale models, were compared to one another. The stage for the design-scale model was about 3 inches higher than the estimate for the large-scale model. This suggested that the downstream control point for the design-scale model was valid.

Roughness

Manning's 'n' (roughness) values from the BBL HEC-2 analysis provided a reasonable representation of the roughness characteristics in the bed and on the floodplain. The values used in that model were similar to estimates from available resources. Estimated values of Manning's 'n' are listed in Table C-4, Appendix C. Calculated (assuming D_{90} = 1 inch) and tabulated (dredged channel, some weeds; Chow, 1959, 99-0219) estimates for channel bed roughness were between 0.02 and 0.027. These estimates were similar to the range of values used in the BBL HEC-2 analysis, so the n = 0.025 was used in the HEC-RAS model for the channel bed. The roughness coefficient was not increased to include effects such as channel alignment, section irregularity, or obstructions. Within the 1.5-Mile Reach, the river has been straightened and

sections made fairly uniform. From river reconnaissance, there appeared to be minimal debris or vegetation within the channel where the bed roughness coefficient was used. For the floodplain, the range of roughness values in the upper portion of the large-scale model were comparable to tabulated values for cleared land to land with medium dense vegetation (Chow, 1959). In the lower reaches, the roughness values were higher, comparable to heavy timber or dense willows (Chow, 1959). This seemed reasonable given the landscape. In the upper reaches of the model, the river runs through developed communities that have some vegetation and some cleared areas. In the lower reaches, the floodplain is a largely uninhabited valley that would likely have more dense vegetation.

Verification

The model was verified after its development. Because measured stream flow and velocity data were not available within Phase 1, other means of model verification were explored. Model results were verified by reviewing other models, incipient motion conditions, and anecdotal evidence, and by making field observations of hydraulic conditions.

Flood stage results were compared against results from BBL HEC-2 analysis and FEMA flood study. Stage comparisons are shown in Table C-5. There are notable differences in stage estimates due to differences in model assumptions and methods. Comparison of HEC-RAS stage estimates to those from the FEMA study suggests that cross-section details, calculation methods, and roughness coefficients may have resulted in the differences in model results. FEMA and HEC-RAS stage estimates were in good agreement (as low as 0.2-ft difference) at some locations between Dawes Avenue and the confluence of the East and West Branches. The results are widely divergent at Elm Street. The difference in the predicted flood stage is fairly constant upstream of Elm Street. This may reflect differences in calculation methods and cross-section data in the vicinity of Elm Street The FEMA study assumed subcritical flow and a uniform bed slope, whereas HEC-RAS can include supercritical flow evaluation and irregular bed slope. HEC-RAS predicted supercritical flow just downstream of Elm Street Bridge. Compared to the FEMA study, this resulted in lower WSEL at the bridge, and somewhat lower WSEL in the upstream backwater. It is assumed that the difference in results is more significant for the 10-year storm because smaller storms are more likely impacted by differences in channel geometry.

Alternately, the FEMA study generally predicts WSEL higher than that estimated by the HEC-RAS study, because higher roughness coefficients were used in that study.

The stage difference between the HEC-RAS and HEC-2 studies may be accounted for by the additional cross-section detail that was added to the HEC-RAS model from Lyman Street Bridge to Pomeroy Bridge. The Elm Street Bridge appears to be a hydraulic control that is not adequately accounted for in the BBL HEC-2 model. Immediately downstream of Elm Street, the models show reasonable agreement (0.3-ft difference). However, immediately upstream of the bridge, the HEC-RAS stage estimate is 4 ft higher and remains at a constant 2 ft higher farther upstream. This suggests that the new cross-section data at Elm Street may have created a backwater not accounted for in HEC-2, which maintains a constantly higher WSEL in the reach upstream of the bridge. Evaluation of incipient motion conditions was also used to verify model results. It has been suggested that for many rivers, the bankfull discharge is often the dominant discharge associated with significant grain mobility (Montgomery and Buffington, 1993, 99-0638). Studies of natural rivers suggest that the bankfull discharge is normally associated with a 1- to 5-year flood event. For the fine to medium gravel bed sediments typically found in this reach, critical shear stress is approximately 0.1 pound per square foot (lb/ft^2) as estimated by Lane (1953, 99-0634). From HEC-RAS results, the critical shear stress is reached during flows that exceed the 1- to 2-year events. The coincidence of sediment mobilization with the 1- to 2-year events suggests that model results are representative of hydraulic conditions within the design reach.

Another method of evaluating model accuracy is to assess bridge overtopping. Initial results showed that many of the bridges in the reach were overtopped during the 100-year flood, and that many were probably designed to pass only the 10-year flood. The FEMA study (FEMA, 1987) reported that floods in 1938 (40-year event) and 1949 (35-year event) caused severe damage in municipal and residential areas. This suggests than even a 40-year event can result in significant out-of-bank flow. In addition, the FEMA study showed that the Newell Street, Lyman Street, and Dawes Avenue bridges are all overtopped by the 50-year flood (FEMA, 1987). The Dawes Avenue Bridge plans suggest that it was designed for a 10-year flood (see Table C-1, Appendix C). This evidence corroborates the reliability of the model results.

In addition to these evaluations, Hart Crowser visited the river reach to evaluate hydraulic conditions. The characteristics of the river reach (location of backwater conditions and riffle areas) as represented in the model were found to be accurate.

The model was deemed representative of the reach because it appeared to accurately represent incipient motion conditions and was validated by bridge overtopping conditions and a site evaluation. Although there were significant differences in predicted flood stage when compared to other modeling studies, the HEC-RAS result appears to be the most representative of actual conditions.

Further Verification Based on Sediment Transport Studies

ZZ Consultants has performed studies of sediment movement in the Housatonic River as a subcontractor to WESTON on the Rest of River Team. Modeling methods were discussed with ZZ Consultants at focus group meetings, including a discussion of the results of their field and flume test data. The results of the sediment flume modeling were further reviewed and incorporated into the design team's analysis of scour for the in-river structures (wing deflectors and boulder clusters).

Sheet Pile Cell Overtopping Frequency, Flood Stage, and Hydraulic Loading

Overtopping Frequency

Flood stage and overtopping frequency for sheet pile cells were assessed by adding blocked obstructions to HEC-RAS cross-sections. Obstructions occupied approximately half of the channel width and were placed to block the side of the channel that appeared to have the most capacity. Obstructions were assumed to be 300 ft long and were placed at three locations: Station 500+00 to 503+00 (just downstream of the Lyman Street Bridge), Station 503+50 to 506+50, and Station 511+00 to 514+00 (at the end of the Phase 1 design). Assessing flood stage at these three locations gave an indication of the possible range of stage by evaluating conditions at both ends of the Phase 1 Reach. Cell placement should also represent the worst-case condition for evaluating scour because they were in the higher velocity locations within the reach.

Table C-3 shows the data used to help select a wall height based on the frequency of overtopping. This analysis qualitatively considers the incremental cost of building a higher wall compared to the decreasing cost of delays as overtopping frequency decreases with wall height. Based on the total number of lost work days, an elevation of 976 is selected because only four days of lost work would be expected. Raising the elevation to 977 feet would reduce lost days to two days; therefore, the benefits of constructing a wall higher than 976 feet are expected to be minimal.

The top-of-wall elevation includes a 15-ft wide rectangular notch with invert at El. 975 ft at the downstream perpendicular face. Water levels will not be the same at the upstream and downstream faces of the sheet pile cell due to head losses. The notch allows the cell to fill from the downstream face, decreasing turbulence and erosion within the cell. Based on the standard weir equation, the notch was designed to allow water to flow into the cell and fill a quarter to half of the cell volume within an hour. The elevation of the notch is based on a decrease in stage along the length of the containment cell, due to flow constriction. The cell will be overtopped first at the notch, when the river elevation at the upstream face is approximately El. 976 ft. Along with groundwater inflow (the dewatering system will be shut off when overtopping is imminent), this will partially fill the cell, minimizing scour of the excavation when water begins to overtop the other walls. If the downstream notch proves ineffective or impractical in the field, its use will be discontinued.

Based on the analysis, it was determined for the final design that the tops of the sheets would be set at elevation 976 ft, with a notch at elevation 975 on the downstream perpendicular face. Based on the model, overtopping of the sheets will occur at a river flow (at Lyman Street) of 976 cfs (corresponding to flow of approximately 803 cfs at Coltsville).

Flood Stage

The hydraulic analysis showed that flood stage would be increased with the cells in place. Table C-6 shows estimates of flood stage and the incremental increase compared to existing conditions. Areas that may be affected by the flood stage increase are shown in Figures C-1a and C-1b. The highest flood stage increase is 1.5 to 2.0 ft, associated with the 0.5- to 1-year floods. However, this flow is still within the channel banks so the increase is inconsequential. The most significant

increase is in the stage for the 10-year flood. Under existing conditions, the 10-year flood stage in the vicinity of Lyman Street Bridge is approximately 981 ft. At this level it is approaching the elevations of building foundations along the north bank of the river. With the sheet pile cells in place, the flood stage increases approximately 0.4 ft at the peak of a 10-year flood.

The river fills its banks at approximately elevation 978 ft. As stage increases above that elevation, the low-lying area along the south bank at stations 503+00 to 504+00 and the area south of the upstream end of Day Street Slough will likely experience flooding. In addition, the low area to the northwest of station 510+00 to 512+00 may also experience flooding. In these regions, the potential increase in flooding associated with sheet pile installations will be approximately 0.75 ft based on analysis of the 5-year flood. During a 10-year flood, the flood stage is nearly 981 ft elevation. At this stage, the water covers the parking lot and approaches buildings along the north side of the river from station 502+00 to 508+00. The potential increase in flood stage in these areas is about 0.4 ft. Flows less than the 10-year flood do not appear to reach buildings. Flows higher than that are increased by tenths of feet when the flood stage is 4 to 5 ft higher than the building foundation. Within the potential flood areas located south of the Day Street Slough and west of station 511+00, the extent of the low-lying areas is not completely defined by the detailed survey information. The exact extent of the flood potential in these areas is therefore unknown.

Currently planned corrective actions are to place sandbags as necessary and with USACE and EPA approval along these low areas at the top of the riverbank to minimize increased flooding.

Hydraulic Loading

The equivalent head is listed in Table C-7. Hart Crowser determined equivalent head at the three sheet pile cell locations described previously, and used the maximum values for sheet pile design. Total equivalent head estimates were between 8.5 and 10.5 ft at the flow rate associated with sheet pile overtopping. Some factor of safety should be considered to account for the potential variation of head as water spills over the sheet pile. Results from the analysis with the sheet pile cell at station 503+50 suggest that dynamic force in this area may be very significant. At overtopping, the estimated equivalent head from dynamic force was nearly 5 ft, whereas at other locations it was only about 2 ft. Because more of the force is associated with the dynamic

force, the structural integrity of the corner is of greater significance in this area. The dynamic force may shift and concentrate at the corner, and the sheet pile structure needs to be able to distribute the load.

However, the dynamic hydraulic loading forces were not included in the final design, based on the fact that additional support for the upstream sheet will be provided by the centerline sheet pile and by the bank. Additionally, during construction, excavation activities near the upstream sheet pile wall will be carefully inspected by the Engineer, and efforts will be made to minimize the length of time the excavation remains open immediately downstream of the upstream wall. Excavation will be not be conducted during periods of high water. Additional riprap material will be temporarily placed on the inside of the wall to provide additional support if necessary.

Sheet Pile Scour Analysis

Scour analysis was performed using the cell configuration at station 503+50 to 506+50. Analysis parameters were estimated using the conditions observed at station 502+50. Contraction scour analysis suggested that 3 to 4 ft of material might be removed if left unprotected (see Table C-8). The analysis was performed for flows corresponding to 0.25-, 0.5-, and 5-year floods. The scour estimate was the smallest for the 5-year flood. Because the method overestimated the quantity of flow bypassing the contracted section, it may underestimate the potential scour depth, particularly for larger flows. However, from these results it can be concluded that scour potential exists.

Abutment scour was also evaluated. All three equations predicted significant scour depths of 15 to 20 ft, and results were in general agreement (see Table C-9). Results show that abutment scour should be considered in the design of sheet pile cells, but are not intended to be an estimate of actual scour depth. Bridge abutment scour equations are intended to be very conservative and estimate maximum potential scour because of the cost associated with failure. In addition, these equations were developed from laboratory testing with little or no field verification.

Determining Hydraulic Parameters for Use in Channel Protection Design

HEC-RAS modeling scenarios were successfully run for the three scenarios previously described. Evaluation of water surface profiles suggested that the channel configuration at the

Elm Street Bridge controls flow in the lower part of the design reach. Depth and velocity analyses suggested that in the upper part of the design reach, the channel capacity might also affect flow/stage relationships.

Depth Analysis

Figures C-2, C-3, and C-4 show water surface profiles for each of the three scenarios. Figures C-5, C-6, and C-7 show the corresponding depth profiles. Data are included as Tables C-10 and C-11. The shape of the curve shows a backwater from Elm Street Bridge. The nearly level profile suggests that the water level is controlled at Elm Street Bridge. In the second scenario with Elm St Bridge removed, the same backwater condition is still evident. This suggests that the bridge structure controls the water surface elevation to some degree, but the associated "catch point" (cross-section and uncharacteristically flat bed shown in Figure C-2) is the main control. With the bridge removed, flow depth decreased by only 3 to 9 inches for all flow rates analyzed. However, in the third scenario, with the catch point removed, flow depth decreased by 0.5- to 2-ft just downstream of Lyman Street Bridge and 3 to 5 ft just upstream of Elm Street Bridge.

Velocity Analysis

Figures C-8, C-9, and C-10 show velocity profiles for the design reach. The higher velocities occur in the regions just downstream of Lyman Bridge (station 500+00 to 502+00) and at the end of the Phase 1 of construction (station 510+00 to 514+00). This velocity distribution is associated with constricted channel sections associated with bridges. The region just downstream of Lyman Street Bridge is somewhat constricted with high banks. Flood flows remain within the bank and velocities are generally high. From station 502+00 to 510+00, the river has more access to its floodplain. Higher flows spill out into the floodplain and velocities decrease. As the channel exits Bend B, the banks begin to get taller, the flow is forced back into the channel, and velocities increase. In the regions where the flow is generally contained in the channel, velocity increases with flow rate and the 100-year flow has the highest velocity. In the middle of the reach, velocities peak when the flow is contained (during 10- to 50-year floods) and then decrease as the water spreads over the floodplain (during 100-year floods).

This process helps to identify the portions of the channel that predominantly provide flow control. The constricted approach to Elm Street Bridge establishes a backwater effect that controls elevations upstream to at least Bend B. From that point up to the Lyman Street Bridge, the depth and velocity are influenced by the Elm Street backwater, but because of its access to the floodplain area, the channel conditions also influence the velocity and water surface elevation.

Choice of Scenario for Armor Design

The design conditions used to calculate required armor size were taken from the analysis with the Elm Street Bridge removed. It seems a likely scenario (a bridge rebuild might require removal of the existing structure for a time), and the velocity and depth changes, although small, may be significant. The conditions associated with removal of the catch point associated with the Elm Street Bridge were considered unlikely. For that scenario to occur, the Elm Street Bridge (current span 60 ft) would be replaced by a 100- to 200-ft span, the cross-section within that span would be allowed to return to a natural condition, and the resulting open section would scour the bed to a more uniform slope. A bridge rehabilitation project of that scope does seem likely. In addition, investigation of the bed material in that region suggests that it may be a rock outcrop. In that case, it is not likely that the region will scour to a steeper bed slope.

2.7.3 Bed and Bank Protection

2.7.3.1 Goal of Analysis

An important component of the remediation design was the placement of a stone protection system after removal of contaminated material. The Design Team used results of the hydraulic analysis and USACE guidance to determine the required stone size and layer thickness to protect bed and banks from scour, and design filter materials for the riprap.

2.7.3.2 Methods of Analysis

The Design Team evaluated stone size using the USACE program Riprap 15, which is based on guidance in Engineer Manual (EM) 1110-2-1601 (USACE, 1994, 99-0227) with input from

USACE personnel (USACE, Personal Communication, 2001). Table 2-7.2 lists the input parameters for the Riprap 15 program. The first step in the evaluation was to determine the thickness and size of stone required to maintain stability under the modeled hydraulic conditions. The design was then modified to incorporate other stability issues such as vandalism and ice and debris damage. The Design Team also designed a filter system to be placed beneath the armor layer to protect against loss of the fine-grained subgrade material.

Hydraulic Stability

The Design Team used the results described in Section 2.7.2.4 of the hydraulic analysis to design a stable stone armor system. Although it is common for a stone protection system to be designed for the worst-case hydraulic conditions within the reach, this simplifying assumption was not appropriate because of limitations and cost associated with over excavation.

Four analysis categories were designated based on river geometry (within bends or in straight reaches) and cross-section geometry (on bed or on banks). For each of these categories the Design Team estimated values for the input parameters listed in Table 2-7.3 for use in the Riprap 15 program.

Stage and velocity estimates were obtained from the HEC-RAS model for the three scenarios described in Section 2.7.2 Hydraulics – current conditions; no Elm Street Bridge; and no Elm Street catch point. Stone size was evaluated for each of these conditions to determine how these changes might affect the stability of the armor layer.

Armor Analysis in Bends

For bends, the Riprap 15 program took into account the vertical water velocity and increased horizontal velocity acting on the riprap. The water along the outside of the bend accelerates relative to the water moving along the centerline. In addition, the water tends to super elevate along the outer edge of the bend, causing vertical components of velocity. The program calculated a side slope velocity (V_{ss}) to incorporate these conditions. V_{ss} increases with bend radius/flow width (tighter bend), average velocity (V_{avg}), and channel side slope. It is inversely proportional to flow depth and riprap layer thickness. Bend radius, flow width, and channel side slope were all estimated from maps of the design reach. Flow depth and average velocity

estimates were obtained from the HEC-RAS analysis described in the Hydraulics section. Riprap layer thickness was assumed to be $1.5*D_{100}$. USACE guidance suggests this thickness in areas where high turbulence is expected, such as downstream of a drop structure. This reach was assumed to have the potential for high turbulence since rock deflectors and habitat boulders are to be installed throughout.

Because bend turbulence continues some distance downstream, bends were assumed to include a turbulence dissipation zone. The dissipation distance is a function of V_{ss}/V_{avg}. Downstream of the bend, V_{ss}/V_{avg} is unchanged for the first 100 ft, then decreases by 0.1 per 100 ft of channel.

Armor Analysis in Straight Segments

Straight channel segments were also evaluated since stone protection is to be placed along the entire river reach. For these segments, V_{avg} (main channel average velocity, obtained from HEC-RAS analysis) was converted to a maximum centerline velocity. Design guidance (USACE, 1994) suggested that armor on the channel bed might be subjected to velocities up to 20% higher than the average velocity. Conversion was based on the following equation:

$$V_{centerline} = 120 \text{ percent} * V_{average}$$

Armor Analysis on Channel Banks

Hydraulic conditions are normally the most damaging along the outside bank of bends. Initially, a single analysis was performed for bed and banks in straight segments. The analysis was conservative as it was based on the worst-case velocity ($V_{centerline}$ experienced only by the bed) and incorporated instability of armor rock on a slope (experienced only on the bank). However, results of this analysis suggested using the minimum recommended stone size; therefore, further refinement of the result was considered unnecessary. When designing stone protection, it is common to line only the outer bank, or, if the entire cross-section is to be covered, use one size of riprap designed for the worst-case conditions (along the outer bank) (USACE, 1994). Side slope for banks was estimated from proposed cross-sections. A maximum side slope of 2H:1V was used to represent all banks. Proposed slope steepness, based on combined slope stability analysis and restoration considerations discussed in Section 2.6 is actually as steep as 1.8:1. This additional slope steepness will have little effect on the stability of the riprap. Stone size was

increased from 12 inches, as required for hydraulic conditions, to 18 inches as required for vandal-proofing. This will more than make up for the small increase in slope.

Armor Analysis for Channel Bed

Because the slope of an armor layer affects its stability, smaller stones on the bed (flat slope) may be as stable as larger stones on the bank (steeper slope). Stone size analysis for the bed in bends assumed riprap was on a 5H:1V slope, which was shallow enough to have no effect on the calculations. Thus, the increased turbulence in bends could still be taken into account. For straight segments, the stone size for the bed armor layer was assumed to be the same as that required for the banks. The analysis to size bank armor was based on the maximum centerline velocity, and assumed a bank slope of 2H:1V.

Evaluation of Other Stability Issues

In addition to hydraulic conditions, two other factors were assessed which influence the stability of a stone protection system. Ice and debris can damage the layer in two ways. Debris and ice chunks from upstream can dislodge riprap as they flow through a reach. In addition, ice can freeze to portions of the installed riprap layer, which increases the chance for rock to be dislodged by floating ice and debris. In the riprap design, the Design Team also considered the potential for vandalism. In urban settings, rocks get moved unless they are too heavy to lift (USACE, Personal Communication, 2001). The evaluation was based on USACE guidance manual (USACE, 1994, 99-0227) and discussion with USACE personnel (USACE, Personal Communication, 2001).

Filter Design

The analysis was performed to determine required filter gradation and thickness to prevent movement of fines from the underlying material through the riprap material, potentially causing riprap failure. Initial filter sizing was based on the guidance in the USACE EM 1110-2-1901, Appendix D (USACE, 1986, 99-0634). Data showing gradation of the bed material was obtained from the Pre-Design Geotechnical Data Summary for Housatonic River Project from Lyman Street Bridge to Elm Street Bridge (Hart Crowser, 2000, 07-0041). Characteristics of the native material were estimated and these values were used to design the filter layers. In locations where

the initial design might result in significant cost increase, the conservative requirements in the design method related to the less applicable design objective for permeability were reevaluated. Once a filter design was chosen, the gradation for locally available materials was evaluated and matched to a filter layer requirement to select each filter material. A minimum filter layer thickness of 6 inches was selected, based on constructability.

Native Material Representative Grain Size

The results of geotechnical borings were reviewed to determine the representative gradation for natural material in the riverbed. The Design Team evaluated gradations for samples taken within the top 3 ft of riverbed. These samples were chosen because the maximum contaminant removal depth is 3 ft, and the next closest sample at each boring was taken at a depth of 8 ft.

The filter sizing criteria require that filter material be sized for the fraction of native material that passes the number 4 sieve [4.75 millimeters (mm)]. The four gradation values from river borings were adjusted as described in the filter sizing guidelines. The material with the finest adjusted gradation was chosen as the basis for designing the filter material. The design was initially based on the finest material consistent with conservative filter design practices. However, this resulted in a requirement for additional filter layers. Because the fines content of the riverbed materials was found to be relatively low (generally less than 30% fines) and does not vary significantly in the sample set, the design was revised and based on the average percentage of fines observed in the subsurface investigations.

Filter Size Determination

The USACE method was based on design objectives that include minimizing soil loss, maintaining permeability, and limiting the potential for segregation during handling and placement. These objectives were achieved by establishing relationships between the filter and underlying materials. The method, described in detail in Appendix D, is summarized below.

- To limit soil loss, the fine fraction of the filter (represented by $D_{15filter}$) must not be too large compared to the underlying material (represented by the adjusted $D_{85native}$ or adjusted fines content). Maximum $D_{15filter}$ was calculated from the relationships defined in the method.

- To maintain permeability, the fine fraction of the filter ($D_{15filter}$) must not be too small compared to the fine fraction of the underlying material ($D_{15native}$). Minimum $D_{15filter}$ was calculated from relationships defined in the method. This was a secondary design objective compared to the other design objectives.

- To limit segregation, the coarse fraction of the filter material must not be too large compared to the fine fraction. To meet this criterion, the method defines a relationship between $D_{90filter}$ and $D_{10filter}$.

Using these relationships, a gradation band was defined for the filter material, based on representative grain size for the native material. After the first filter was initially sized, the same type of analysis was performed comparing riprap to the filter material; i.e., riprap and filter material were treated as if they were the filter and native material, respectively. If the relationships defined in the method were satisfied for the riprap over the filter layer, then the design was complete. If not, the process was repeated to design a second intermediate filter.

The initial filter sizing based on the USACE methodology (USACE, 1986) was fairly conservative. Where necessary, the initial evaluation was simplified to focus on limiting the loss of soil fines from underlying soils. This was accomplished using a straight comparison of grain size for the filter and the material to be protected using the equation:

$$D_{15A} < 4*D_{85B}$$

Where:

D_{15A} equals the grain size for which 15% of the filter material is finer.
D_{85B} equals the grain size for which 85% of the material to be protected is finer.

In addition, the requirement to minimize segregation was disregarded. It was assumed that specifying limited handling of filter material could control material segregation.

To adapt the design to reflect locally available material, the Massachusetts Highway Department specifications were obtained for standard material gradations in the area (MHD, 1988, 99-0635). If a standard material appeared to meet the gradation requirements, it was chosen as the filter material. Otherwise, the gradation band was used to define the filter material.

2.7.3.3 Data Sources

The following USACE guidance documents were used for the analyses (see Section 3, References):

- Hydraulic Design of Flood Control Channels (USACE, 1994, 99-0227).
- Seepage Analysis and Control for Dams (USACE, 1986, 99-0643).

In addition, personal communication with USACE personnel and geotechnical data described in Section 2.6 were used for the analyses.

2.7.3.4 Results

Hydraulic Stability

Two bends were identified within the design reach, and one was identified upstream of the design reach. Stone size was assessed for three locations – Bend A, Bend B, and straight channel. Location, design parameters and calculations for each analysis segment are shown in Appendix D. Estimates of velocity and depth were taken from the tables produced in the hydraulic analysis (see Section 2.7.2, Hydraulics, and Appendix C).

For this analysis, it was assumed that the hydraulic design conditions were those associated with the no-Elm-Street-Bridge condition. In all cases the required stone size was the same for current conditions versus conditions with the bridge removed. Conditions with the catch point removed were much more erosive. Stone size would have to be doubled to maintain stability if the catch point were removed. However, the likelihood of extensive channel modification is low, so riprap design did not consider results from that scenario.

Bend A

Bend A was assumed to represent stations 500+00 to 504+00. The bend ends at approximately station 502+00, and the turbulence dissipation zone extends to station 504+00 (see Appendix D, Table D-1, Part C for turbulence dissipation calculation). Results suggest that the armor layer should be at least 18 inches thick with D_{100} of 12 inches on the riverbank and 14 inches thick with D_{100} of 9 inches on the riverbed.

Bend B

Bend B is located at station 508+00 to 510+00 with turbulence dissipation to station 512+00 (see Appendix D, Table D-2, Part C for turbulence dissipation calculation). Design thickness and stone size requirements are the same as for Bend A. Although Bend B has a smaller radius, it also had a lower velocity, and deeper flow, which resulted in similar design requirements as for Bend A.

Straight Channel Segments

Assessment of straight channel showed that for bed and banks, the calculated D_{30} was about half the maximum allowable 9-inch riprap (see Table D-3). Although 9-inch riprap would be over-design, it is the minimum standard USACE riprap size. To minimize over-design (USACE, 2001), the Design Team assumed a 9-inch layer of 4½-inch riprap as a starting point, then increased the size as appropriate to account for other factors such as ice and debris, and vandalism.

The bend upstream of Lyman Street Bridge was evaluated to compare results of this analysis with those in the reach between Newell Bridge and Lyman Street Bridge. Results suggest that an armor layer with D_{100} of 9 inches and a thickness equal to D_{100} should be adequate. The riprap installed in that reach has D_{100} of 9 inches. This comparison suggests that the methodology is similar. The bends in the design reach generally have higher velocities, lower depths, and tighter bend radii, which all tend to increase the required stone size.

Evaluation of Other Stability Issues

Table 2-7.4 lists the results of hydraulic stability analysis and associated increases to account for other stability issues. From discussion with USACE personnel, it was decided that increases in bed and bank stone size and layer thickness were warranted to protect against damage associated with ice, debris, and vandalism. Large pieces of debris have been noted in the design reach. Flow depth under average conditions is low enough (average annual flood, 2 to 4 ft deep) that debris may be able to damage riprap on the channel bed (USACE, Personal Communication, 2001). For protection against ice and debris, the Design Team increased D_{100} to the next standard size and

increased thickness by 6 inches (USACE, 1994, and USACE, Personal Communication, 2001). Corps guidance states that vandal-proofing is achieved by setting minimum W_{50} of 80 pounds, which corresponds to a standard Corps riprap size of D_{100} equal to 21 inches (USACE, 1994). Based on these guidelines, the preliminary riprap size to meet all requirements would be a 21-inch layer of D_{100} equal to 21 inches. However, this would have resulted in over-excavation beyond the predetermined design requirement. Resolution of this issue was obtained through discussion with USACE, EPA, and Hart Crowser project leads as described below in the Summary of Design section.

Filter Design

Native Material Representative Grain Size

A summary of the results of sieve analyses from geotechnical boring samples is shown in Table D-4, Appendix D. These four samples were considered representative of the native material on which the filter material would be placed. They were chosen because they were taken 3 ft below the bed surface, which is the same as the maximum contaminant removal depth. Initial filter sizing was based on an average of the native material samples. Note that the gradation from sample BH00024-00030 had a much higher adjusted percent fines (63%) and the smallest D_{85} (0.8 mm). Since the other samples were much more coarse (percent fines <15), it was assumed that an analysis based on the BH00024 sample was overly conservative.

Filter Size Determination

The filter design calculations are shown in Appendix D, Tables D-5 through D-8. Filter gradations are depicted in Figures D-1, D-2, and D-3. Initial evaluation of riprap and native material showed that for 9- to 12-inch riprap, a single filter material, 1½ to 2½-inch minus gravel, was required. For riprap sizes greater than or equal to 18 inches, two filter layers were required. The system would consist of a 3 to 3½-inch gravel over a ¾-inch gravel. Both materials should be washed gravels, because they can have no more than 5% fines. The initial evaluation was considered to be overly conservative. It incorporated requirements for permeability and segregation, which are not considered as significant as underlying soil retention for this design. This stone protection system does not need to meet stringent permeability requirements because

flow capacity through the filter layer is not a significant concern. Protection against segregation is provided by including material handling directions in the specifications.

Filter Thickness Determination

USACE guidance (USACE, 1983, 99-0642) states that filter layer may be as thin as 6 inches. Other guidance (Milligan, 1997, 99-0636) states that filter blanket thickness usually ranges from 6 to 15 inches or 4 to 8 inches for layers of more than one filter gradation. The guidance also states that filter thickness is generally a function of constructability. It was determined for this design that all filter layers would be 6 inches in thickness.

Summary of Design

With the information described above, it was then necessary to develop a design that met the requirements for stability of the system, but minimized the amount of excavation beyond that needed to meet the cleanup goal of 1 ppm. This was worked out by developing a comparative summary spreadsheet and obtaining a consensus opinion from the Hydraulics Focus Group, which included representatives from EPA, USACE, WESTON, and Hart Crowser. The summary spreadsheets, Tables D-9, and D-10, are shown in Appendix D.

Bed Armor

The Hydraulics Focus Group, including the EPA and the USACE, decided that the vandalism requirements for bed armor could be waived as long as the areas designated for bed armor were submerged. For these areas, Hart Crowser used the design based on hydraulic conditions, modified to account for ice and debris damage. It was decided that for the bed in straight reaches, a 15-inch thick layer of 9-inch riprap would be adequate. The bed in bends required a 20-inch thick layer of 12-inch riprap, because of the additional turbulence in bends. A single filter layer (material A) was chosen to underlie the armor layer. Through Bend B (stations 508+50 to 512+00), the total design armor system thickness exceeded the specified cut depth. To avoid the cost of over-excavation, the Hydraulics Focus Group determined that reducing the armor layer thickness to 18 inches would not significantly reduce the stability of the system. Therefore, the 18-inch armor thickness was selected.

Bank Armor

The Hydraulics Focus Group also determined that it was important to meet vandalism requirements for armor placed on the banks. However, with the minimum 21-inch stone size, three filter layers were required. The thickness of riprap and three armor layers exceeded the expected 36-inch cut depth for the entire design reach. To balance the cost versus the potential for vandalism, Tables D-9 and D-10, Appendix D, were developed. They show the comparative armor thickness for an armor system of 18-inch and 21-inch riprap. To estimate the armor thickness shown in the spreadsheets, it was assumed impractical to construct a layer of riprap any thinner than D_{100} plus 6 inches. The tables show that an armor system of 21-inch riprap would require overexcavation of 9 inches throughout the design reach. Placing the 18-inch riprap on the bank would not require any overexcavation. Using this size of riprap meets the design requirements based on hydraulic conditions. As noted above, the participants in the Hydraulics Focus Group determined that although the 18-inch riprap does not meet the standard vandalism requirement, it is still large enough to be a deterrent. Thus, a 24-inch thick layer of D100 = 18 inches was selected for bank armor throughout Phase 1 of the 1.5-Mile Reach.

2.8 SILVER LAKE OUTFALL EXTENSION

The team prepared a design for the Silver Lake Outfall Extension with design objectives of minimizing the loss of existing flood storage and accommodating truck and heavy construction equipment traffic. Several concepts were evaluated and EPA and CENAE selected the final configuration. The final configuration consists of a double-barrel box culvert consisting of two 10-ft by 10-ft reinforced concrete box culverts running side by side. The transition between the existing 48-inch steel pipe and the box culverts is constructed of cast-in-place reinforced concrete. The box culverts will end in precast end sections with a sloped wall. The culvert will be embedded in the armor protection at the outfall.

The twin box culvert design resulted in a loss of only approximately 210 cy of flood storage capacity. Other alternatives that were reviewed generally required more filling and had an associated flood storage capacity loss of about 400 to 500 cy.

The reinforced concrete transition was designed for a HS-20 loading and to accommodate a 150-ton crane with 1 ft of cover over the culverts. The design was in accordance with Portland Cement Association (PCA, n.d., 99-0639). The pre-cast design will be in accordance with ASTM A 850 Precast Reinforced Box Culverts, Storm Drains, and Sewers with less than 2-ft Cover Subjected to Highway Loadings (ASTM, 1990, 99-0624).

2.9 RESTORATION

This section describes the basis of the design for the restoration of the riverbed and riverbank in Phase 1. The basis of the restoration design was developed to achieve the habitat restoration objectives (listed in Section 1) and was based on the synthesis of literature reviews, past restoration experiences, calculations and analyses, conversations with restoration specialists and contractors, and discussions with the project design team (e.g., Design Focus Group Meetings). The process, design criteria, and assumptions are described below and supported with various appendices.

The goal of the restoration design is to meet the habitat restoration objectives for the 1.5-Mile Reach. The habitat restoration objectives have been developed to ensure that the functions and values that the aquatic and riparian habitat provide are maintained and enhanced following the removal action, and that restoration is performed in accordance with the Consent Decree among GE, the Trustees, EPA, the Commonwealth of Massachusetts, and the State of Connecticut (United States of America et al. vs. General Electric Company, 1999).

2.9.1 Riverbank Restoration

The proposed riverbank restoration is intended to mitigate damage created by the removal action and to improve the existing condition of the riverbank as defined by the habitat restoration objectives. The EE/CA report (WESTON, 2000, 07-0030) contained a restoration stabilization screening process that was based both on the existing riverbed and riverbank conditions, and whether the habitat restoration objectives could be achieved in a cost-effective and ecologically sound manner. Restoration stabilization methods that were eliminated (e.g., methods that used wood debris or wooden structures) are not described in this document.

Thus, this section begins with the potential riverbank stabilization methods resulting from the EE/CA screening process. The design process evaluated these methods based on the integration of other primary design elements that were determined during the overall project design process. Primary design elements included riverbank armor elevation, geotechnical analyses (e.g., maximum allowable grades, filter design), proposed cross-sections, hydraulic and hydrologic analyses (e.g., shear stresses, flood elevations, armor size), and riverbank stabilization design criteria (e.g., constructability, performance, maintenance, geomorphic position). Geotechnical and hydraulic design analyses are described in Sections 2.6 and 2.7, respectively.

As described in more detail below, the final riverbank restoration design was developed through an iterative process with these primary design elements and the habitat restoration objectives, and then refined based on the assessment of design impacts (e.g., flood storage capacity, excavation volumes, costs, and compatibility with the riverbed restoration designs).

2.9.1.1 Riverbank Stabilization Methods

Potential approaches that were considered for restoration of the riverbank included methods of revegetation, bioengineering, and hard structures. These methods are defined in general terms below.

Revegetation

Revegetation consists of installing native trees, shrubs, and seeds to develop the needed ground cover and rooting systems to ensure erosion protection and to re-establish natural plant communities of the high-floodplain forest that currently exist adjacent to the Housatonic River. Depending on the site conditions, such as soil characteristics, slope lengths, or degree of flooding, revegetation is generally applicable on slopes less steep than 2H:1V.

Bioengineering

Bioengineering is characterized by the combined use of vegetation and mechanical elements (i.e., structures) where both components complement each other to achieve specific biological and structural objectives. For example, a vegetated rock gabion is a bioengineering method that uses a series of stacked wire baskets filled with rock to protect the bank from being undermined

by the river while plants installed between the layers of baskets provide riparian habitat and increase soil stability by holding soil particles with their rooting systems. Bioengineering methods assessed in this design include vegetated geogrids, brushlayering, live fascines, vegetated rock gabions, and joint planting. Depending on the site conditions, such as soil characteristics, slope lengths, materials, or degree of flooding, bioengineering is generally applicable to slopes less steep than 1H:1V.

Hard Structures

Hard structures stabilize banks using only mechanical elements, such as concrete retaining walls, riprap, or steel sheet pile walls. They are typically very durable, provide excellent erosion resistance, and can be applied, depending on site conditions, on slopes that approach vertical. Hard structures, however, provide only limited habitat because they exclude vegetation and may limit other habitat components within the bank (e.g., denning).

2.9.1.2 Riverbank Armor

The EE/CA presented a conceptual approach to bank stabilization that involved a combination of hard structures (e.g., riprap armor) along the lower portions of the riverbank with bioengineering and revegetation methods installed above. The restoration basis of design assumes that this approach would be applied in developing the final riverbank stabilization designs (unless slope stability or river hydraulics warranted the use of other hard structures such as retaining walls). Both the effectiveness and the cost of this approach are sensitive to the elevation that defines the top of armor where riprap transitions to bioengineering or revegetation stabilization methods. The determination of this elevation also provides a critical design element that establishes the foundation on which the rest of the riverbank restoration design can be developed.

The objectives of the bank armor are to protect the riverbank from scour that could cause potential remobilization of residual contaminated sediments while also meeting, to the maximum extent practical, the other habitat restoration objectives. The upper limit elevation of the bank armor was determined by Hart Crowser, Inc. and was based on these objectives, as well as hydrologic and hydraulic analyses and discussions within the framework of the Restoration and Hydraulic Design Focus Group meetings.

As shown in Section 2.7, the hydraulic and hydrologic analyses provided a quantitative description of the flow velocities, flow depths, and boundary shear stress values throughout the design reach associated with floods ranging from the average annual flood to the 100-year flood. As a result, the 10-year flood event had the higher velocities and shear stress values (flows higher than this overtopped the channel banks and spread out onto the floodplain where velocities and shear stress values decreased), and these values were used to determine the appropriate riprap size and gradation for placement within the riverbed and along the riverbanks. These design hydraulic parameters were also used in assessing bioengineering and revegetation stabilization methods for their ability to protect against scour (see Appendix F).

The establishment and persistence of thriving, living plants is essential to ensure the effectiveness of any bioengineering method. In addition to appropriately fitting the hydraulic conditions (velocity, depth, shear stress), the plants that form the bioengineering installations must be able to establish and persist under the anticipated hydrologic conditions (frequency and duration of inundation). On almost any river or stream one can observe a line of vegetation along the riverbank that corresponds to the edge of the active river channel. Such a line is readily observed along the Housatonic River within and adjacent to the design reach. Established vegetation persists above this line. Vegetation will rarely establish below this line, and when it does it is transitory and often dies or gets washed away. The vegetation line, along with other morphological features, is often used to identify the "bankfull channel," and it typically corresponds approximately to the 1.5-year floodwater surface elevation. From the HEC-RAS analysis of the existing conditions, the water surface elevation associated with the 1.5-year flood averages about 975.6 ft in the design reach (974.8 ft at the Elm Street Bridge to 976.4 ft at the Lyman Street Bridge).

The elevation selected as the upper limit of riverbank armor for the entire design reach was 975 ft, which was agreed upon within the Design Focus Group discussions. The group decided that a single elevation could be used to facilitate construction and still meet the habitat restoration objectives by using a bank armor elevation that is less than the 1.5-year flood stage. Such an elevation will also maximize the revegetation area and reduce riprap costs. (The chosen top of armor elevation may still be slightly conservative based on field observations that the lower limit of vegetation occurs at elevations less than 975 ft [see Appendix F].)

Two exceptions are located at Stations 508+15 to 509+50 (east bank) and 513+20 to 514+00 (west bank) where the armor elevation was reduced to 973.5 ft. Here, the armor elevation could be reduced and still provide the needed erosion protection because the riverbank grades are less than 3H:1V and are located on the inside portion of a river bend where localized shear stresses and velocities are lower. This results in enhancing the riparian habitat objective by increasing the extent of the revegetation planting area and minimizing armor construction costs.

2.9.1.3 River and Drainage Swale Cross-Sections

This section describes the process used to develop the proposed river and drainage swale cross-sections. The proposed cross-sections were based on the existing conditions developed from the 2001 topographic map (WESTON, 2000, 08-0099), the proposed extent of excavation, and the geotechnical analysis (Section 2.6). The cross-sections were designed specifically to meet the habitat restoration objectives while minimizing impacts to the secondary design criteria (i.e., excavation volume and flood storage capacity).

Existing cross-sections were developed in AutoCAD at 50-ft intervals from Station 500+00 to 514+00 for both the east and west banks, and within the drainage swale. Cross-sections typically ended at the limit of excavation (LOE) but were extended in some cases where topography upslope of the LOE needed to be reviewed to ensure restoration effectiveness (e.g., transitions between regraded slopes and slopes outside the limit of excavation). At two stations on the west bank (Station 500+00 and 504+00), the 50-ft interval was shifted downstream by approximately 5 to 10 ft to obtain a more representative assessment of the bank.

To meet the habitat restoration objectives, the proposed cross-sections were primarily designed to accommodate revegetation stabilization methods to the maximum extent practicable because, generally, revegetation methods provide the highest ecological quality, as well as the highest restoration effectiveness and efficiency compared to bioengineering and hard structure methods. Also, since slopes are typically flatter in revegetation areas, they further increase erosion resistance (i.e., lower bank shear stresses). Based on the slope stability assessment, stable restoration grades for revegetation within the project area varied depending on site-specific conditions (i.e., soil characteristics, and bank slope and height), but were generally limited to grades less steep than 2H:1V on the east bank and 2.5H:1V on the west bank.

Where riverbanks could not be effectively regraded to accommodate revegetation methods (i.e., because of slope stability or secondary design impacts), applications of bioengineering methods were considered. As shown in the next subsection, several bioengineering methods were considered and a bioengineering alternative analysis was conducted to determine the preferred method. Slope stability assessments were then conducted using this preferred method. Because soil properties (e.g., soil strength) of bioengineering methods have not been well studied and also vary between methodologies and site-specific conditions (Gray and Sotir, 1996, 99-0632; Goldsmith et al., 2001, 99-0631), conservative assumptions were used to assess slope stability as described in the geotechnical analysis section (Section 2.6). Given these assumptions, and the soil characteristics and bank configurations within the project area, the stability assessments determined that riverbanks to be treated with the preferred bioengineering method would be stable on slopes as steep as 1.5H:1V on the east bank and 2H:1V on the west bank.

Hard structure methods were considered where riverbanks could not be effectively regraded to slopes suitable for bioengineering methods or where maximum shear stresses and velocities were relatively high. As shown in the next subsection, the outside bend on the west bank from Station 507+50 to 510+00 met both of these conditions, and additional bank protection using hard structures was recommended.

The table in Appendix G contains a summary of the existing and proposed slope grades, the stabilization method selected at each station for both the east and west banks, and the drainage swale. Also listed in the table are (1) the slope grades for both the bank armor (i.e., below 975-ft elevation) and the slope above the armor (i.e., >975-ft); (2) the criteria used to select the proposed grades for each cross-section and any design modification that would be needed (e.g., changes to the existing limit of excavation); and (3) the estimated effects to secondary design criteria (i.e., changes in excavation volume or flood storage capacity).

The criteria used to determine the proposed grades for the cross-sections followed the hierarchy listed below:

- **CENAE Guideline.** Maximum allowable bank armor grade is 1.5H:1V (USACE, 2001, Personal Communication with Jon Kullberg, and e-mail from Don Wood).

- **Geotechnical Analyses.** For both revegetation and bioengineering, maximum grades less than 1.5H:1V are based on slope stability analysis (Section 2.6).

- **Restoration Design.** Grade modifications needed for the design include bioengineering construction (e.g., maintaining the same slope for each station), blending grade transitions between stations, or compensating for flood storage capacity losses elsewhere on the project.

- **Construction Efficiency.** Regrading the slope to improve the efficiency of construction (e.g., reducing the number of different slope grades).

2.9.1.4 Riverbank Stabilization Methods Selected

Several alternative riverbank stabilization methods were considered based on the analyses and criteria outlined above. Listed below is a summary of how the various methods were analyzed and how the preferred alternatives were ultimately selected.

Revegetation

The riverbank revegetation method was initially developed in the EE/CA for the 1.5-Mile Reach (WESTON, 2000, 07-0030) and in the Removal Action Work Plan for the Upper ½-Mile Reach (BBL, 1999, 07-0020) to meet the habitat restoration objectives. Those documents contained revegetation criteria related to (1) planting density for trees, shrubs, and vines; (2) plant and seed species; (3) plant sizes and stock type; (4) general planting patterns; (5) topsoil specifications; and (6) erosion control measures following planting and seeding. The EE/CA document also established which slope grades were appropriate for revegetation and which plant species would be planted within the various flood stage elevation ranges. Per the EE/CA, revegetation was to occur on slopes no steeper than 3H:1V.

Based on the criteria in the EE/CA and Upper ½-Mile documents, specifications and preliminary design drawings were developed for the 65% Design Submittal. The 65% specifications followed the EE/CA criteria closely, but also included additional, preliminary details on seasonal planting times, plant installation and seeding methods, mulching and fertilizing, and maintenance. These specifications were based on research into the conditions specific to the project area, and on correspondence with local nurseries.

The specifications and design drawings for the revegetation measures were further refined in the final design Submittal based on (1) reviewer comments on the 65% Submittal; (2) input from the Restoration Design Focus Group meetings; (3) the results of soil stability analyses; and (4) continued research into plant, seed, fertilizer, topsoil, and erosion control blanket applications. The areal extent of using revegetation to stabilize the riverbank increased during this portion of the design because the revised slope criteria allowed revegetation to occur on slopes as steep as 2H:1V. Topsoil specifications were reviewed and modified in regard to texture and organic content, allowing the use of a sandy loam augmented by locally available compost material, as necessary (Brady, 1990, 99-0627; USDA et al., 1988, 99-0229). Vendors were contacted to collect information on specifications, applications, and prices of permanent erosion control blankets to be used on the revegetation areas following final grading. Nurseries were contacted to inquire about the general availability of the chosen species in their specified sizes and to further define the general fertilization requirements and planting windows (Marcus, Personal Communication, 2001; Pierson, Personal Communication, 2001). In addition, a customized seed mix specification was developed to provide a range of native herbaceous species that can be seeded at any time of year, allowing for flexibility in construction scheduling (Marcus, Personal Communication, 2001). Finally, plant numbers for each planting cell were calculated based on the density and distribution criteria set forth in the EE/CA.

The plans and specifications for revegetation remained essentially unchanged from the 95% to the final design submittal. One change of note was the replacement of smooth shadbush (*Amelanchier laevis*), one of the planned shrub species, with choke cherry (*Prunus virginiana*). This change was made because high mortality and low vigor were observed in 2001 among the shadbush planted along the Upper ½-Mile Reach. The change to choke cherry was agreed to by the NRD Trustees and GE (O'Brien, Personal Communication, 2001).

Bioengineering

Selection of the preferred bioengineering method was based on the primary design criteria discussed previously (e.g., armor elevation, slope stability, and hydrologic analyses), and a bioengineering alternative analysis (see below), which was conducted within the framework of

the Restoration Design Focus Group. This subsection summarizes the alternative analysis and outlines the design features of the preferred method, the vegetated geogrid.

Also incorporated into the restoration design was the decision by the design team to broaden the initial EE/CA bioengineering slope applicability criteria (i.e., 2.25H:1V to 3H:1V) to include steeper slopes (i.e., 1H:1V to 3H:1V). This was done so that bioengineering methods like vegetated geogrids or brushlayering, which are suitable for steeper slopes, could be potentially used more effectively. This also helped reduce (and eventually eliminate) the linear distance of retaining walls, reduce total restoration costs, and increase the riparian habitat component by providing a more extensive planting area for revegetation.

Bioengineering Alternative Analysis

Appendix H contains information on the five riverbank bioengineering alternatives considered, including schematics, design considerations, and a matrix table comparing design and cost factors. The alternatives included Vegetated Geogrids (also called soil lifts) (Alternative 1), Rock Wall Terraces (Alternative 2), Live Fascines (Alternative 3), Brushlayering (Alternative 4), and Brush Mattress (Alternative 5). Although technically not part of the riverbank restoration, joint planting was also considered as a potential bioengineering method to establish woody vegetation in the uppermost portions of the bank armor adjacent to revegetation and bioengineering bank treatments.

Vegetated Geogrids—The preferred bioengineering alternative is vegetated geogrids. Selection was based primarily on the suitability of the existing bank slope conditions (i.e., short slope lengths [15 to 20 ft] and relatively steep slopes [1.5H to 2.0H:1V]), flexibility for the construction schedule (i.e., can be constructed any time of year), long-term slope stability, and ease of merging with other bank stabilization methods. Disadvantages of this design include its higher costs and construction complexity.

Vegetated geogrids are a system of fabric-encapsulated soil layers that are installed on the bank to provide an added measure of soil stability in areas that would otherwise be prone to scour, erosion, or slumping. Woody plants (shrub species) are installed between the wrapped soil lifts,

forming roots that become interwoven with the fabric grids and binding the entire system into a unified, coherent mass (Gray and Sotir, 1996).

Listed below are the other alternatives and their associated limitations that led to their rejection for use in the Phase 1 of the 1.5-Mile Removal Action Work.

Rock Wall Terraces—This method would involve reducing the bank slope by the construction of one or more vertical rock walls between shallow-sloped terraces. The slopes of these terraces would be shallow enough to allow revegetation by standard means. The existing conditions proposed for bioengineering stabilization (up to 1.5H:1V) are too steep for using a single 3-ft wall (maximum slope grade is 2.25H:1V). An additional wall could be added to stabilize the steeper grades, but total costs would be approximately $620/lf. Also, the ease of merging terraces with other riverbank stabilization methods, which are not terraced and located upstream and downstream of the rock wall terraces (e.g., revegetation on a uniform grade slopes), would increase construction complexity and decrease stability by creating interfaces that may be prone to erosion.

Live Fascines—Live fascines are made by tying dormant live branch cuttings into long bundles. These bundles are then placed in shallow trenches dug across the slope, staked in and partially buried in topsoil. If installed properly and in the right season (dormant season only), the cuttings within the fascine sprout branches and a dense mat of roots, thereby protecting the soil from surface runoff and scour. Fascines are applicable up to slopes as steep as 1H:1V, but for the existing conditions proposed for bioengineering stabilization (i.e., 1.5H:1V slopes with 3 ft of fill) their slope applicability was reduced to 2.5H:1V (Franklin, Hampden, and Hampshire Country Conservation Districts, 1998, 99-0242; Fischenich, Personal Communication, 2001).

Brushlayering—Brushlayering involves alternating layers of densely packed live branch cuttings with layers of soil. This method is similar to vegetated geogrids except that the soil layers are not wrapped in fabric. The construction period for this method is limited to the dormant season (November – May). This would limit construction flexibility and would require some additional bank stabilization to be installed from June through October until the window for construction opened in November.

Brush Mattress—A brush mattress is a combination of live branch cuttings and fascines staked and secured to the slope to form a protective bank cover. The mattresses are typically formed by laying down a dense, interwoven mat of live branches about 1-ft thick, and securing to the slope with long stakes (sometime live stakes are used) and wire. Soil is then loosely placed on the mattress to promote rooting and sprouting. Existing conditions proposed for bioengineering stabilization are too steep for brush mattresses, which are limited to slopes shallower than 2H:1V. Also, the construction period can occur only during the dormant season for cuttings (November – May), and thus would be limited in the same manner as brushlayering.

Joint Planting—Joint planting involves the installation of live willow stakes in among the stones of the bank armor between the assumed low-flow elevation (972 ft) and the top of bank armor (975 ft). This method was included in the 65% and final design submittals as a measure to "jump start" vegetation in the upper portions of the bank armor, but was dropped from the 100% design when tree seedlings were found to be readily colonizing the bank armor in the recently constructed Upper ½-Mile Reach.

Vegetated Geogrid Design

The design of the vegetated geogrid for this project was developed by researching the scientific literature and consulting with various entities that have used this type of bank stabilization method in similar situations, and experiences from other restoration projects. The vegetated geogrid was designed to address the features and constraints specifically associated with the design reach, including typical flow velocities, remedial excavation depth, foundation type and design, elevation in relation to base flows and flood events, upper bank treatments, and the need to be able to construct during any season. Listed below are the design elements considered and the literature and expert sources that were referenced or consulted.

Application and effectiveness:	Miller and Hoitsma, 1998, 99-0244; Verdi, 1998, 99-0243; USDA et al., 1998, 99-0229; Gray and Sotir, 1996, 99-0632; USDA, 1996, 99-0228; Johnson and Stypula, 1993, 99-0633
Slope limitations:	Miller and Hoitsma, 1998; Verdi, 1998; USDA et al., 1998; Gray and Sotir, 1996; USDA, 1996; Johnson and Stypula, 1993

Construction sequence:	Gray and Sotir, 1996; USDA, 1996; Moriarty, Personal Communication, 2001
Geogrid foundation:	Gray and Sotir, 1996; USDA, 1996; Fischenich, Personal Communication, 2001
Drainage considerations:	Gray and Sotir, 1996; Fischenich, Personal Communication, 2001
Lift height, width, and length:	Miller and Hoitsma, 1998; Verdi, 1998; Gray and Sotir, 1996; USDA, 1996; Johnson and Stypula, 1993
Soil lift fabrics:	Miller et al., 1998, 99-0637; Miller and Hoitsma, 1998
Staking:	USDA, 1996
Soil type and compaction:	Goldsmith et al., 2001; Miller and Hoitsma, 1998; Gray and Sotir, 1996; Fischenich, Personal Communication, 2001
Vegetation between lifts (types, species, timing, placement, and preparation):	Sotir, 1998, 99-0640; Verdi, 1998; Gray and Sotir, 1996 USDA, 1996; Miller and Hoitsma, 1998; Marcus, 2001; Fischenich, 2001a; Fischenich and Allen, 2000, 99-0628; Sorrie and Somers, 1999, 99-0650
Seeding within lifts:	Miller and Hoitsma, 1998; Marcus, 2001; Moriarty, Personal Communication, 2001

Hard Structures

The only area considered for hard structure for bank stabilization occurred on the west bank from approximately Station 507+00 to 510+00. These stations are along the outside portion of a river bend where the river is moving laterally as a result of typical river morphological processes of river bends. The banks show active erosion (e.g., bank slumping) and vary in height from 5 to 7 ft and are nearly vertical in some locations.

The design team decided to extend the bank armor up to the LOE along this river bend because of the following factors:

- The need to protect the bank from scour and erosion due to the potential of localized, relatively high shear stresses and velocities that occur along the river bend.

- The area above the upper limit of bank armor (975 ft elevation) has a relatively narrow width, generally 2 to 3 ft, and the topography outside the LOE is relatively flat, which limits the efficiency and effectiveness of bioengineering methods.
- The short bank heights limit the applicability of retaining wall systems.
- The overall cost of installing bank armor is assumed to be less than the overall cost of installing retaining walls.

2.9.2 Riverbed Restoration

Riverbed restoration consists of replacing the riverbed after remediation so the habitat restoration objectives are met. Previous sections have discussed the analyses conducted to design the riverbed armor and filter layers to prevent erosion and the subsequent mobilization of contaminated sediments (Sections 2.6 and 2.7). This subsection describes the basis of design to restore the aquatic habitat.

2.9.2.1 Design Concept

Existing Conditions

In the summer of 2000, Woodlot Alternatives, Inc. conducted an aquatic habitat survey within the 1½-Mile Reach of the GE/Housatonic River Site (Woodlot Alternatives, Inc., 2000, 07-0034) to assess current conditions and to define more specific aquatic habitat restoration objectives. The 1.5-Mile Reach has been divided into three general geomorphic reach types as defined in the EE/CA. Phase 1 ends at Station 514+00, approximately ¾ of the way through the first geomorphic reach (Lyman Street Bridge to Elm Street Bridge). The survey results summarized below describe the habitat conditions from Lyman Street Bridge to Elm Street Bridge. Additional information on the Housatonic River watershed, such as geology or historical river management, is included in Section 2.0 of the EE/CA and is not presented in this document.

This portion of the river has a relatively low riverbed gradient (i.e., <0.5%) and is made up of habitat types that consist approximately of 70% pools and 30% runs. There are three pools within this reach, and their average low-flow channel width, length, and maximum depth are 50 ft, 380 ft, and 4.5 ft, respectively. Pools are located within the channel bends and have a classic meander bend morphology with the point bar on the inside bend and a well-developed thalweg along the

outside portion of the bend. Two of these bends are moderately sharp (i.e., arc angles ranging from 70 to 80 degrees), while the other bend near Lyman Street Bridge has a shallower angle. Average pool spacing within this reach is 9 channel widths (600 ft apart) and is fairly typical for a river of this character (USDA et al., 1998). Hiding cover in the pools is primarily a result of water depth (ranges 3 to 6 ft deep at low flow) and woody debris clusters.

Between the pools, there are relatively wide and shallow runs with minimal channel structure, low hiding cover, and no defined thalweg. There are two runs, which are located in the straight portions of the river and have lengths from 400 to 500 ft. Low-flow channel widths and depths in the runs average 60 ft and 2.5 ft, respectively. There are a few relatively small pools located along the channel margin that are generally less than the channel width in length. These smaller pools are caused by lateral scour as a result of woody debris.

Because of past channelization within this portion of the river, the riverbank cross-sections are typically trapezoidal with average bank grades of 2H:1V and bank heights from 8 to 15 ft. However, where localized erosion is occurring (e.g., west bank, Station 509, outside portion of a river bend), bank grades exceed slopes steeper than 1H:1V. Some remnant terraces are present, but energy dissipation of flood waters generally occur when the river overtops its banks and spreads out onto the higher floodplains (i.e., floods that exceed the 10-year event).

Baseflow is approximately 30 to 40 cfs with a water surface elevation of approximately 972 ft. Velocity at this flow is low (average = 0.4 ft/s). Based on the hydrographs of the USGS Coltsville station and field observations, the East Branch of the Housatonic River responds quickly to precipitation events, which cause flood stages to increase rapidly. After the precipitation event, flood stages recede more gradually.

As a result of the hydrologic analyses conducted (Section 2.7), the 1.5-year flood event was used as the bankflow flood event, which corresponded to a discharge of 1450 cfs and an average water surface elevation of 975 ft. The average velocity and bank shear stress at this event depended on the specific river station, but were generally 3.5 ft/s and 0.15 lb/ft^2, respectively. This estimated bankfull elevation correlates with field indicators of bankfull stage within this reach (e.g., lower limit of riparian vegetation) and observations of water surface elevations when bankfull

discharges were occurring. For additional information on the hydrology and hydraulics within the Phase 1 Reach, see Section 2.7.

Riverbed substrate is primarily sand with minor amounts of fine gravel (i.e., <20%). Point bars associated with the pools are the predominant bar type in this reach. Based on field observations and previous aquatic habitat surveys (Woodlot Alternatives, Inc., 1999, 07-0006), the runs do not seem to maintain any long-term bar formations and appear to shift as a result of flood events. This is additionally supported by the preliminary analyses of the field data gathered for input into the sediment transport modeling studies being conducted by the Rest of River Team. These observations indicate that the net sediment transport rate is in a state of dynamic equilibrium, sediment inputs from upstream sources balance the downstream transport quantities—sand is transported in and out of channel units during flood events at an equal rate such that overall bed elevations and bar sizes remain the same.

Aquatic Habitat Restoration Objectives

Specific aquatic habitat restoration objectives are as follows:

- **Increase the variability in velocity and in low-flow channel width.** Stream velocity is the speed at which water flows in the river channel. The low-flow channel width is the area that the stream occupies during typical low flow periods, usually late summer. Velocity changes in the stream as water passes over and around objects, such as large woody debris (i.e., dead trees) and boulders. Increased velocities occur along the edges of the object, and decreased velocities occur in eddies that typically form behind the debris. Increased velocities increase oxygen exchange and enhance habitat, while decreased velocities in eddies and pools enhance habitat by providing feeding cover for fish. Increasing the variability of the low-flow channel width increases natural diversity in the stream by changing the flow dynamics and providing more types of habitat for aquatic species. It also enhances habitat value by decreasing stream homogeneity, like that found in previously channelized portions of the 1.5-Mile Reach.

- **Increase the diversity and amount of substrate cover types and water turbulence cover types.** Substrate cover types can include cobbles, large rocks, boulders, and large woody debris. These cover types provide feeding and cover habitat for fish and macroinvertebrates. Water turbulence cover is typically provided by riffles in the river, which visually obstruct views into the water from above. Piscivorous birds, such as belted kingfishers, are unable to forage in these areas because they cannot see the fish through the turbulence.

2.9.2.2 In-Stream Structures

The in-stream structures were selected to perform specific functions and processes within the pools and runs to achieve the specific aquatic habitat objectives listed above, while ensuring the other habitat restoration objectives are met (i.e., bed and bank protection). These structures include single-wing deflectors, rock spurs, and individual and clustered boulder placements.

Described below are the assumptions and calculations for the in-stream structures according to the channel units where they are to be installed (i.e., runs and pools).

The design is based on the synthesis of various design criteria, which included:

- Existing habitat conditions.
- Hydrologic and hydraulic characteristics (e.g., flood frequencies).
- Project work boundaries.
- Structure stability and functions.
- Scour analyses.
- River morphology processes (e.g., deposition and erosion areas).
- Discussions with the Restoration Design Focus Group and river restoration experts.
- Comments from the 65% and final design submittals.
- Literature reviews and experiences of previous restoration work.
- Outside of the river considerations (e.g., stormwater management—locations of outfalls, tributaries).
- Observations on the restoration efforts currently being conducted on the GE ½-Mile Reach.
- Secondary in-stream structure design criteria (e.g., structure constructability).

Runs

A single-wing deflector is an aquatic habitat enhancement structure that is typically made out of rock or logs and projects into the channel so that the channel width decreases and the river velocity increases adjacent to the deflector. Deflector size (i.e., width, height, and length), the

spacing between deflectors, and boulder sizes are critical design elements that can influence the degree that these processes occur as well as how they perform at higher flows and their long-term stability. The specific parameters used for these elements in this design and how they were determined are described below. Supporting design calculations are shown in Appendix I.

To provide the needed diversity to channel width and velocity at low flows, a series of single-wing deflectors (triangular in plan view) will be used in the runs. The deflectors will be placed on alternating sides of the riverbank so that low-flow channel width is reduced near the deflectors, and low flows are deflected to cause a low-flow meandering channel pattern. With the additional placement of boulder clusters near the deflectors, generally placed on the opposite side of the river across from the wing deflector, various flow patterns and velocities will develop that will subsequently enhance aquatic habitat (e.g., complexity, species diversity, hiding cover).

Diversity in channel depth is also expected to occur as sands deposit over the riverbed armor and then scour or fill during flood events, which will enhance habitat structure during low-flow, such as creating a distinct path for the deeper part of the channel (thalweg) or by providing macroinvertebrate habitat (e.g., sand scour around boulders where the cobble armor surface is maintained). After floods, sand and silt is expected to deposit around and on the wing deflectors (e.g., bars that form due to eddies created upstream and downstream of these structures), which will ultimately form and create potential areas to support riparian vegetation over the long-term. Even though this riparian vegetation is expected to be temporary and consists primarily of herbaceous communities, it will still provide aquatic habitat benefits (e.g., hiding cover and food sources for aquatic organisms). The amount of vegetation and its stability will ultimately depend on the frequency and duration of flood events.

The triangular single-wing deflector was selected because, as flows increase and overtop the structure, the flow will be redirected into the center of the channel, which will alleviate stress on the restored banks. At higher flood stages, particularly those that exceed bankfull flow, these structures are expected to be “washed out” (i.e., very limited effects on directing flow). Also, as the flows increase, the deflectors will provide additional channel roughness that will help dissipate energies, protect the bed and banks from erosion, and provide areas of lower velocity refuges for aquatic organisms during flood events.

Deflectors that are more of a single vane shape were considered for the design, but were not selected. Those that are oriented downstream tend to redirect higher flows into the bank, causing potential bank instability, whereas deflectors oriented upstream may trap debris or ice at higher flows and cause structure instability.

As mentioned, the deflector will cause local increases in velocity and will redirect flows toward the opposite bank during low flows, which is expected to increase the local shear stress and velocity on that bank. To assess the stability of the riverbank armor, these local hydraulic parameters were estimated at the flow that would produce the maximum values (i.e., flows where the stage height is equal to the height of the deflector). The discharge predictions from the hydraulic model and the site-specific channel cross-sections of the river where deflectors would be installed were used to determine maximum shear stress and velocity. Because these values were below the values used to design the bank armor (typically values associated with the 10-year flood event), the single-wing deflectors proposed for the final design will not affect the stability of the riverbank armor.

The guidelines for the effective width of a deflector (perpendicular distance from apex of deflector to riverbank) typically range from 10 to 50% of the channel width, depending on the site conditions and the restoration objectives (Fischenich and Allen, 2000; Johnson and Stypula, 1993; Wesche, 1985, 99-0645). To maximize low-flow deflection and minimize backwater effects, the effective width selected for the final design was 30%. The effective width was based on recommendations by Craig Fischenich of CENAE (Fischenich, Personal Communication, 2001) and field observations of the flow and scour/fill patterns around a rock wing deflector installed in the Upper ½-Mile Reach. Depending on the site-specific channel width within runs, the effective deflector width used in the final design ranges from 18 to 20 ft.

The triangular wing deflectors have 45-degree angles adjacent to the bank, which make their lengths range from 30 to 35 ft long depending on the station. The height of the wing deflector is between 2 to 2.5 ft. This height corresponds to the low-flow elevation (approximately 30 – 50% of bankfull stage) so as to minimize bed scour and bank erosion at flows greater than bankfull, and maintain flood capacity (Abt et al., 1994, 1995, 99-0623).

The deflector is constructed of boulders that vary in diameter from 1 to 2.5 ft with the larger size boulders located on the outside of the deflector. Cobble size rock (same as bed armor) is utilized on the inside portion as depicted in the Plan Sheets. This structure is assumed to be stable at the design discharge because this material is the same size or larger than what was determined for the bed and bank armor size (see Section 2.7) and the various cobble and boulder sizes are partially interlocked, which increases the stability of the structure.

Spacing was based on design guidelines that were developed for low-flow aquatic habitat enhancement projects (Abt et al., 1994, 1995; Florentin et al., 1996, 99-0630) and the comments provided by GE and Craig Fischenich of CENAE (Fischenich 2001, 07-0074) on the final design submittal. Deflectors were spaced 5 to 7 low-flow channel widths apart (same side of the bank). The low-flow channel width was measured from the apex of the deflector to the opposite bank (Fischenich, 2001). Using the site-specific low-flow channel widths in the runs where the deflectors are to be installed, the average width is approximately 40 ft. Therefore, the spacing between deflectors on the same bank is approximately 200 to 280 ft apart. The spacing guideline was then refined and adapted to fit the site-specific conditions within the runs (e.g., confluence with drainage swale, outfalls, channel morphology) so that aquatic habitat enhancement efforts could be optimized. This resulted in six single-wing deflectors being used for the final design (two runs with a series of three deflectors in each), which are spaced 260 to 280 ft apart on same bank (or 130 to 140 ft apart if measured on opposite banks).

Boulders and boulder clusters will be placed in strategic locations to enhance fish cover (substrate and turbulence) and minimize potential movement as a result of ice or woody debris impacts as shown on the Design Sheets. Generally, the boulders will be placed in the deeper portions of the channel to provide cover during low flow periods or in shallow areas, such as runs, where cover will be provided by turbulence created by the boulders at low flow. Through the combination of the wing deflectors and boulders, some localized scouring of presumed sand depositions will occur. (Scour analysis is presented in Section 2.9.2.3.)

Pools

Riverbed topography will be restored to pre-construction elevations after remedial measures have been completed. This means the size and locations of pools and bars will be maintained

because these features are associated with the channel planform, which will generally remain the same as the pre-existing condition after construction has been completed. For example, all the pools in this reach are located along channel bends where the associated helical flow patterns, which transport fines from the pools and cause point bars to form, will continue to occur after the reconstruction process is complete.

The habitat quality of the pool, however, will be altered by the project (e.g., removal of woody debris that provides hiding cover for aquatic organisms). To mitigate the loss of woody debris, boulders and boulder clusters will be used throughout the pools to provide hiding cover, add channel roughness (dissipate energy in the bend), and increase the diversity of velocities. Boulder locations and orientations were based on meeting these objectives, while protecting the riverbed and riverbank armor from scour (USDA et al., 2000; Fischenich and Seal, 2000, 99-0629; Johnson and Stypula, 1993).

Boulder diameters range from 2.5 to 3 ft, and their stability was assessed, using an analysis suggested by Fischenich and Allen (2000) along with hydraulic design conditions determined by HEC-RAS results, to estimate the minimum rock size needed (see Appendix J for calculations). This analysis, in additional to the analyses conducted to determine bed armor size and past restoration experiences, indicate that boulders with diameters of 2 to 3 ft will be stable.

As mentioned previously, bank armor (riprap) will be installed along the outside riverbank at Station 507 to 510 to protect it from erosion. To enhance the pool habitat at this location, rock spurs will be installed. Rock spurs or hard points are relatively small deflection structures that are placed on the riverbed along the outside portion of the riverbank. These structures were selected to maintain the habitat type and the channel alignment while enhancing habitat quality.

As depicted on the plan sheets, the rock spurs are boulder structures that are triangular in plan view and extend riverward from 5 to 7 ft, which is approximately 10% of the low-flow channel width. The rock spurs will be submerged at low flow and will create eddies and variability in river velocities in localized areas near these structures. Such changes will enhance habitat for aquatic organisms by providing hiding cover, creating refuge areas during high flows, and increasing the habitat complexity by adding diversity to the localized velocity patterns within the pool. The rock spurs are spaced between 25 to 45 ft apart and were located based on the radius of

curvature of the bend and site-specific flow directions to enhance aquatic habitat (i.e., location of eddies) and protect the riverbed and riverbank from scour (Ohio Department of Natural Resources, 1999, 99-0649; Johnson and Stypula, 1993, 99-0633).

Other Structures Considered

Structures such as double wing deflectors, W-rock weirs, or J-hook rock vanes were considered but not used in the design reach. Double-wing deflectors are primarily used to scour holes and create pools. The pools in the design reach are "geomorphically" spaced (within 5 to 7 channel widths [Leopold et al., 1964, 99-0223]) and are relatively stable (channel migration is not likely given the gradient, channelization, and proposed riverbank armor). These structures were not used because (1) they can cause scour at high flows and may create bed armor instability, and (2) no additional pools are needed in the design reach.

W-rock weirs are not used in the design reach because these structures need steeper gradients to perform well. J-hook rock vanes may be used on the outside of bends, but given the gradient and cross-section morphology (steep banks, deep pools), they are not used.

2.9.2.3 In-Stream Structure Stability and Scour Analyses

Methods of Analysis

The rock wing deflectors were evaluated in three ways to determine the needed stone requirements to protect against scour that may result from these structures. The scour analyses included assessments of the deflectors as bends, constrictions, and as part of a drop structure (i.e., where the water begins to overtop the deflector).

Deflectors were analyzed as bends to estimate potential for scour along the upstream face of the deflector at low flows. This analysis was based on the procedures for river bends described in Section 2.7, Hydraulics. In this analysis, however, ice, debris, and vandalism factors were not considered. It was assumed that the deflectors could increase the potential for hydraulic instability, but would not increase the potential damage because of these other factors. Bend radius and flow width were estimated from the project drawing of proposed deflector design. The worst-case condition (lowest depth, highest velocity) was used in the analysis, which used the

flow depth and velocity from the HEC-RAS analysis of 0.5- to 2-year storms. A flat side slope was assumed because the scour is likely to occur in the bed adjacent to the deflector.

Deflectors were also analyzed as contractions by the Gill equation (Gill, 1972, 99-0648), as suggested by Craig Fischenich (2001a). Detailed calculations are shown in Table K-1 and K-2 in Appendix K. The Gill equation estimated scour depth by comparing the constricted width to approach width, and the critical shear stress of the bed material to the shear stress in the constriction.

To evaluate deflectors as drop structures, equations developed by Schocklitsch and Jager to estimate plunge pool depth downstream of a weir (Simons and Senturk, 1992, 99-0640) were used. The scour depth estimate was based on bed material size, head loss across the deflector, velocity, and flow rate. The parameters used to make the estimate were based on the velocity and depth from the sheet pile analyses (described in Section 2.7, Hydraulics). These values were assumed to be conservative because the sheet pile blocked more of the channel than the rock deflectors. Parameters used in the equations were based on the assumption that rock deflectors overtop when flow reaches approximately 500 cfs (i.e., the 0.125- to 0.25-year storm). Flow velocity and depth from the HEC-RAS analysis of that storm were used in the calculations.

Results of Analysis

For all three methods of analysis, the 9-inch riprap appeared to provide adequate protection for the low flow conditions. For the bend analysis, calculations are shown in Appendix K, Table K-1. Based on USACE guidance, the bed along the upstream face of the deflector would require 9-inch riprap to be stable during a flow with velocity of 5 ft per second and depth of 6 ft.

Analysis of contraction scour based on the Gill equation suggests that there is limited scour potential. Critical shear stress was assumed to equal 1 lb/ft^2, based on a 9-inch riprap (D_{30} = 4.5 inches). Scour was evaluated for the 0.125-, 0.25-, and 0.5-year storms, and the equation predicted a negative scour depth for all cases (see calculations in Appendix K, Table K-2). Because the deflectors are likely to be overtopped during the 0.125-year storm, and because the Gill equation does not assume all flow passes through the constriction, it was assumed that these estimates over-predict scour potential. It was also assumed that, as flows increase beyond the

0.5-year storm, the deflectors would function as roughness elements rather than flow constrictions.

Analysis of downstream scour as the water spills over the deflector also suggested that 9-inch riprap was adequate (see Appendix K, Table K-4). The analysis assumed head drop across the deflectors to equal the head drop across the sheet pile (approximately 2 ft), and maximum velocity to equal the estimated value at the upstream end of the sheet pile (6 ft/s). Analysis was performed for 9-, 12-, and 15-inch riprap. The average predicted scour depth for the two equations was negative for all material sizes.

2.9.3 Post-Construction Monitoring and Maintenance

Post-construction monitoring durations and frequencies and specific maintenance activities and procedures for both the riverbank and riverbed restoration measures will be outlined at a later date in a Post-Construction Monitoring and Maintenance Plan Design Impact Analysis.

2.10 DESIGN IMPACT ANALYSIS

2.10.1 Flood Storage Capacity

This section summarizes the calculations performed for estimating the change in flood storage capacity due to the proposed restoration plan for Phase 1. The volume calculations consist of the following steps:

- Use cross-sections generated by Woodlot Alternatives showing existing grade and proposed final grade at approximately 50-ft intervals along the first design reach of the river and the drainage swale.
- Using AutoCAD, calculate the cross-sectional area between the two grade lines at each station.
- Calculate the volume by using average end area method used in the EE/CA for calculation volume of excavation and backfill. The calculations involve taking the average of the two end areas for a given river section; and the volume is calculated by multiplying the averaged area by the length of the river between the cross-sections. Calculations are performed using MS Excel.

Table 2-10.1 summarizes the final estimated change in flood-storage capacity. In summary, the flood storage capacity in the design reach is increased by approximately 1,000 cy (about 200,000 gallons), based on the following primary factors:

- Approximately 1,220 cy of flood storage capacity is gained because of the difference between the volume of sediment/soil excavated compared to the volume of backfill added to restore the site.
- Approximately 210 cy of flood storage capacity is lost due to construction of the Silver Lake outfall extension.

2.10.2 Comparison of EE/CA and Final Design Excavated Soil and Sediment Volume Estimates

Table 2-10.2 compares the in-place volumes presented in Appendix O of the EE/CA to the design volume calculations. Subsequent to the EE/CA, the EE/CA Addendum and July 2000 proposed plan added additional excavation volume to account for deeper excavation at aggrading bars downstream of Elm Street Bridge and increased excavation on residential properties. None of these specific increases occurred in Phase 1 of construction. Therefore, use of the quantities in Appendix O for Phase 1 is appropriate. In-place volumes are shown, and the total in-place volumes as well as totals with a 10% overexcavation factor applied are shown. In the EE/CA, an in-place volume estimate of 16,600 cy (18,300 cy with overexcavation factor) was estimated from station 500+00 to station 514+00 using the Average-End Method. From the final design excavation calculations discussed in Section 2.5.1.2, an in-place volume estimate of 17,900 cy was calculated from station 500+00 to station 514+00 (19,700 cy with overexcavation factor). The increase in excavated volume for the final design over the EE/CA volume is mainly attributable to inclusion of the drainage swale and a previously undocumented aggrading bar. The in-place excavation volumes of 1,200 cy from the drainage swale area, and the increase of about 300 cy for the aggrading bar was not included in the EE/CA, EE/CA Addendum, proposed plan, or the Action Memo. Detailed calculations for the east bank, river channel, and west bank are included as Tables A-1, A-2 and A-3, respectively, in Appendix A.

2.10.3 Hydraulics

Hart Crowser performed hydraulic modeling to evaluate the effects of the proposed design conditions. Hydraulic modeling was used to estimate water surface elevations (WSEL) and channel velocities of proposed channel conditions relative to existing conditions. Estimates of WSEL were calculated to evaluate the hydraulic characteristics of the 0.5-, 1-, 1.5-, 2-, 5-, 10-, 50-, and 100-year floods. Flow rates are presented in Table 2-10.3. A total of four plans were developed for this assessment. Three plans were created for existing conditions in order to test the sensitivity of HEC-RAS to changes in roughness (Manning's n value), and one plan was created for proposed conditions. For a given flow rate, it was assumed that a predicted flood stage increase was not significant if the magnitude of the stage increase was similar to the increase calculated in the Upper ½-Mile, allowing for an increase in roughness coefficient in the design reach that was not incorporated in the Upper ½-Mile.

2.10.3.1 Existing Conditions

Evaluating current hydraulic conditions was necessary for determining the effect of the proposed design conditions on WSEL and flow velocities. Cross-sectional data describing existing conditions were used to evaluate current hydraulic characteristics for a range of flow events. Cross-sectional data for existing conditions were obtained from an optical survey performed by the USACE in 1998. For existing conditions, the roughness value (Manning's n) used for the channel was 0.025 and for overbank was 0.052. Manning's n plays an important role in influencing the dynamics of flow through a cross-section. Small increases in the estimated roughness value may result in a lower estimated velocity and higher estimated flow depth. This is demonstrated for existing conditions in Table 2-10.3, which shows the difference in WSEL for existing conditions using roughness coefficients of 0.029 and 0.033. The sensitivity of the HEC-RAS model to changes in Manning's n was also tested for by running three plans using the same geometric and flow data for existing conditions, but using channel bed roughness coefficients of 0.025, 0.029, and 0.033. The roughness values used are considered to approximately represent existing conditions (0.025), proposed conditions (0.033, see discussion under section Proposed Conditions), and an average value similar to the FEMA (1987) roughness value (0.029) used for existing conditions. Table 2-10.4 shows the difference in WSEL between proposed conditions (at

n = 0.033) and existing conditions at n = 0.033, 0.029, and 0.025 respectively (for the 2-year flood).

The data provided in Table 2-10.3 show that changes in the "n" value appear to exert more influence on the WSEL near the Lyman Street Bridge during all modeled flow events. Changes in "n" also more generally influence WSEL for flood events approaching bankfull (0.5 to 2 year return intervals) at both locations. The effects of increasing the "n" value appear to diminish as flow conditions begin to inundate nearby buildings (flows greater than the 5-year flood).

The data provided in Table 2-10.4 show that changes in the "n" value within the study reach influence WSEL upstream of Lyman Bridge within an averaged range of 0.1 ft (where "n" = 0.033) to 0.38 ft (where "n" = 0.025) for the 2-year flood. The greatest changes in WSEL appear to occur upstream of Lyman Bridge. The effect of changing the "n" value to 0.029 for existing conditions appears to result in WSEL changes between existing and proposed conditions that are approximately half or less of the output results using an "n" value of 0.025.

2.10.3.2 Proposed Conditions

Hart Crowser designed the cross-sections for proposed conditions used in the HEC-RAS analysis. Proposed conditions took into account added channel roughness from armoring (n = 0.033). The channel bed roughness for proposed conditions was calculated as the average of roughness values for the existing condition and the proposed riprap material to be placed in the bed (12-inch; D_{90min} = 0.7-ft) and on the bank (18-inch; D_{90min} = 1.0-ft). This calculation is based on the assumption that bank armor will remain exposed and that bed armor will be partially exposed during flood events (see Table C-4). Although construction in the reach from Newell Street to Lyman Street may increased bed roughness, this change was not incorporated because water surface elevation in the design reach is not controlled by upstream hydraulic conditions.

Proposed conditions also included in-channel flow deflectors at six cross-section locations, and changes in channel bank dimensions. The rock deflectors were modeled as blocked obstructions at representative cross-sections. The cross-sections were updated to reflect post-construction conditions. Floodplain dimensions for the proposed cross-sections were extrapolated from the existing conditions geometry data. Comparison between existing conditions at n = 0.025 and

proposed conditions at n = 0.033 provides the basis for evaluating the effectiveness of the proposed design.

The data provided in Tables 2-10.5 through 2-10.7 and Figures 2-10.1 through 2-10.3 show that proposed conditions appear to increase the water surface elevation a small amount. The WSEL near Lyman Street has a greater sensitivity to proposed conditions than Newell Street during flood events approaching bankfull (0.5- to 2-year return intervals). The highest increase in water surface elevation occurs near Lyman Street at an estimated 0.55 ft. The highest increase in WSEL for Newell Street is an estimated 0.3 ft. Both occur during the 5-year flood (QDesign Reach = 3336 cfs). Changes in WSEL increase as flows approach the 5-year flood and then decrease during the medium- and large-sized floods. Although the stage increase in the design reach is similar for the 2-, 5-, and 10-year floods, the stage increase in the upper half mile is minimal during the 10-year flood (QDesign Reach = 4375 cfs).

The predicted stage increase may be associated with modeling assumptions and the proposed channel condition. The results of the roughness sensitivity analysis suggest that more than 50% of the increased stage is associated with difference in roughness. The actual roughness value for proposed conditions is likely to be lower than 0.033 based on probable sediment transport and deposition in the reach. In addition, it may be lower if the bank armor (which had the highest roughness) does not affect hydraulic conditions as much as the bed material.

Stage increase may also be associated with the proposed channel configuration. Rock deflectors can affect flood stage by reducing flow capacity. The stage increase may also be associated with the accuracy of the cross-section input data. The existing and proposed cross-sections are based on interpretation of the same contour information, but channel bed elevations do not all correspond. Discrepancies in bed elevation, which are generally on the order of 6 inches, may have caused some of the reported stage increase. However, resolving those discrepancies would not necessarily improve the accuracy of the model. The cross-sections used in the model may have that much error in them because they only represent conditions every 50 ft.

From this analysis the estimated average increase in flood stage associated with changes in channel configuration is on the order of 0.2 ft. The model runs with changes in n values between 0 (proposed n = existing n) and 0.008 (proposed n = 0.033, existing n = 0.025) showed a range of

increases in flood stage from ~ 0.1 to ~ 0.3 ft, with an estimated local maximum stage increase of approximately 0.5 ft near the Lyman Street Bridge (using proposed n of 0.033). The average increase in WSEL for the design reach is similar to predictions for the maximum increase in WSEL predicted for the upper half mile. However, no change in roughness was assumed for the Upper ½-Mile (GE, 2000, 08-0098).

The maximum increase in flood stage could be decreased to between 0.2 and 0.5 ft, depending on the extent of sedimentation in the bed and banks. If there is sufficient sedimentation to lower the roughness, the average and maximum WSEL will decrease accordingly.

As stated above, and using reasonably conservative assumptions, the average increase in WSEL for proposed conditions is estimated at 0.2 ft, and the maximum increase in WSEL is estimated at 0.5 ft. Based on these analysis results, it is believed that the proposed design meets applicable project ARARs for flood stage impacts. As indicated above, natural sedimentation over the riprap may decrease the roughness, resulting in a corresponding decrease in WSEL. The additional FSC incorporated in the design was intended, in part, to accommodate natural sedimentation.

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TABLES

Table 2-5.1a - 100% Design Excavation Volumes by Area

Location	In-Place Volume	Total With Overexcavation Factor of 10%
East Bank	4,000	4,400
West Bank	4,500	5,000
River	8,200	9,000
Subtotal (Housatonic)	16,700	18,400
Drainage Swale	1,200	1,300
Total	**17,900**	**19,700**

Table 2-5.1b - 100% Design Excavation Volumes by Soil/Sediment Classification

Soil/Sediment Classification	In-Place Volume	Total With Overexcavation Factor of 10%
TSCA	2,900	3,200
non-TSCA	15,000	16,500
Total	**17,900**	**19,700**

Table 2-5.2 - 100% Design Backfill Volumes

Estimated Backfill Volume in Cubic Yards	Riprap	Filter A	Filter B	Revegetation Common Fill/Top Soil*		Bio-engineering @	Total Backfill
East Bank	500 (D_{100} = 18")	125	125	2,500 400	*	250	3,900
West Bank	1,400 (D_{100} = 18")	350	350	1,700 600	*	0	4,400
Riverbed with underfill	3,200 (D_{100} = 12") 1,400 (D_{100} = 9")	1,600	0	900 (Common Fill)		0	7,100
Drainage Swale#	320 (D_{100} = 18")	80	80	450 170	*	0	1,100
Total (in place)	2,220 (D_{100} = 18") 3,200 (D_{100} = 12") 1,400 (D_{100} = 9")	2,155	475	5,550 1,170	*	250	16,500

Table 2-5.3

Summary of N-Values
Phase I Geotechnical Borings

Depth (ft bgs)	Geotechnical Boring Location N-values						
	GB-A	GB-B	GB-C	GB-D	GB-E	GB-F	GB-G
0-2	30	24	21	16	9	17	3
2-4	43	37	28	<109/11"	13	44	4
4-6	5	15	17	24	14	32	2
6-8	9	19	13	17	6	42	3
8-10	18	12	9	11	12	10	4
10-12	9	12	7	8	13	11	8
12-14	24	6	14	10	10	25	10
14-16	8	16	15	10	10	11	10*
16-18	16	28	9	21	17	17	19*
18-20	53	34	4	12	13	11	NS
20-22	NS	NS	16	17	NS	11	19
25-27	43	31	23	NS	44	23	41
30-32	88	49	15	NS	51	50	156
35-37	101	71	35	NS	33	30	>100/5"
40-42	>157/10"	>100/5"	26	NS	64	90	>100/4"
45-47	>100/5"	97	33	NS	134	>100/5"	127
50-52	>100/4"	94	>175/11"	NS	>100/5"	96	NS**
55-57	54	>100/3"	>100/3"	NS	>100/5"	NS	>100/2"
60-62	>100/3"	>100/2"	>173/10"	NS	>100/6"	NS	NS***

LEGEND:
ft bgs - feet below ground surface
NS - Not Sampled
<X/Y" - refusal encountered after X blows with total penetration from 6-18 inches of Y inches.
*Data from these intervals represent the 15-17 and 17-19 ft bgs intervals, respectively.
**Cored a 9.5" boulder at this interval.
***Not sampled, but drilling rate was similar to boulder drilling rate (<100/2").

Table 2-5.4

Results of the Sheet Pile Design Scenarios

Design Parameter	Scenario I (3-Ft Excavation Depth)	Scenario II (5-Ft Excavation Depth)
Minimum Required Embedment Depth of Sheeting Below Base of Channel Bottom Excavation (ft)	19	17/22
Factor of Safety on Minimum Required Embedment Depth	1.20	1.00/1.29
Required Minimum Purchase Length of Sheet Piling (ft)	30	30/35
Calculated Maximum Moment in Sheet Piling (ft-lb/ft)	110,849	142,938
Minimum Required Section Modulus of ASTM A-572, Grade 50 Sheet Piling (in^3/ft)*	37.21	47.98

*Assumes that maximum permissible flexural stress in sheeting is 65% of the 50 Ksi yield stress of the ASTM A-572, Gr. 50 steel (i.e., 32.5 Ksi). This value was then increased by 10% to 35.8 Ksi to determine the minimum required Section Modulus of the sheet piling consistent with a temporary, short-term construction condition assumption in accordance with conventional sheet piling design practice.

Table 2-6.1 – Summary of Borings Performed from Lyman Street Bridge to Transect 96

Boring #	Approximate Location	Approx. Surf. Elev., ft	Depth of Boring/ Elev. of Bot. of Boring, ft	# of Split-Spoon Samples
In River Borings				
BH000112	Sta. 501+30; 10-ft east of CL	968 (968)	20-ft / El. 948	4
BH000124	Sta. 505+90; 5-ft east of CL	968.5 (968)	20-ft / El. 948.5	4
BH000125	Sta. 510+35; at CL	968.5 (968)	20-ft / El. 948.5	4
BH000128	Sta. 515+95; 5-ft east of CL	967 (968)	15-ft / El. 952	3
West Bank				
BH000104	Sta. 500+20; 75-ft west of CL; 20-ft west of excav. Limit	983.35 (987)	35-ft / El. 948.35	5
BH000105	Sta. 505+50; 55-ft west of CL; 5-ft west of excav. Limit	981.66 (981)	35-ft / El. 946.66	5
BH000116	Sta. 509+60; 75-ft west of CL; 40-ft west of excav. Limit	979.43 (976)	30-ft / El. 949.43	5
BH000133	Sta. 511+30; 75-ft west of CL; 25-ft west of excav. Limit	980.14 (975)	35-ft / El. 945.14	6
East Bank				
BH000141	Sta. 504+65; 75-ft east of CL; 25-ft east of excav. Limit	983.42 (983)	32-ft / El. 951.42	6
BH000142	Sta. 507+40; 90-ft east of CL; 20-ft east of excav. Limit	982.31 (985)	37-ft / El. 945.31	6
BH000097	Sta. 510+10; 70-ft east of CL; 5-ft east of excav. Limit	981.98 (982)	32-ft / El. 949.98	15
BH000143	Sta. 510+40; 75-ft east of CL; 5-ft east of excav. Limit	982.58 (985)	37.5-ft / El. 945.08	7
BH000145	Sta. 513+50; 50-ft east of CL; 5-ft east of excav. Limit	982.69 (982)	35.7-ft / 946.99	6
BH000098	Sta. 515+50; 60-ft east of CL; 10-ft east of excav. Limit	987.68 (988)	20-ft / 967.68	8

Note: For borings located on land, the surface elevation is generally based on measurements obtained from the land survey. Surface elevations for in-river borings are estimated using project topo map and the GPS surveyed locations of the borings. Elevation values in parentheses reflect boring elevations reported on boring logs that are generally based on the project topo map and GPS surveyed coordinates.

Table 2-6.2 – Summary of Existing River Bank Borings between Lyman Street Bridge and Transect 96

	West Bank	East Bank
Number of Borings	4	6
Total Number of SPT Samples above El. 968	8	28
Number of Samples with N < 10	8 (100%)	5 (18%)
Number of Samples with 10 < N < 20	0 (0%)	14 (50%)
Number of Samples with N > 20	0 (0%)	9 (32%)
Average N for all SPT Samples obtained above El. 968	4.5	22
Average N for SPT Samples obtained above El. 968 and N < 20	4.5	12

Table 2-6.3 - Assumed Soil Properties along the West and East Banks

Soil Stratum	Unit Weight, γ_t (pcf)	Average Blow Count, N_{avg} (blows/ft)	West Bank Friction Angle, ϕ' (o)	East Bank Friction Angle, ϕ' (o)	Cohesion, c (psf)
Riprap	140	---	38	38	30
Bioengineering	115	---	33	33	100
Revegetation	same as native soil				
Upper Sand From surface to El. 964	115	5	28	32	0
Lower Sand From El. 964 to El. 951	115	10	30	32	0
Till From El. 951 to El. 940	125	20	38	38	0
Bedrock at El. 940	---	---	---		---

Note: EE/CA assumption: γ_t = 120pcf, ϕ' = 32°, c = 30 psf for all soil

γ_t = 140pcf, ϕ' = 40°, c = 100 psf for riprap

Assumed groundwater location:

beyond 60-ft from toe of slope: El. 973

At 30-ft from to of the slope: El. 971

at the toe of slope and river: at existing grade (no water in river)

Table 2-6.4 – Summary of Existing Slope Configuration Along West Bank

Station	Toe Elev.	Elev. @ Limit of Work	Horiz. Distance, ft	Slope Height, ft	Slope, H/V
500+00	971	984	23	13	1.77
500+50	971	983	24	12	2
501+00	971	984	33	13	2.54
501+50	971	981	24	10	2.4
502+00	971	980	26	9	2.89
502+50	971	979.5	26	8.5	3.06
503+00	971	979	23	8	2.88
503+50	971	979.5	20	8.5	2.35
504+00	972	980	18	8	2.25
504+50	971	981.5	21	10.5	2
505+00	970	981.5	19	11.5	1.65
505+50	971	981.5	21	10.5	2
506+00	971	978	14	7	2
506+50	971	978	17	7	2.43
507+00	971	978	17	7	2.43
507+50	971	Silver Lake Outfall			
508+00	971	978	12	7	1.71
508+50	971	977	6	6	1
509+00	970	977.5	7	7.5	0.93
509+50	970	974	8	4	2
510+00	970	976	8	6	1.33
510+50	971	976	11	5	2.2
511+00	971	979	17	8	2.13
511+50	971	978.5	15	7.5	2
512+00	971	980	23	9	2.56
512+50	971	980	35	9	3.89
513+00	971	980	42	9	4.67
513+50	970	980.5	45	10.5	4.29
514+00	970	981	45	11	4.09
			Average	8.68	2.41

Note: used $\phi' = 28$, $c = 0$ psf

Table 2-6.5 – Summary of Existing Slope Configuration Along East Bank

Station	Toe Elev.	Elev. @ Limit of Work	Horiz. Distance, ft	Slope Height, ft	Slope, H/V
502+00	971	978	15	7	2.14
502+50	971	978.5	14	7.5	1.87
503+00	971	978	8	7	1.14
503+50	971	977	13	6	2.17
504+00	971		Drainage Swale		
504+50	971	982	27	11	2.45
505+00	970	981.5	21	11.5	1.83
505+50	971	982	32	11	2.91
506+00	971	982.5	28	11.5	2.43
506+50	971	982	35	11	3.18
507+00	971	981.5	41	10.5	3.9
507+50	971	981.5	39	10.5	3.71
508+00	970	980	32	9	3.56
508+50	971	981	36	10	3.6
509+00	971	983	44	12	3.67
509+50	971	983	37	12	3.08
510+00	971	983	32	12	2.67
510+50	971	981	37	10	3.7
511+00	971	980	42	9	4.67
511+50	971	981	23	10	2.3
512+00	970	981	13	11	1.18
512+50	971	979	12	8	1.5
513+00	971	981	17	10	1.7
513+50	970	982.5	16	12.5	1.28
514+00	970	984	19	14	1.36
			Average	10.17	2.58

Note: used $\phi' = 32$, $c = 0$ psf

Table 2-6.6 – Additional Slope/W Analyses Performed for Evaluating Existing Slopes

Restoration Option	West Bank $\phi' = 28^o$	East Bank $\phi' = 32^o$
Revegetation with bank armor at El. 975	Group E	Group G
Bioengineering with bank armor at El. 975	Group F	Group H

Table 2-6.7 – Preliminary Assessment of Bank Restoration Options along West Bank

Station	Slope Height in Feet	Slope, H/V	Revegetation	Bio-Engineering	Rip Rap Slope	Comments
500+00	13	1.77		need to shift limit of work		
500+50	12	2		need to shift limit of work		
501+00	13	2.54	X		same	slope shallower than 2.4:1 and H < 12
501+50	10	2.4	X		same	slope shallower than 2.4:1 and H < 12
502+00	9	2.89	X		same	slope between 3:1 and 2.6:1
502+50	8.5	3.06	X		same	slope shallower than 3:1
503+00	8	2.88	X		same	slope between 3:1 and 2.6:1
503+50	8.5	2.35	X		same	slope shallower than 2.3:1 and H < 9
504+00	8	2.25	X		same	slope shallower than 2.2:1 and H < 8
504+50	10.5	2		X	same	2:1 slope with H < 12
505+00	11.5	1.65		need to shift limit of work		
505+50	10.5	2		X	same	2:1 slope with H < 12
506+00	7	2		X	same	2:1 slope with H < 12
506+50	7	2.43	X		same	slope shallower than 2.4:1 and H < 12
507+00	7	2.43	X		same	slope shallower than 2.4:1 and H < 12
507+50						
508+00	7	1.71		X	same	1.7:1 slope with H < 7.5
508+50	6	1		need to shift limit of work		
509+00	7.5	0.93		need to shift limit of work		
509+50	4	2	X		same	slope shallower than 2:1 and H < 6
510+00	6	1.33		X	same	1.3:1 slope with H < 6.5
510+50	5	2.2	X		same	slope shallower than 2.2:1 and H < 8
511+00	8	2.13	X		same	slope shallower than 2.1:1 and H < 8
511+50	7.5	2		X	same	2:1 slope with H < 12
512+00	9	2.56	X		same	slope shallower than 2.4:1 and H < 12
512+50	9	3.89	X		same	slope shallower than 3:1
513+00	9	4.67	X		same	slope shallower than 3:1
513+50	10.5	4.29	X		same	slope shallower than 3:1
514+00	11	4.09	X		same	slope shallower than 3:1

Table 2-6.8 – Preliminary Assessment of Bank Restoration Options along East Bank

Station	Slope Height in Feet	Slope, H/V	Revegetation	Bio-Engineering	Rip Rap Slope	Comments
502+00	7	2.14	X		same	slope between 3:1 and 2:1
502+50	7.5	1.87	X		same	slope shallower than 1.8:1 and H < 11
503+00	7	1.14		Need to shift limit limit of work		
503+50	6	2.17	X		same	slope between 3:1 and 2:1
504+00						
504+50	11	2.45	X		same	slope between 3:1 and 2:1
505+00	11.5	1.83	X		same	slope shallower than 1.8:1 and H < 11
505+50	11	2.91	X		same	slope between 3:1 and 2:1
506+00	11.5	2.43	X		same	slope between 3:1 and 2:1
506+50	11	3.18	X		same	slope shallower than 3:1
507+00	10.5	3.9	X		same	slope shallower than 3:1
507+50	10.5	3.71	X		same	slope shallower than 3:1
508+00	9	3.56	X		same	slope shallower than 3:1
508+50	10	3.6	X		same	slope shallower than 3:1
509+00	12	3.67	X		same	slope shallower than 3:1
509+50	12	3.08	X		same	slope shallower than 3:1
510+00	12	2.67	X		same	slope between 3:1 and 2:1
510+50	10	3.7	X		same	slope shallower than 3:1
511+00	9	4.67	X		same	slope shallower than 3:1
511+50	10	2.3	X		same	slope between 3:1 and 2:1
512+00	11	1.18		Need to shift limit limit of work		
512+50	8	1.5		X	same	1.5:1 slope and H < 9
513+00	10	1.7		X	same	1.7:1 slope and H < 11
513+50	12.5	1.28		Need to shift limit limit of work		
514+00	14	1.36		Need to shift limit limit of work		

Table 2-6.9 – Summary of Composite Slope Analyses

Station	Slope Height, ft	Exist. Horizontal Distance, ft	Horizontal Distance	Rip Rap Slope	Bio-Eng	Remaining Slope	Comments	Shift in Limit of Work
West Bank								
501+00	13	33	33	1.75		3.03	min rip rap slope 1.75H:1V	no
501+50	10	24	24	1.75		3.05	rip rap slope at 1.75H:1V	no
502+50	8.5	26	26	2.3		4.14	rip rap slope at 2.3H:1V	no
503+00	8	23	23	2		4.33	rip rap slope at 2H:1V	no
505+00	11.5	19	26	1.5	*	2.85	rip rap slope at 1.5H:1V	7
505+50	10.5	21	23	1.5	*	2.82	rip rap slope at 1.5H:1V	2
506+00	7	14	14	1.5	*	3.25	rip rap slope at 1.5H:1V	no
506+50	7	17	17	1.6		4.5	min rip rap slope at 1.6H:1V	no
507+00	7	17	17	2		3.5	rip rap slope at 2H:1V	no
510+50	5	11	11	2			rip rap slope at 2H:1V	no
511+00	8	17	17	1.75		2.75	rip rap slope at 1.75H:1V	no
512+00	9	23	23	2		3.25	rip rap slope at 2H:1V	no
512+50	9	35	35	1.75		6.56	rip rap slope at 1.75H:1V	no
513+00	9	42	42	2		8	rip rap slope at 2H:1V	no
East Bank								
502+50	7.5	14	14	1.25		3.1	rip rap at 1.25H:1V	no
503+00	7	8	10	1.25		1.88	rip rap at 1.25H:1V	2
503+50	6	13	13	1.25		6.75	rip rap at 1.25H:1V	no
504+50	11	27	27	2		2.83	rip rap at 2H:1V	no
505+00	11.5	21	21	1.75		1.88	rip rap at 1.75H:1V	no
505+50	11	32	32	1.5		4.08	rip rap at 1.5H:1V	no
506+00	11.5	28	28	1.5		3.15	rip rap at 1.5H:1V	no
506+50	11	35	35	1.5		4.58	rip rap at 1.5H:1V	no
507+00	10.5	41	41	1.5		6.09	rip rap at 1.5H:1V	no
507+50	10.5	39	39	1.5		5.73	rip rap at 1.5H:1V	no
508+00	10	32	32	1.5		4.9	rip rap at 1.5H:1V	no
510+50	10	37	37	2		5.4	rip rap at 1.5H:1V	no
511+50	10	23	23	1.5		3.1	rip rap at 1.5H:1V	no
512+00	11	13	18	1.5	*	1.75	rip rap at 1.5H:1V	5
513+50	12.5	16	22	1.6	*	1.87	rip rap at 1.6H:1V	6
514+00	14	19	25.5	1.8	*	1.83	rip rap at 1.8H:1V	6.5

* indicates with Bio-Engioneering

Table 2-6.10 – Limit of Work Needs for Slope Options

Station	Factor of Safety for Rip Rap Slope	Factor of Safety for Bioengineered Slope	Required Extension of Limit of Work
Option 1			
512+00	1.5	2	6.5 ft
512+50	1.5	2	1.5 ft
513+00	1.5	2	0.5 ft
513+50	1.5	2	6.5 ft
514+00	1.5	2	6.5 ft
Option 2			
512+00	1.5	First 3 vert. ft.:1.5 Remaining: 2.3	5.9 ft
512+50	1.5	First 3 vert. ft.:1.5 Remaining: 2.3	0 ft
513+00	1.5	First 3 vert. ft.:1.5 Remaining: 2.3	-0.4 ft
513+50	1.5	First 3 vert. ft.:1.5 Remaining: 2.3	6.35 ft
514+00	1.5	First 3 vert. ft.:1.5 Remaining: 2.3	6.8 ft
Option 3			
512+00	1.5	First 3 vert. ft.:2.2 Remaining: 1.8	6.5 ft
512+50	1.5	First 3 vert. ft.:2.2 Remaining: 1.8	2.1 ft
513+00	1.5	First 3 vert. ft.:2.2 Remaining: 1.8	0.7 ft
513+50	1.5	First 3 vert. ft.:2.2 Remaining: 1.8	6.2 ft
514+00	1.5	First 3 vert. ft.:2.2 Remaining: 1.8	5.9 ft

Table 2-6.11 – Summary of Restoration Options Along West Bank (Sta. 507+00 to 510+00)

Station	Exist. Bank Height in Feet	Exist. Horizontal Slope Distance in Feet	Average Slope	Minimum Rip Rap Slope	Restoration Requirement	
					Rip Rap Slope	Shift in Limit of Work
507+00	7	17	2.43	2.1	2.2 2.1	-1.6 ft -2.3 ft
507+50	Silver Lake Outfall					
508+00	7	12	1.71	2.1	2.2 2.1	3.4 ft 2.7 ft
508+50	6	6	1	2	2.2 2.1 2	7.2 ft 6.6 ft 6 ft
509+00	7.5	7	0.93	2.2	2.2	9.5 ft
509+50	4*	8	2	1.3	2.2 2.1 2 1.3	0.8 ft 0.4 ft 0 ft -2.8 ft
510+00	6	8	1.33	2	2.2 2.1 2	5.2 ft 4.6 ft 4 ft

* At Sta. 509+50, top of bank at El. 974, 1-ft lower than the minimum armor El. 975. May want to consider raising the bank height at this location.

Table 2-6.12 – Existing Slope Configuration within the Drainage Swale

Drainage Swale North Side				**Armor to El. 975 and Revegetation Above**	
Station	**Toe Elev**	**Elev. @ Limit of Work**	**Horiz. Distance, ft**	**Slope Height, ft**	**Slope, H/V**
0+50	970	977	25	7	3.57
1+00	971	977.5	21	6.5	3.23
1+50	971	978.5	24	7.5	3.2
Drainage Swale South Side				Armor to El. 975 and revegetation above	
Station	**Toe Elev**	**Elev. @ Limit of Work**	**Horiz. Distance, ft**	**Slope Height, ft**	**Slope, H/V**
0+50	970	980	24	10	2.4
1+00	971	983	26	12	2.17
1+50	971	984.5	27	13.5	2

Note: used ϕ' = 32 deg, c = 0 psf

Table 2-6.13 – Restoration Configuration within the Drainage Swale Area

	Existing slope Configuration		Proposed Restoration Configuration			
Station	**Slope Height, ft**	**Slope, H/V**	**Top of Rip Rap**	**Rip Rap Slope**	**El. at Limit of Work**	**Slope within Revegetation Zone**
Drainage Swale North Side						
0+50	7	3.57	El. 975	2.2	977	2.2
1+00	6.5	3.23	El. 975	3	977.5	3
1+50	7.5	3.2	El. 975	3	978.5	3
Drainage Swale South Side						
0+50	10	2.4	El. 975	1.9	980	1.9
1+00	12	2.17	El. 975	2.1	983	2.1
1+50	13.5	2	El. 975	1.9	984.5	1.9

Table 2-6.14 – Existing Slope Geometry at Three Selected Critical Slope Locations

	Sta. 512+50 East Bank Revegetation	Sta. 514+00 East Bank Bioengineering	Sta. 505+00 West Bank Revegetation
Elev. at Top of Slope	979	984	981.5
Elev. at Top of Armor	975	975	975
Elev. at Toe of Slope	970	970	970
Horizontal Distance from Top of Slope to Top of Armor	8.7	8.75	12.43
Horizontal Distance from Top of Armor to Toe of Slope	8.7	16.77	15.37

Table 2-6.15 – Summary of Assumed Soil Properties for Slope Stability

Soil Stratum	Unit Weight, γ_t (pcf)	West Bank Friction Angle, ϕ' (°)	East Bank Friction Angle, ϕ' (°)	Cohesion, c (psf)
Rip Rap	140	38	38	30
Bioengineering	115	33	33	100
Revegetation	Same as native soil			
Upper Sand From surface to El. 964	115	28	32	0
Lower Sand From El. 964 to El. 951	115	30	32	0
Till From El. 951 to El. 940	125	38	38	0
Bedrock at El. 940	---	---	---	---

Note: EE/CA assumption: γ_t = 120pcf, ϕ' = 32°, c = 30 psf.

Table 2-6.16 – Summary of Results for Impact of Sesmic Loads and Water Level Changes on the Factor of Safety

Case Analyzed	Sta. 512+50, east Revegetation	Sta. 514+00, east Bioengineering	Sta. 505+50, west Revegetation
Case A – no water in river, far field GW at El. 973 ($FS_{required}$ > 1.5)	1.586	1.468	1.48
Case A with surcharge ($FS_{required}$ > 1.2)	1.483 (-6%)	1.406 (-4%)	1.402 (-5%)
Case A with seismic ($FS_{required}$ > 1.0)	1.238 (-22%)	1.155 (-21%)	1.082 (-27%)
Case D – no water in river, rapid drawdown with far field GW at El. 975. ($FS_{required}$ > 1.2)	1.212 (-24%)	1.336 (-9%)	1.228 (-17%)
Case D with surcharge ($FS_{required}$ > 1.2)	1.161 (-27%)	1.285 (-12%)	1.177 (-20%)
Case F – River at El. 975 ($FS_{required}$ > 1.2)	1.542 (-3%)	1.36 (-7%)	1.358 (-8%)
Case G – River at El. 971 ($FS_{required}$ > 1.5)	1.556 (-2%)	1.468 0%	1.465 (-1%)

* Note: all the previous analyses presented in Section 2.6.3 to 2.6.5 are classified as Case A.

Table 2-7.1 - Summary of Hydrologic Analysis for the East Branch, Housatonic River

Return Period	Determination of Flow Rate (cfs) at Coltsville			Station Peak Flow Estimates (cfs) for HEC-RAS Model Input[4]						
yr	Annual Series[1]	Partial Duration Series[2]	Coltsville Gauge Station Estimate[3]	Coltsville Gage Station	Design Reach	West Br. Confluence	Sykes/ Sackets	Sandwash/ Farnam	Yokun Brook	Woods Pond
100	7180		7180	7180	8721	13000	14492	16033	16930	17791
50	5960		5960	5960	7239	10790	12028	13307	14052	14767
25	4870		4870	4870	5915	8818	9830	10875	11484	12068
10	3602		3602	3602	4375	6521	7270	8043	8493	8925
5	2746		2746	2746	3336	4972	5543	6132	6476	6805
2	1686	1553	1686	1686	2047	3052	3402	3764	3975	4177
1.5	1333	1505	1450	1450	1761	2625	2926	3238	3419	3593
1	532	1414	1375	1375	1670	2489	2775	3070	3242	3407
0.75		1328	1328	1328	1612	2404	2679	2964	3130	3289
0.50		1171	1171	1171	1422	2120	2364	2615	2761	2902
0.33		970	970	970	1178	1757	1958	2166	2288	2404
0.25		804	804	804	976	1455	1622	1795	1895	1992
0.13		379	379	379	460	686	764	846	893	938
Avg				110	134	199	222	245	268	291
Discharge Factors [5]				1.00	1.21	1.81	2.02	2.23	2.36	2.48

Notes:

1. Annual series flows were calculated based on Log Pearson III analysis of Coltsville gage station annual peaks. Calculation summary and methods are shown in Table B-1
2. Partial duration flow estimates were based on hourly flow data from the Coltsville gage station, 1988 to 1998. Calculation summary and methods are shown in Table B-2.
3. For the 1- and 1.5-yr storms, information from both annual and partial duration series was used to calculate flow because of modeling limitiations. See description in Table B-2.
4. Calculation summary and methods are shown in Table B-5.1 and B-5.2.
5. Station flow rate = Gage station flow rate * discharge factor.

Table 2-7.2 - Riprap 15 Input Parameters

Parameter	Units	Notes
Specific Weight Of Stone	lb/ft^3	Average of 165 lb/ft^3. From discussion with Don Woods at USACE, considered this a reasonable approximation.
Minimum Centerline Bend Radius	ft	Measured from site map, start and end approximately tangent to river centerline.
Water Surface Width	ft	Measured from site map at approximately bank full condition. Did not include flood plain for out-of-bank flow conditions.
Flow Depth	ft	Chosen from HEC-RAS analysis data set.
Channel Side Slope	1V:?H	Assumed 1V:2H for all side slopes, initially, was to be the maximum bank slope in the restored reach.
Average Channel Velocity	ft/sec	Chosen from HEC-RAS analysis data set.
Stone Layer Thickness/D100		Ratio of layer thickness to riprap size. Standard = 1, High turbulence areas = 1.5.

Table 2-7.3 - Analysis Segments

Analysis Segments	Station	Bend Radius, ft	Bend Width, ft	Side Slope, h:v	Design Velocity, fps	Design Depth, ft	Notes
Lyman St. Bridge	499+50	330	100	2:1	7.0	14:24	Represents conditions under Lyman St. Bridge. Not part of this design reach, but conditions may negatively impact upstream end of stone protection.
Bend A:	500+00 to 504+00				6.6	16.5	Bed and banks analyzed separately. The bend terminates at station 502+00, the turbulence dissipation zone terminates at station 504+00.
Bank		330	100	2:1			
Bed		330	100	5:1			
Bend B:	508+00 to 512+00				5.9	12.5	Bed and banks analyzed separately. The bend terminates at station 510+00, the turbulence dissipation zone terminates at station 512+00.
Bank		200	100	2:1			
Bed		200	100	5:1			
Straight Segments	504+00 to 508+00; 512+00 to 514+00	NA	NA	NA	8	11.3	Centerline velocity assumed 20% higher than average velocity obtained from HEC-RAS analysis (see EM 1110-2-1601).
Bend in Upper Reach	NA	500	100	2:1	5.1	16.8	Although stone protection design upstream of Lyman St. Bridge is not part of this analysis, hydraulic conditions should be evaluated at the upstream end of the design.

Table 2-7.4 - Riprap Design: Incorporation of Other Stability Issues

Reach	Hydraulic Evaluation[1]		Increase for Ice and Debris[2]		Minimum Vandalism Requirement[3]	
	D_{100} (max) in inches	Layer Thickness in inches	D_{100} (max) in inches	Layer Thickness in inches	D_{100} (max) in inches	Layer Thickness in inches
Bend A:						
Bank	12	18	15	24	21	21
Bed	9	14	12	20	21	21
Bend B:						
Bank	12	18			21	21
Bed	9	14			21	21
Straight Segments	9	14	9	15	21	21

Notes:
Riprap 15 program used to iterate calculations.
1. Represents the stone size and layer thickness for riprap to meet stability requirements based on hydraulic conditions.
2. Represents increased stone size and layer thickness to compensate for potential ice and debris damage. Corp guidance suggests increase in stone size to next standard size and increase of 6 inches in thickness (USACE, 1994 and Kullberg, 2001).
3. Represents minimum size required for vandal proofing. Minimum thickness is based on constructability. There was no reported thickness requirement for protection against vandalism.

Table 2-10.1 - Summary of Estimated Flood Storage Capacity (FSC) Changes

Section	Volume in cubic yards[1]
Net Change between the Existing Conditions and the 95% Design Excavation/Backfilling	1,220
Silver Lake Outfall Additional Filling	(210)
Estimated Total	**1,010**

[1] Positive value indicates net increase (i.e. proposed grade is below existing grade).

Table 2-10.2 - Comparison of Excavation Volume Estimates in Cubic Yards (in-place volume)

Location	EE/CA	100% Design Calculation
East Bank	4,200	4,000
River	8,200	8,200
West Bank	4,200	4,500
Drainage Swale		1,200
Total (in place)	16,600	17,900
Total with 10% Overexcavation Factor	18,300	19,700

Table 2-10.3 - Summary of Water Surface Elevations for Existing Conditions using Two Manning's n Roughness Values, n=0.025 and n=0.033

Return Interval	Flow Rate, cfs		WSEL, ft, for Existing Conditions n = 0.025		WSEL, ft, for Existing Conditions n = 0.033		Difference in WSEL, ft	
	Coltsville Gauge Station	Design Reach	Near Lyman St.	Near Newell St.	Near Lyman St.	Near Newell St.	Near Lyman St.	Near Newell St.
0.5	1171	1422	975.78	977.46	976.08	977.7	0.3	0.24
1	1375	1670	976.31	978.03	976.6	978.25	0.29	0.22
1.5	1450	1761	976.47	978.23	976.79	978.43	0.3	0.2
2	1686	2047	977.04	978.84	977.36	979.07	0.32	0.23
5	2746	3336	979.36	980.87	979.67	981.07	0.31	0.2
10	3602	4375	981.08	982.67	981.32	982.89	0.24	0.22
50	5960	7239	985.2	987.62	985.31	987.71	0.11	0.09
100	7180	8721	987.12	990.12	987.24	990.15	0.12	0.03

Table 2-10.4 - Change in Water Surface Elevations from Proposed Conditions to Existing Conditions for the 2-Year Flood

Cross sections		Water Surface Elevations within the Design Reach for the 2-year Flood						
HEC-RAS	River St.	Proposed (n=0.033)	Existing n=0.033	Difference	Existing n=0.029	Difference	Existing n=0.025	Difference
50550	514+00	976.36	976.33	0.03	976.33	0.03	976.32	0.04
50600	513+50	976.4	976.41	-0.01	976.4	0	976.39	0.01
50650	513+00	976.44	976.43	0.01	976.41	0.03	976.4	0.04
50700	512+50	976.42	976.45	-0.03	976.42	0	976.4	0.02
50750	512+00	976.52	976.47	0.05	976.44	0.08	976.41	0.11
50800	511+50	976.57	976.51	0.06	976.47	0.1	976.44	0.13
50850	511+00	976.61	976.54	0.07	976.49	0.12	976.45	0.16
50900	510+50	976.67	976.53	0.14	976.47	0.2	976.42	0.25
50950	510+00	976.71	976.66	0.05	976.59	0.12	976.53	0.18
51000	509+50	976.81	976.72	0.09	976.65	0.16	976.59	0.22
51050	509+00	976.82	976.8	0.02	976.73	0.09	976.66	0.16
51100	508+50	976.83	976.81	0.02	976.73	0.1	976.66	0.17
51150	508+00	976.84	976.83	0.01	976.75	0.09	976.67	0.17
51200	507+50	977.01	976.85	0.16	976.76	0.25	976.68	0.33
51250	507+00	976.91	976.87	0.04	976.78	0.13	976.69	0.22
51300	506+50	976.92	976.95	-0.03	976.85	0.07	976.75	0.17
51350	506+00	976.92	976.94	-0.02	976.84	0.08	976.74	0.18
51400	505+50	977.04	976.96	0.08	976.85	0.19	976.74	0.3
51450	505+00	977.15	977.05	0.1	976.93	0.22	976.82	0.33
51500	504+50	977.13	977.07	0.06	976.94	0.19	976.83	0.3
51600	503+50	977.22	977.12	0.1	976.98	0.24	976.85	0.37
51650	503+00	977.31	977.22	0.09	977.07	0.24	976.95	0.36
51700	502+50	977.35	977.19	0.16	977.04	0.31	976.91	0.44
51750	502+00	977.38	977.17	0.21	977	0.38	976.87	0.51
51800	501+50	977.37	977.22	0.15	977.06	0.31	976.91	0.46
51850	501+00	977.44	977.36	0.08	977.19	0.25	977.04	0.4
51900	500+50	977.52	977.36	0.16	977.19	0.33	977.04	0.48
51948	500+00	977.46	977.3	0.16	977.12	0.34	976.96	0.5
AVERAGE				**0.07**		**0.17**		**0.25**
51973	Lyman Bridge							
52000	499+48	978.1	977.97	0.13	977.78	0.32	977.59	0.51
52023	499+25	978.34	978.22	0.12	978.04	0.30	977.88	0.46
52073	498+75	978.37	978.26	0.11	978.09	0.28	977.93	0.44
52148	498+00	978.42	978.31	0.11	978.14	0.28	977.98	0.44
52200	497+48	978.42	978.31	0.11	978.14	0.28	977.98	0.44
52243	497+05	978.42	978.31	0.11	978.14	0.28	977.98	0.44
52273	496+75	978.47	978.36	0.11	978.19	0.28	978.04	0.43
52350	495+98	978.47	978.36	0.11	978.19	0.28	978.04	0.43
52398	495+50	978.52	978.42	0.10	978.25	0.27	978.10	0.42
52400	495+48	978.52	978.41	0.11	978.25	0.27	978.10	0.42
52490	494+58	978.52	978.41	0.11	978.25	0.27	978.10	0.42
52523	494+25	978.57	978.46	0.11	978.30	0.27	978.16	0.41
52630	493+18	978.57	978.46	0.11	978.30	0.27	978.16	0.41
52773	491+75	978.59	978.48	0.11	978.33	0.26	978.18	0.41
52873	490+75	978.65	978.55	0.10	978.40	0.25	978.26	0.39
52883	490+65	978.64	978.54	0.10	978.38	0.26	978.24	0.40
52921	490+27	978.62	978.52	0.10	978.36	0.26	978.22	0.40
52928	490+20							
52935	490+13	978.62	978.52	0.10	978.36	0.26	978.22	0.40
52970	489+78	978.7	978.6	0.10	978.45	0.25	978.31	0.39
53033	489+15	978.72	978.62	0.10	978.47	0.25	978.33	0.39
53073	488+75	978.71	978.61	0.10	978.46	0.25	978.33	0.38
53108	488+40	978.71	978.61	0.10	978.46	0.25	978.32	0.39
53140	488+08	978.77	978.67	0.1	978.52	0.25	978.39	0.38
53233	487+15	978.75	978.65	0.1	978.5	0.25	978.37	0.38
53278	486+70	978.75	978.65	0.1	978.5	0.25	978.37	0.38
53303	486+45	978.77	978.67	0.10	978.52	0.25	978.39	0.38
53383	485+65	978.79	978.7	0.09	978.55	0.24	978.42	0.37
53533	484+15	978.82	978.72	0.10	978.58	0.24	978.45	0.37
53538	484+10	978.85	978.75	0.10	978.61	0.24	978.47	0.38

Table 2-10.4 - Change in Water Surface Elevations from Proposed Conditions to Existing Conditions for the 2-Year Flood

Cross sections		Water Surface Elevations within the Design Reach for the 2-year Flood						
HEC-RAS	River St.	Proposed (n=0.033)	Existing n=0.033	Difference	Existing n=0.029	Difference	Existing n=0.025	Difference
53573	483+75	978.85	978.76	0.09	978.61	0.24	978.48	0.37
53683	482+65	978.86	978.77	0.09	978.62	0.24	978.5	0.36
53773	481+75	978.87	978.79	0.08	978.64	0.23	978.52	0.35
53833	481+15	978.89	978.81	0.08	978.66	0.23	978.54	0.35
53930	480+18	978.9	978.82	0.08	978.67	0.23	978.55	0.35
53983	479+65	978.94	978.86	0.08	978.71	0.23	978.6	0.34
54083	478+65	978.94	978.86	0.08	978.72	0.22	978.6	0.34
54183	477+65	978.96	978.88	0.08	978.73	0.23	978.62	0.34
54283	476+65	978.97	978.89	0.08	978.75	0.22	978.64	0.33
54383	475+65	978.97	978.89	0.08	978.74	0.23	978.63	0.34
54483	474+65	978.96	978.89	0.07	978.74	0.22	978.63	0.33
54683	472+65	979.06	978.98	0.08	978.84	0.22	978.74	0.32
54783	471+65	979.08	979.01	0.07	978.87	0.21	978.76	0.32
54790	471+58	979.11	979.04	0.07	978.90	0.21	978.79	0.32
54900	470+48	979.14	979.07	0.07	978.93	0.21	978.83	0.31
54935	470+13	979.15	979.08	0.07	978.94	0.21	978.84	0.31
54970	469+78	979.16	979.09	0.07	978.95	0.21	978.85	0.31
55030	469+18	979.19	979.12	0.07	978.98	0.21	978.88	0.31
55100	468+48	979.19	979.12	0.07	978.99	0.20	978.89	0.3
55181	467+67	979.2	979.13	0.07	979.00	0.20	978.89	0.31
AVERAGE				0.09		0.25		0.38

Table 2-10.5 - Summary of Water Surface Elevations for Existing and Proposed Channel Conditions

Return Interval	Flow Rate, cfs		WSEL, ft, for Existing Conditions[1] near Lyman St.			WSEL, ft, for Existing Conditions[1] near Newell St.			WSEL, ft, for Proposed Conditions n = 0.033	
	Coltsville Gauge Station	Design Reach	n = 0.025	n = 0.029	n = 0.033	n = 0.025	n = 0.029	n = 0.033	Near Lyman St.	Near Newell St.
0.5	1171	1422	975.78	975.93	976.08	977.47	977.57	977.72	976.22	977.78
1	1375	1670	976.31	976.45	976.60	978.06	978.16	978.28	976.75	978.34
1.5	1450	1761	976.49	976.63	976.79	978.27	978.37	978.49	976.94	978.55
2	1686	2047	977.04	977.19	977.36	978.89	978.99	979.12	977.52	979.19
5	2746	3336	979.35	979.51	979.67	980.99	981.09	981.19	979.88	981.30
10	3602	4375	981.08	981.19	981.32	983.41	983.41	983.29	981.53	983.43
50	5960	7239	985.20	985.25	985.31	987.72	987.74	987.79	985.41	987.82
100	7180	8721	987.12	987.18	987.24	990.18	990.19	990.22	987.28	990.23

Return Interval	Flow Rate, cfs		Difference in WSEL[2], ft, near Lyman St.			Difference in WSEL[2], ft, near Newell St.		
	Coltsville Gauge Station	Design Reach	n = 0.025	n = 0.029	n = 0.033	n = 0.025	n = 0.029	n = 0.033
0.5	1171	1422	0.44	0.29	0.14	0.31	0.21	0.06
1	1375	1670	0.44	0.30	0.15	0.28	0.18	0.06
1.5	1450	1761	0.45	0.31	0.15	0.28	0.18	0.06
2	1686	2047	0.48	0.33	0.16	0.30	0.20	0.07
5	2746	3336	0.53	0.37	0.21	0.31	0.21	0.11
10	3602	4375	0.45	0.34	0.21	0.02	0.02	0.14
50	5960	7239	0.21	0.16	0.10	0.10	0.08	0.03
100	7180	8721	0.16	0.10	0.04	0.05	0.04	0.01

Notes:
1. Water surface elevations for existing conditions were calculated using different roughness coefficients to evaluate model sensitivity.
WSEL near Lyman St. were taken from HEC-RAS station 51900.
WSEL near Newell St. were taken from HEC-RAS station 55100.
2. Represents the difference in predicted WSEL between the proposed condition and the existing condition with the given roughness coefficient.

Table 2-10.6 - Change in Water Surface Elevations from Proposed Conditions to Existing Conditions for the 5-Year Flood

Cross sections		WSEL Design Reach, 5-year Flood		
HEC-RAS	River St.	Proposed n=0.033	Existing n=0.025	Difference
50550	514+00	978.7	978.66	0.04
50600	513+50	978.75	978.75	0
50650	513+00	978.76	978.74	0.02
50700	512+50	978.76	978.74	0.02
50750	512+00	978.82	978.75	0.07
50800	511+50	978.89	978.79	0.1
50850	511+00	978.98	978.82	0.16
50900	510+50	979.01	978.76	0.25
50950	510+00	979.04	978.9	0.14
51000	509+50	979.15	978.94	0.21
51050	509+00	979.15	979.03	0.12
51100	508+50	979.16	979.03	0.13
51150	508+00	979.16	979.03	0.13
51200	507+50	979.4	979.04	0.36
51250	507+00	979.26	979.03	0.23
51300	506+50	979.29	979.12	0.17
51350	506+00	979.28	979.1	0.18
51400	505+50	979.41	979.09	0.32
51450	505+00	979.52	979.19	0.33
51500	504+50	979.48	979.2	0.28
51600	503+50	979.59	979.21	0.38
51650	503+00	979.65	979.29	0.36
51700	502+50	979.72	979.24	0.48
51750	502+00	979.72	979.17	0.55
51800	501+50	979.69	979.2	0.49
51850	501+00	979.77	979.36	0.41
51900	500+50	979.88	979.35	0.53
51948	500+00	979.78	979.27	0.51
AVERAGE				**0.25**

Table 2-10.6 - Change in Water Surface Elevations from Proposed Conditions to Existing Conditions for the 5-Year Flood

Cross sections		WSEL Upper 1/2 Mile, 5-year Flood		
HEC-RAS	River St.	Proposed	Existing n=0.025	Difference
51973		Lyman Bridge		
52000	499+48	979.75	979.21	0.54
52023	499+25	980.13	979.66	0.47
52073	498+75	980.18	979.72	0.46
52148	498+00	980.27	979.82	0.45
52200	497+48	980.25	979.81	0.44
52243	497+05	980.25	979.8	0.45
52273	496+75	980.35	979.91	0.44
52350	495+98	980.34	979.9	0.44
52398	495+50	980.43	980.01	0.42
52400	495+48	980.41	979.98	0.43
52490	494+58	980.42	980	0.42
52523	494+25	980.52	980.1	0.42
52630	493+18	980.48	980.07	0.41
52773	491+75	980.52	980.11	0.41
52873	490+75	980.62	980.22	0.4
52883	490+65	980.66	980.25	0.41
52921	490+27	980.59	980.18	0.41
52928	490+20			
52935	490+13	980.59	980.19	0.4
52970	489+78	980.66	980.27	0.39
53033	489+15	980.72	980.34	0.38
53073	488+75	980.71	980.33	0.38
53108	488+40	980.69	980.31	0.38
53140	488+08	980.74	980.38	0.36
53233	487+15	980.7	980.34	0.36
53278	486+70	980.76	980.39	0.37
53303	486+45	980.8	980.43	0.37
53383	485+65	980.82	980.46	0.36
53533	484+15	980.84	980.48	0.36
53538	484+10	980.92	980.57	0.35
53573	483+75	980.91	980.56	0.35
53683	482+65	980.91	980.56	0.35
53773	481+75	980.92	980.57	0.35
53833	481+15	980.98	980.63	0.35
53930	480+18	980.97	980.62	0.35
53983	479+65	981.02	980.68	0.34
54083	478+65	981.03	980.69	0.34
54183	477+65	981.04	980.7	0.34
54283	476+65	981.05	980.71	0.34
54383	475+65	981.02	980.68	0.34
54483	474+65	981	980.66	0.34
54683	472+65	981.13	980.8	0.33
54783	471+65	981.2	980.87	0.33
54790	471+58	981.23	980.91	0.32
54900	470+48	981.27	980.95	0.32
54935	470+13	981.27	980.96	0.31
54970	469+78	981.27	980.96	0.31
55030	469+18	981.31	981	0.31
55100	468+48	981.3	980.99	0.31
55181	467+67	981.29	980.99	0.3
AVERAGE				**0.38**

Table 2-10.7 - Change in Water Surface Elevations from Proposed Conditions to Existing Conditions for the 10-Year Flood

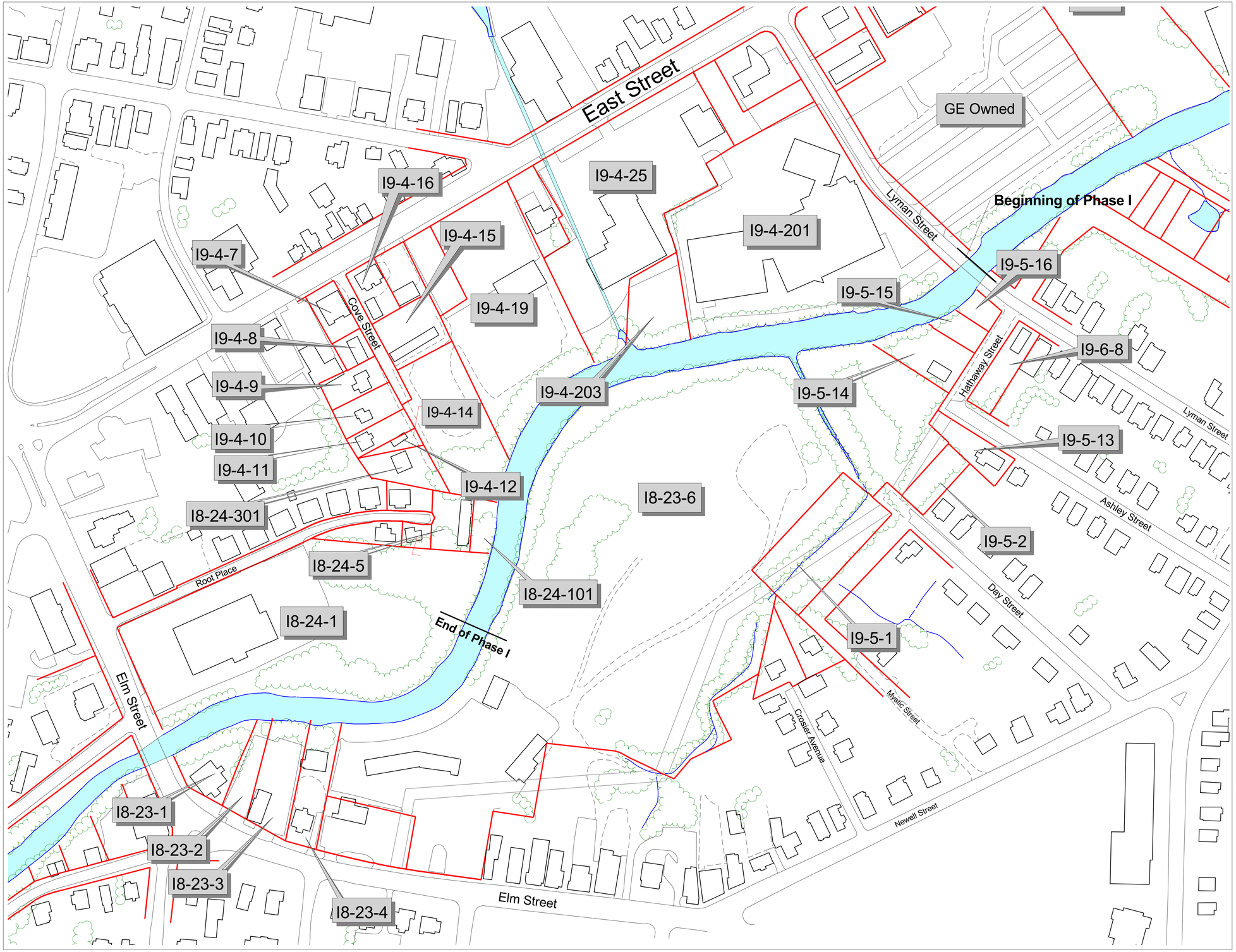
Cross sections		WSEL Design Reach, 10-year Flood		
HEC-RAS	River St.	Proposed n=0.033	Existing n=0.025	Difference
50550	514+00	980.38	980.36	0.02
50600	513+50	980.44	980.46	-0.02
50650	513+00	980.43	980.44	-0.01
50700	512+50	980.43	980.45	-0.02
50750	512+00	980.47	980.46	0.01
50800	511+50	980.56	980.53	0.03
50850	511+00	980.74	980.6	0.14
50900	510+50	980.73	980.5	0.23
50950	510+00	980.74	980.65	0.09
51000	509+50	980.86	980.69	0.17
51050	509+00	980.86	980.76	0.1
51100	508+50	980.85	980.75	0.1
51150	508+00	980.84	980.76	0.08
51200	507+50	981.1	980.77	0.33
51250	507+00	980.97	980.75	0.22
51300	506+50	981.01	980.86	0.15
51350	506+00	980.99	980.84	0.15
51400	505+50	981.08	980.82	0.26
51450	505+00	981.17	980.93	0.24
51500	504+50	981.12	980.94	0.18
51600	503+50	981.3	980.97	0.33
51650	503+00	981.38	981.05	0.33
51700	502+50	981.42	981.01	0.41
51750	502+00	981.37	980.88	0.49
51800	501+50	981.3	980.9	0.4
51850	501+00	981.4	981.08	0.32
51900	500+50	981.53	981.05	0.48
51948	500+00	981.43	980.98	0.45
AVERAGE				**0.20**

Cross sections		WSEL Upper 1/2 Mile, 10-year Flood		
HEC-RAS	River St.	Proposed	Existing n=0.025	Difference

Table 2-10.7 - Change in Water Surface Elevations from Proposed Conditions to Existing Conditions for the 10-Year Flood

51973		Lyman Bridge		
52000	499+48	982.02	981.98	0.04
52023	499+25	982.29	982.26	0.03
52073	498+75	982.34	982.3	0.04
52148	498+00	982.44	982.41	0.03
52200	497+48	982.41	982.38	0.03
52243	497+05	982.4	982.37	0.03
52273	496+75	982.54	982.51	0.03
52350	495+98	982.51	982.47	0.04
52398	495+50	982.64	982.61	0.03
52400	495+48	982.59	982.56	0.03
52490	494+58	982.62	982.59	0.03
52523	494+25	982.75	982.72	0.03
52630	493+18	982.66	982.63	0.03
52773	491+75	982.68	982.66	0.02
52873	490+75	982.78	982.75	0.03
52883	490+65	982.92	982.89	0.03
52921	490+27	982.8	982.77	0.03
52928	490+20			
52935	490+13	982.81	982.78	0.03
52970	489+78	982.82	982.79	0.03
53033	489+15	982.92	982.89	0.03
53073	488+75	982.91	982.88	0.03
53108	488+40	982.87	982.84	0.03
53140	488+08	982.9	982.87	0.03
53233	487+15	982.85	982.83	0.02
53278	486+70	982.94	982.92	0.02
53303	486+45	982.97	982.94	0.03
53383	485+65	982.96	982.93	0.03
53533	484+15	982.98	982.96	0.02
53538	484+10	983.1	983.07	0.03
53573	483+75	983.08	983.06	0.02
53683	482+65	983.07	983.04	0.03
53773	481+75	983.07	983.04	0.03
53833	481+15	983.14	983.11	0.03
53930	480+18	983.13	983.1	0.03
53983	479+65	983.2	983.18	0.02
54083	478+65	983.22	983.19	0.03
54183	477+65	983.22	983.19	0.03
54283	476+65	983.22	983.19	0.03
54383	475+65	983.18	983.15	0.03
54483	474+65	983.16	983.13	0.03
54683	472+65	983.27	983.25	0.02
54783	471+65	983.38	983.36	0.02
54790	471+58	983.39	983.36	0.03
54900	470+48	983.43	983.41	0.02
54935	470+13	983.44	983.41	0.03
54970	469+78	983.44	983.41	0.03
55030	469+18	983.46	983.43	0.03
55100	468+48	983.43	983.41	0.02
55181	467+67	983.43	983.42	0.01
AVERAGE				**0.03**

FIGURES



LEGEND:

Roads

Hydrology

Property Lines

N

Scale in Feet

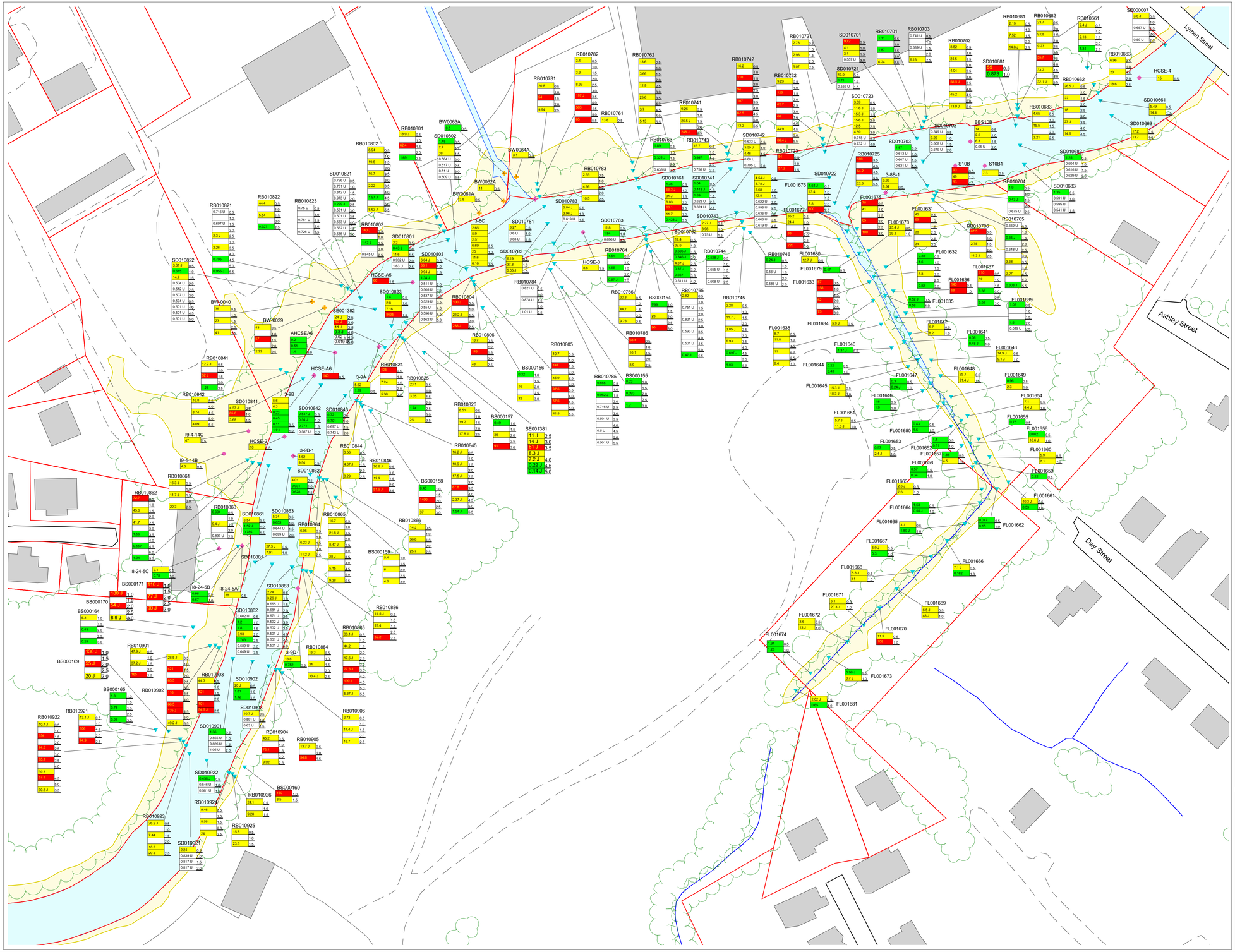
100 0 100 200

WESTON

MANAGERS DESIGNERS/CONSULTANTS

1.5 Mile Removal Action
First Phase Basis of Design
Site Map
Figure 2-1

| g:\projects\ryan\arc view data browser\acoe realtor 3-20-01.apr | Tony Map Request 5-3-02 | c:\ryan\documents\ee-ca\phase i\design\drawings\pre-design drawings\map for tony 5-3-02 | 2:07 PM, 5/6/2002 |



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LEGEND:

- EPA - Corp of Engineers Sample Location
- EPA_REG1/EPA_START Sample Location
- GE Sample Location
- Surface Water
- 10-year Floodplain
- Buildings
- Property Boundary

PCB Concentration (ppm)

	result value	lower depth value
no sample		0.5
non-detect	0.65 U	1.0
< 2	0.51	1.5
2 - 50	15.3	2.0
> 50	87U	2.5

result flag

NOTE: Result flag indicates -
J = not detected at reported value
J = estimates at or below reported value
UJ = estimated at or below reported value

Base features derived from BBL drawings.

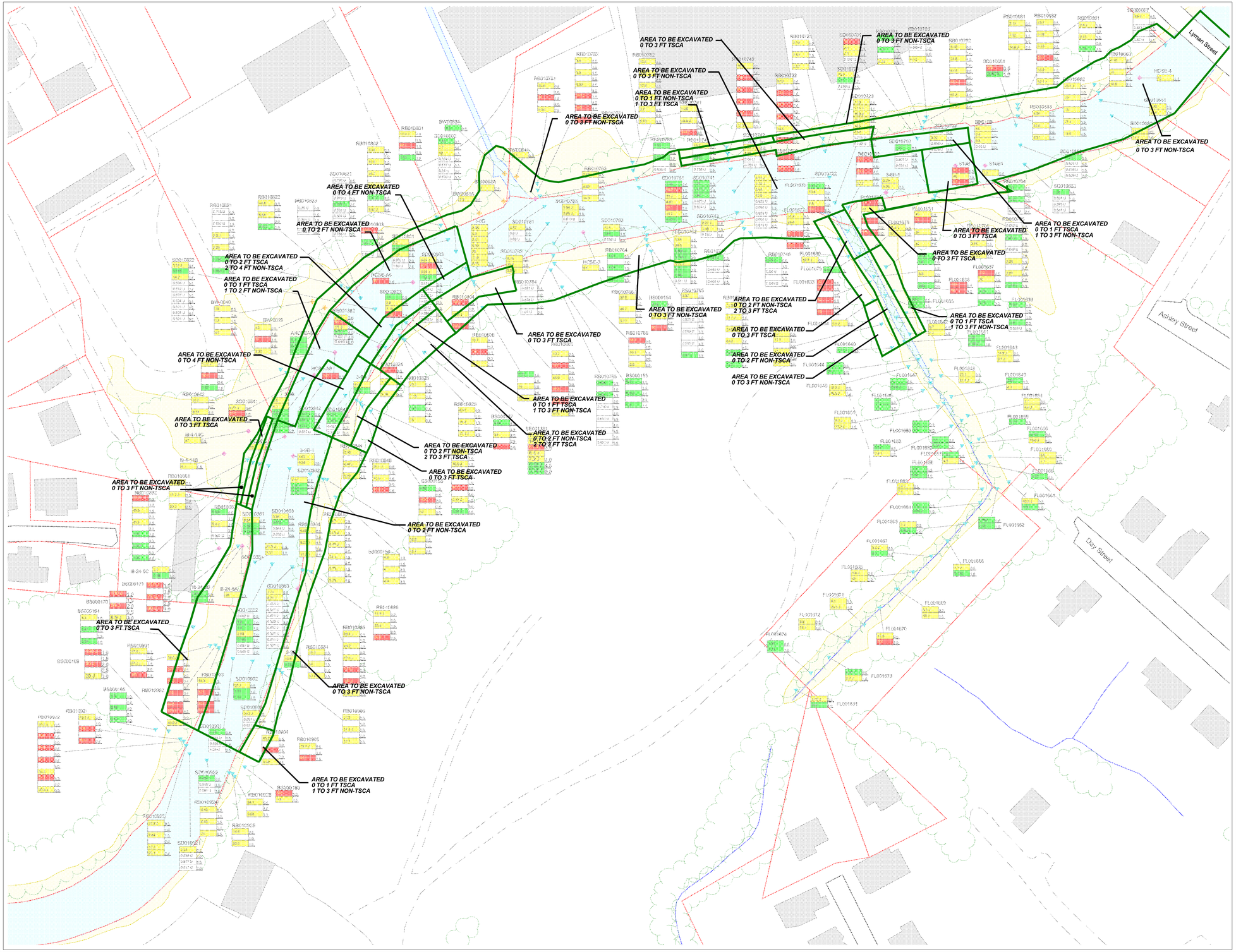
N

Scale in Feet

50 0 50 100 150

Basis of Design Document
Site Specific Environmental Restoration Contract (SSERC)
GE/Housatonic River Project
Pittsfield, Massachusetts

FIGURE 2-2.1
STACK BAR MAP
LYMAN STREET BRIDGE TO STATION 514+00



WESTON
MANAGERS DESIGNERS/CONSULTANTS

LEGEND:

- EPA - Corp of Engineers Sample Location
- EPA_REG1/EPA_START Sample Location
- GE Sample Location
- Surface Water
- 10-year Floodplain
- Buildings
- Property Boundary

PCB Concentration (ppm)

	result value	lower depth value
no sample		0.5
non-detect	0.65 U	1.0
< 2	0.51	1.5
2 - 50	15.3	2.0
> 50	87U	2.5

result flag

NOTE: Result flag indicates -
U = not detected at reported value
J = estimates at or below reported value
UJ = estimated at or below reported value

Base features derived from BBL drawings.

N

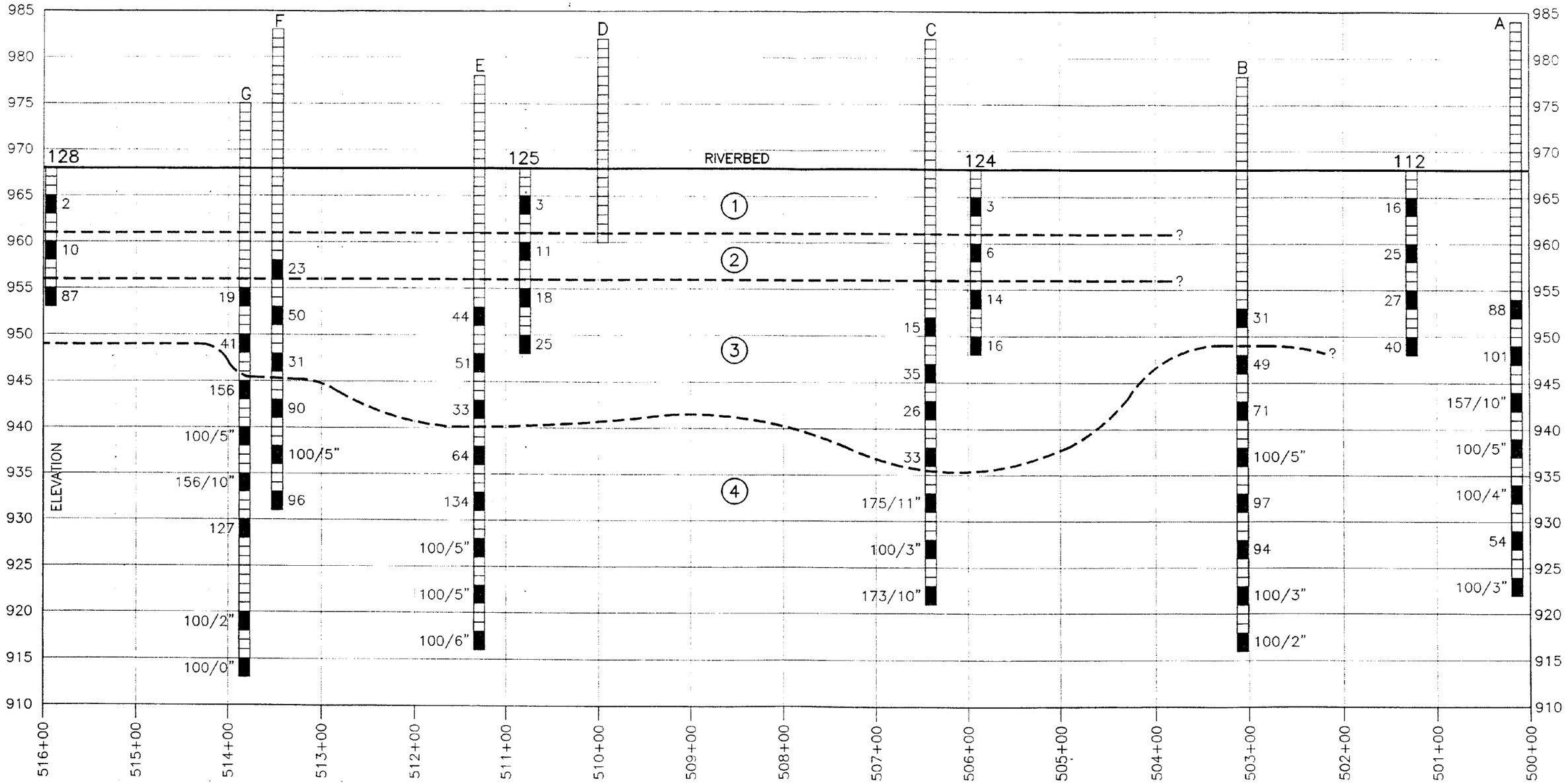
Scale in Feet

50 0 50 100 150

Basis of Design Document
Site Specific Environmental Restoration Contract (SSERC)
GE/Housatonic River Project
Pittsfield, Massachusetts

FIGURE 2-2. 2
STACK BAR MAP AND TSCA / NON-TSCA DESIGNATIONS LYMAN STREET BRIDGE TO STATION 514+00

SUBREACH 3-8 AND 3-9 SUBSURFACE PROFILE



LEGEND

1. VERY LOOSE GRANULAR SOILS
2. LOOSE TO MEDIUM DENSE GRANULAR SOILS
3. MEDIUM DENSE TO DENSE GRANULAR SOILS
4. VERY DENSE GRANULAR SOILS

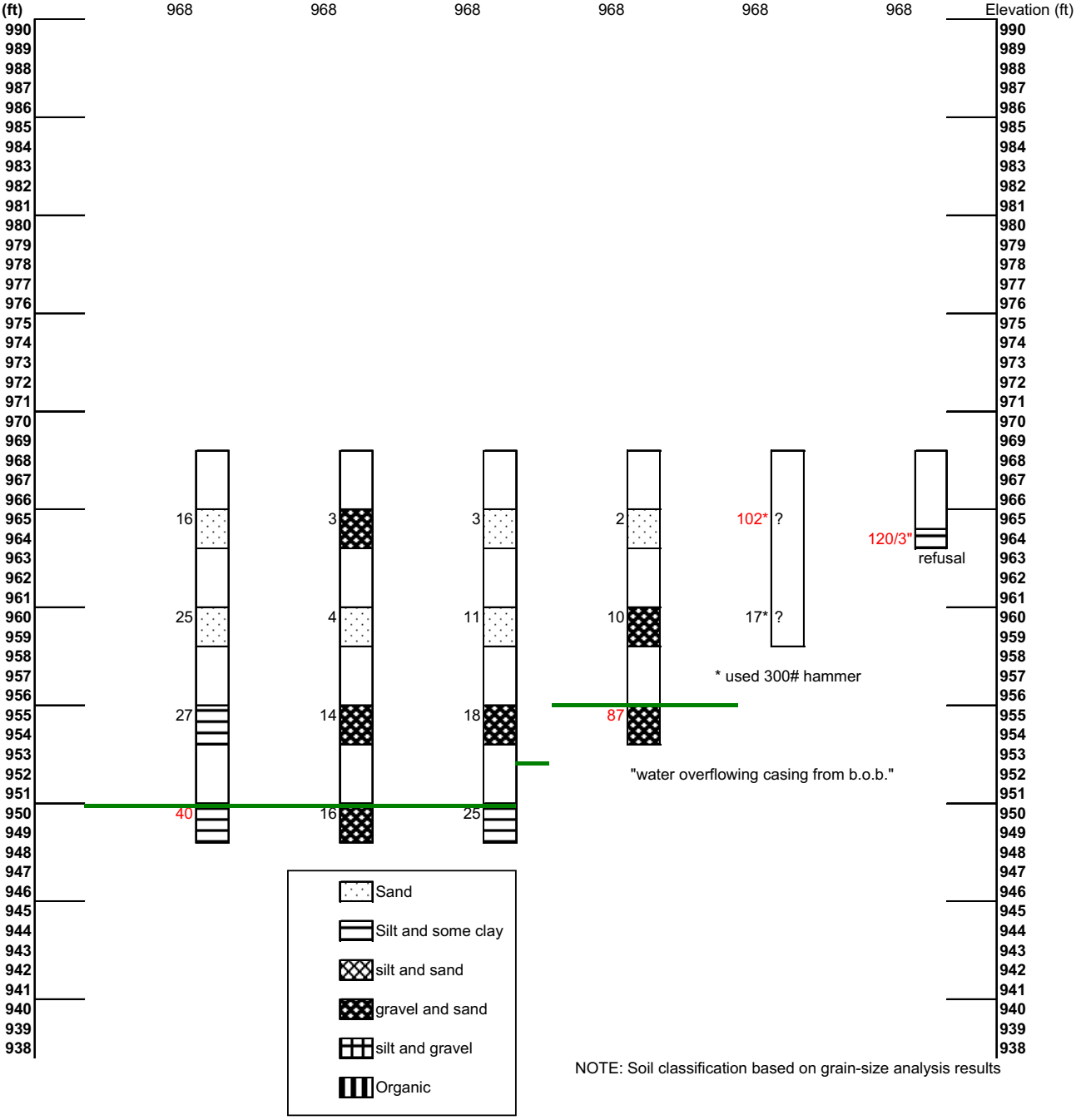
20 ■ STANDARD PENETRATION RESISTANCE (I.E. N) VALUE BASED ON ASTM D-1586.

River Boring Locations Used in Steel Sheet Piling Design
Figure 2-5.1

BORING LETTERS E & C ARE MOVED 50' TO THE LEFT FOR CLARITY

Summary of In-River Borings

	Sta. 501+25	Sta. 509+90	Sta. 510+30	Sta. 516+20	Sta. 518+20	Sta. 521+20
Boring	**BH000112**	**BH000124**	**BH000125**	**BH000128**	**BH000131**	**BH000129**
Location	River	River	River	River	River	River
Northing (m)	912255.8481	912229.8465	912166.6371	912011.3523	912003.4062	911988.587
Easting (m)	57022.1629	56883.0773	56774.2645	56710.8065	56628.3309	56557.3059
Elevation (ft)	968	968	968	968	968	968



NOTE: Soil classification based on grain-size analysis results

RAR 1/25/02 738510 Fig 2-6-1.cdr

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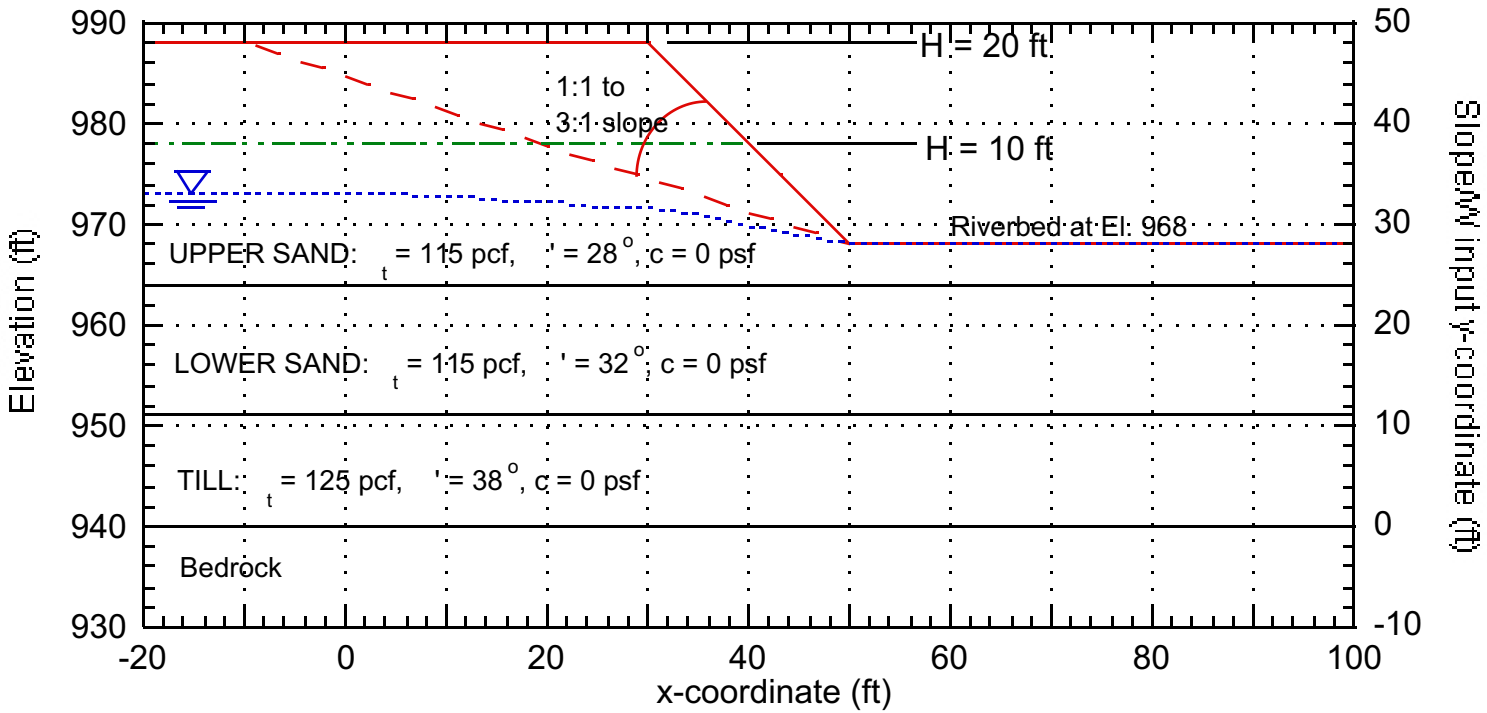
Figure 2-6.1

Basic Slope Stability Analyses Problem Set-up



Note: Soil properties for the west bank are shown.

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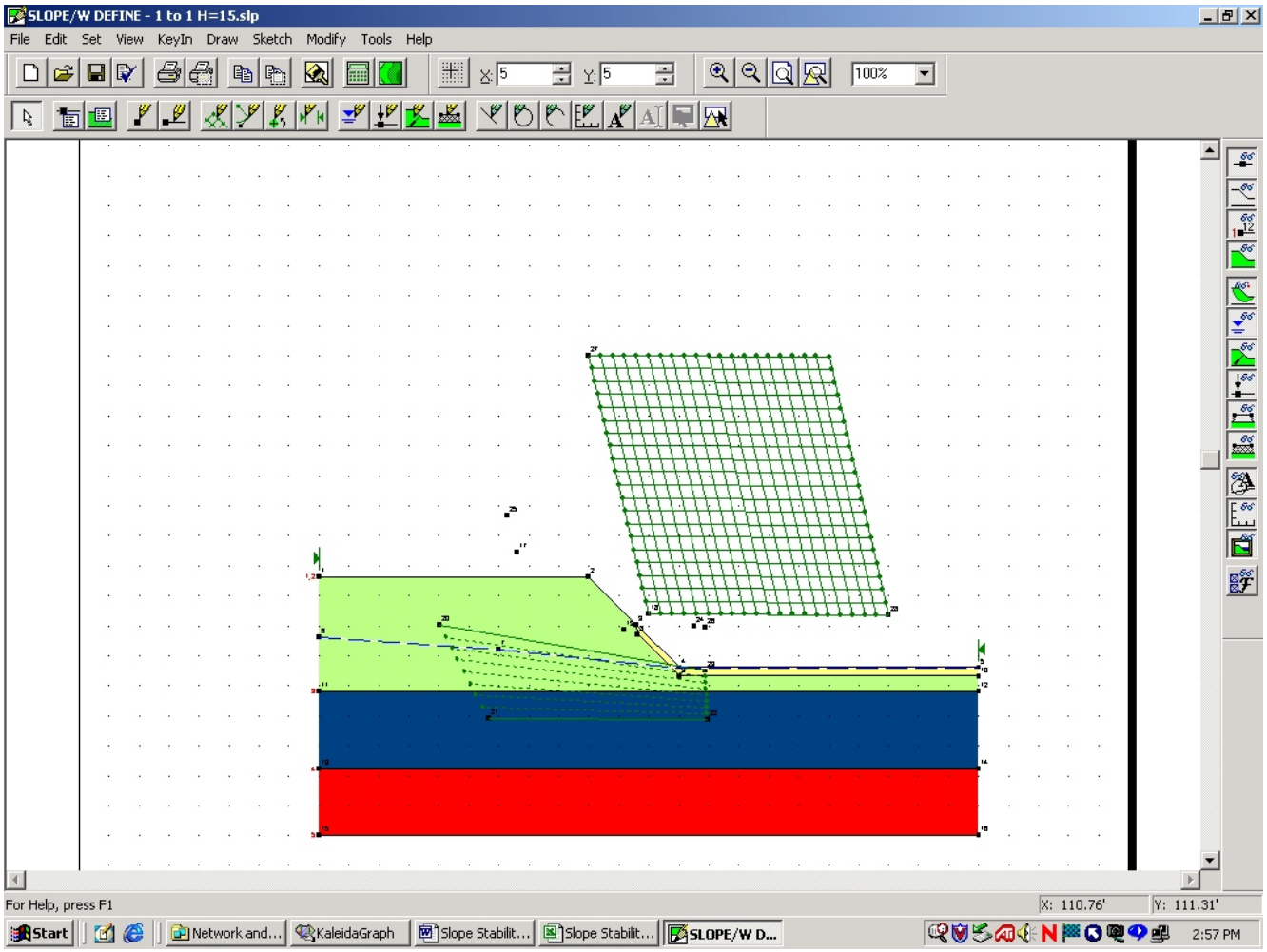
Figure 2-6.2

SJG 1/23/02 738510 Fig 2-6-2.cdr

Slope/W Analysis Set-up for 1H:1V Slope with H = 15 ft and Riprap



RAR 1/25/02 7385010 Fig 2-6-3.cdr

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Figure 2-6.3

Parametric Analyses Focusing on the Impacts of Friction Angle

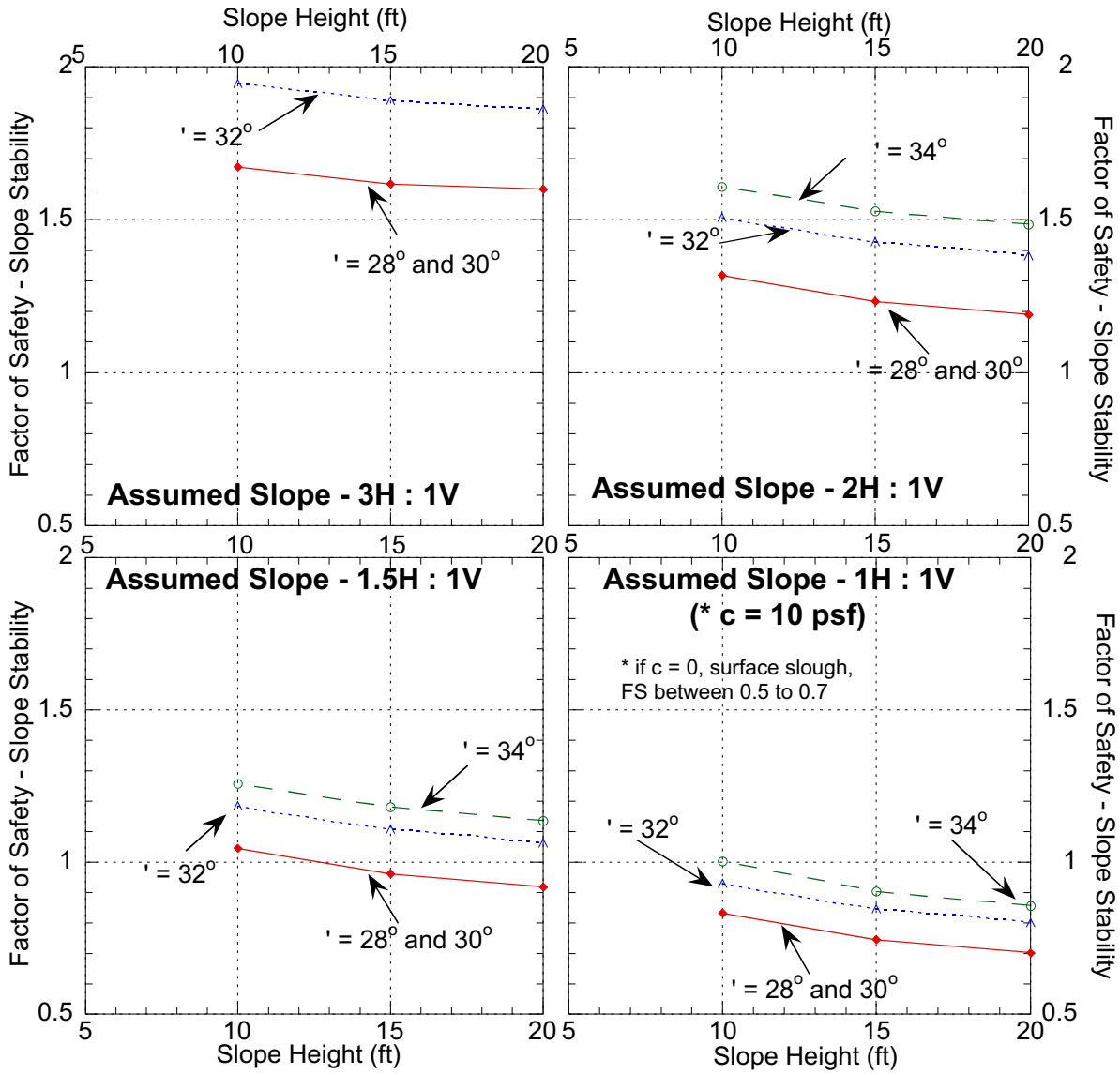

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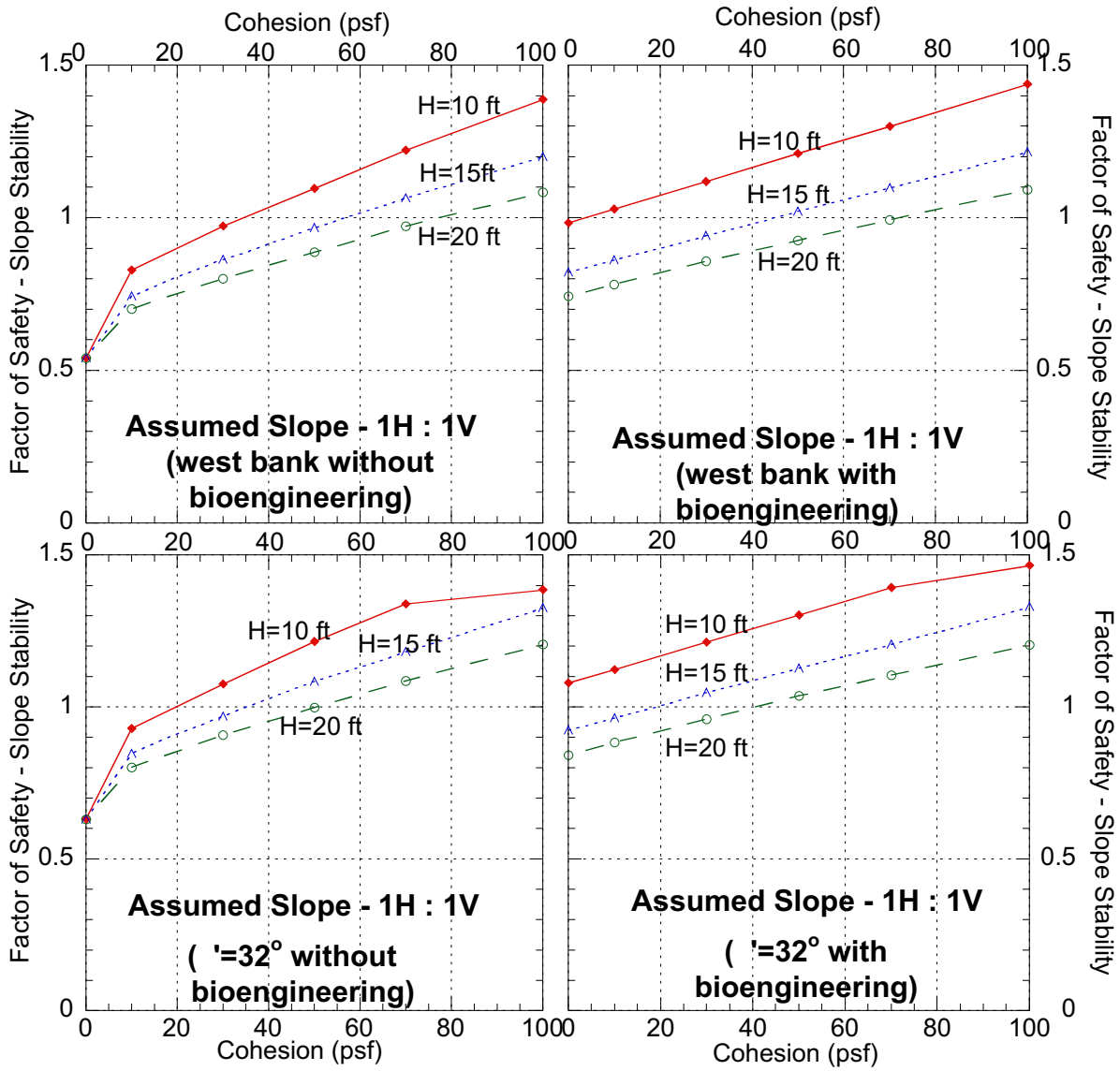
Figure 2-6.4

RAR 1/25/02 738510 Fig 2-6-4 .cdr

Parametric Analyses Focusing on the Impacts of Cohesion



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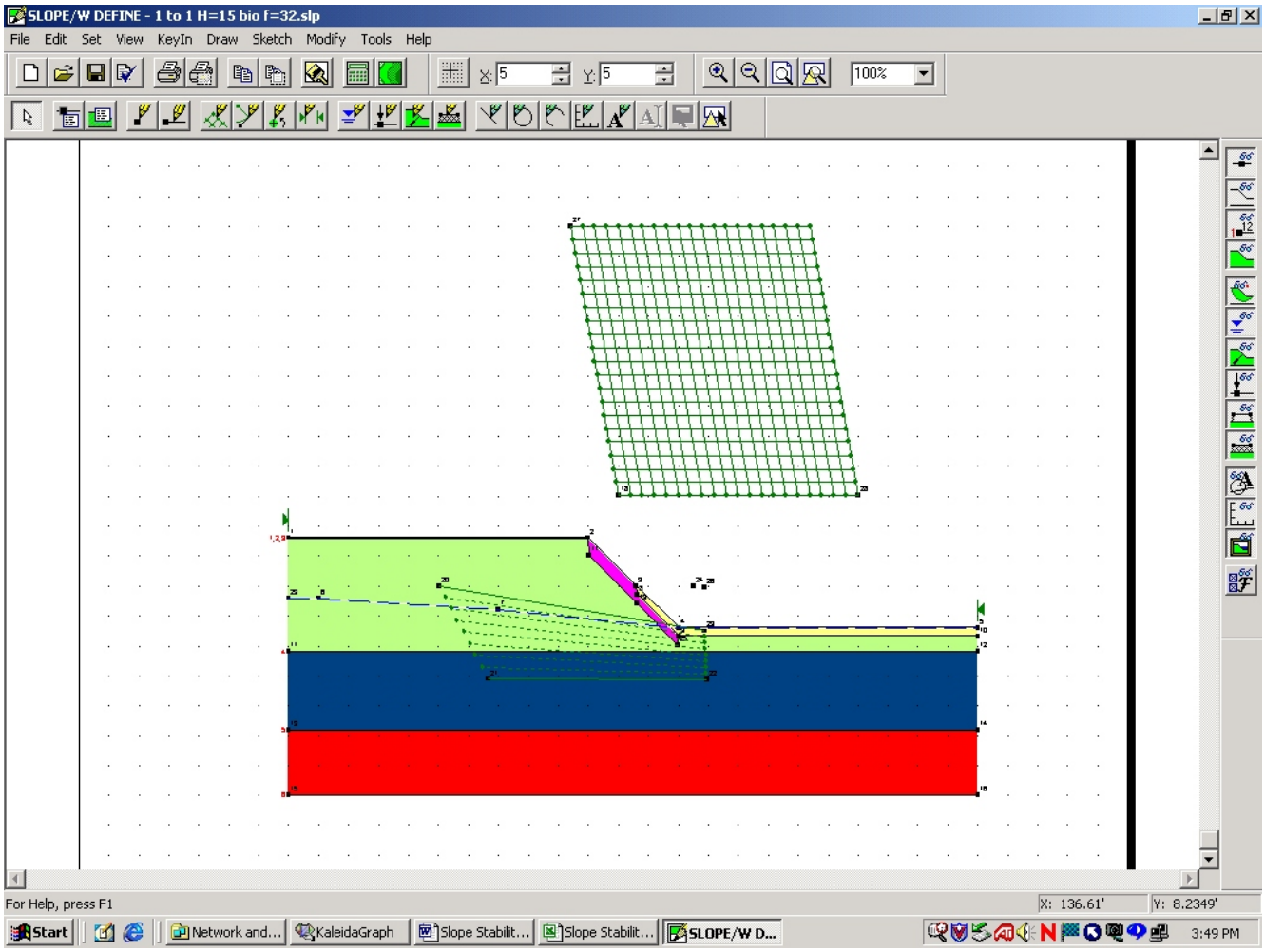
J-7385-07 2/02
Figure 2-6.5

RAR 1/25/02 738510 Fig 2-6-5.cdr

Typical Slope/W Problem Set-up for Analyses with Bioengineering



RAR 1/25/02 738510 Fig 2-6-6.cdr

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Figure 2-6.6

Effects of Bioengineering (West Bank Properties)

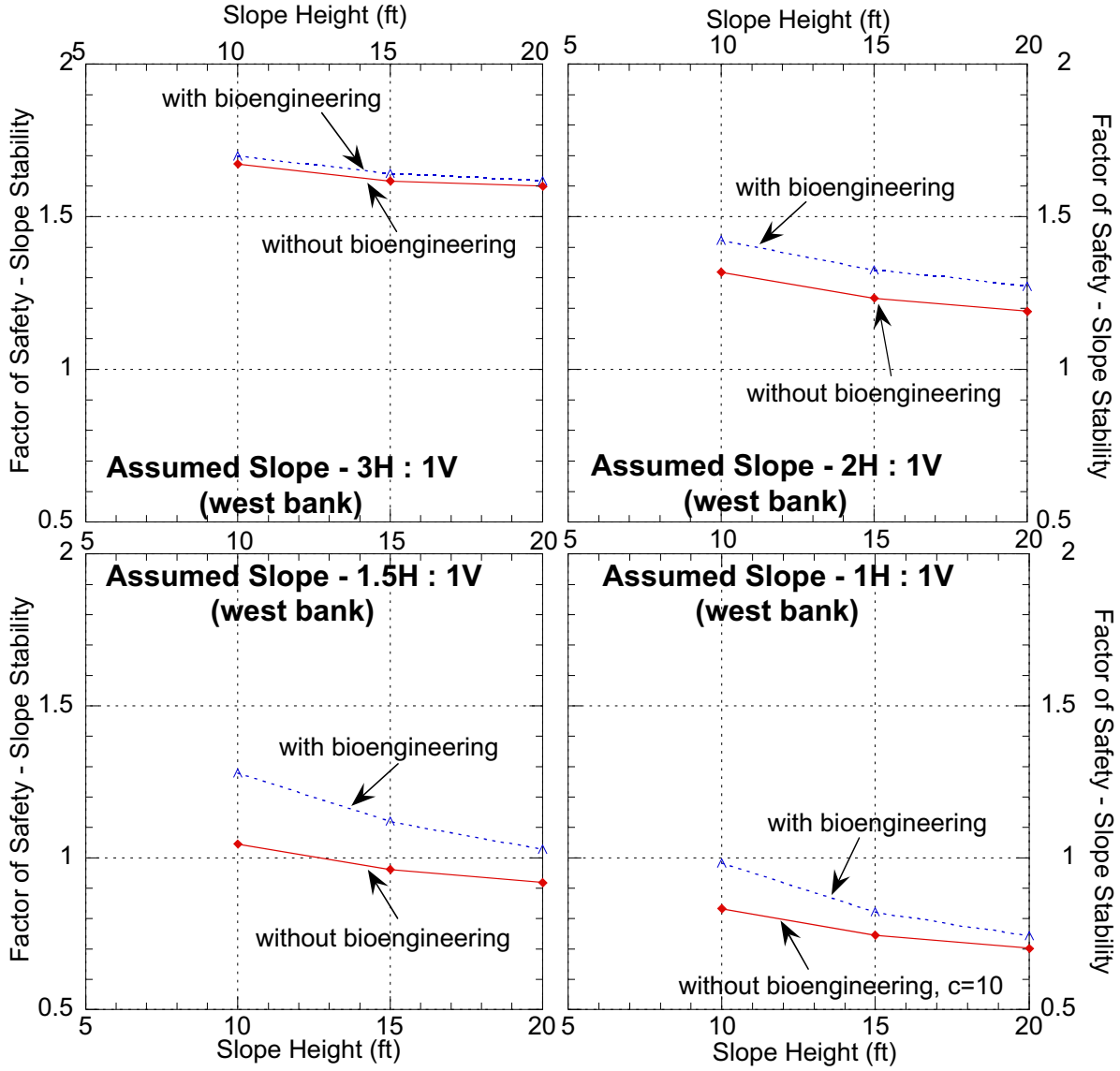

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Figure 2-6.7

RAR 1/25/02 738510 Fig 2-6-7.cdr

Effects of Bioengineering (f = 32 degrees)

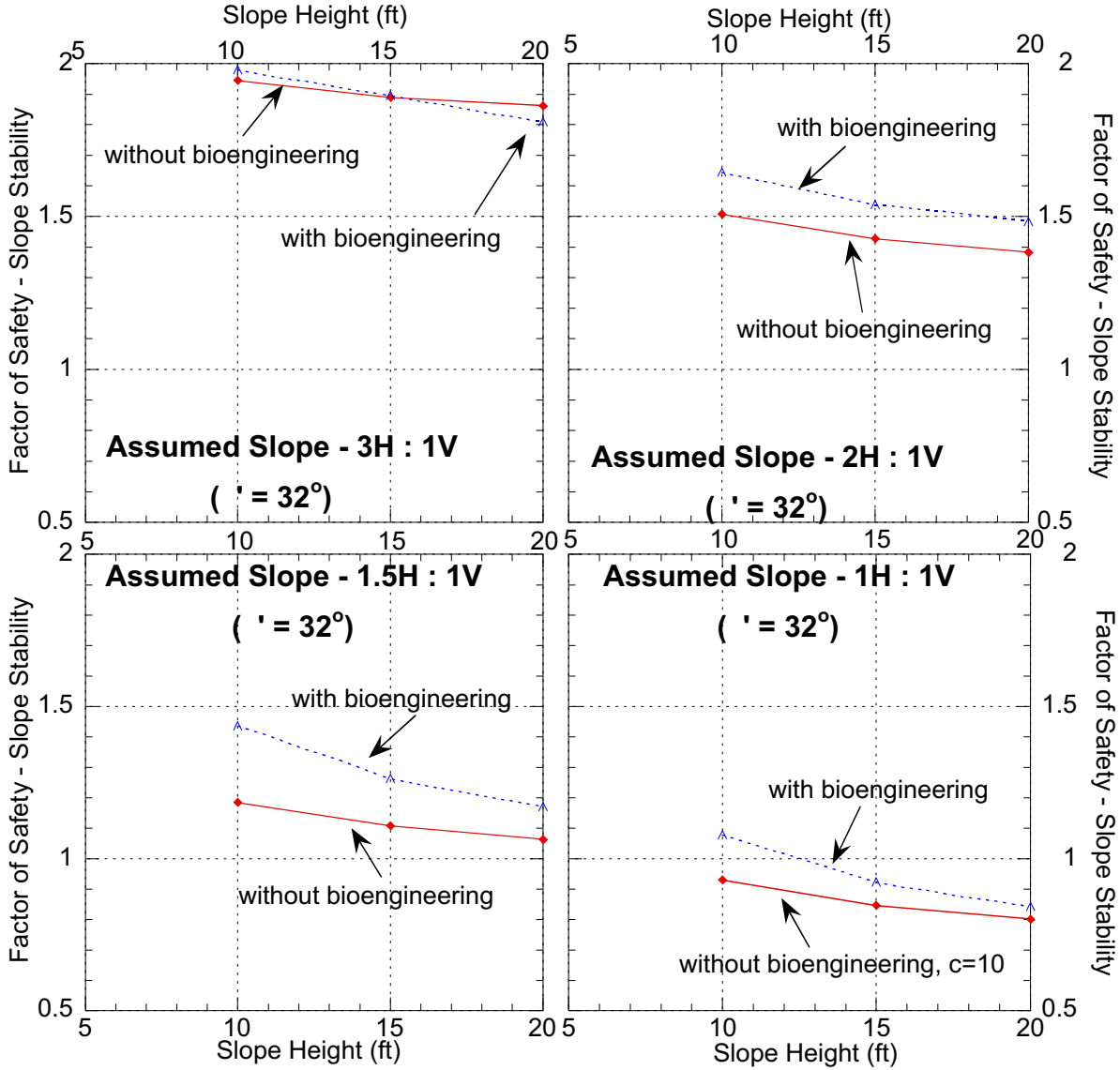

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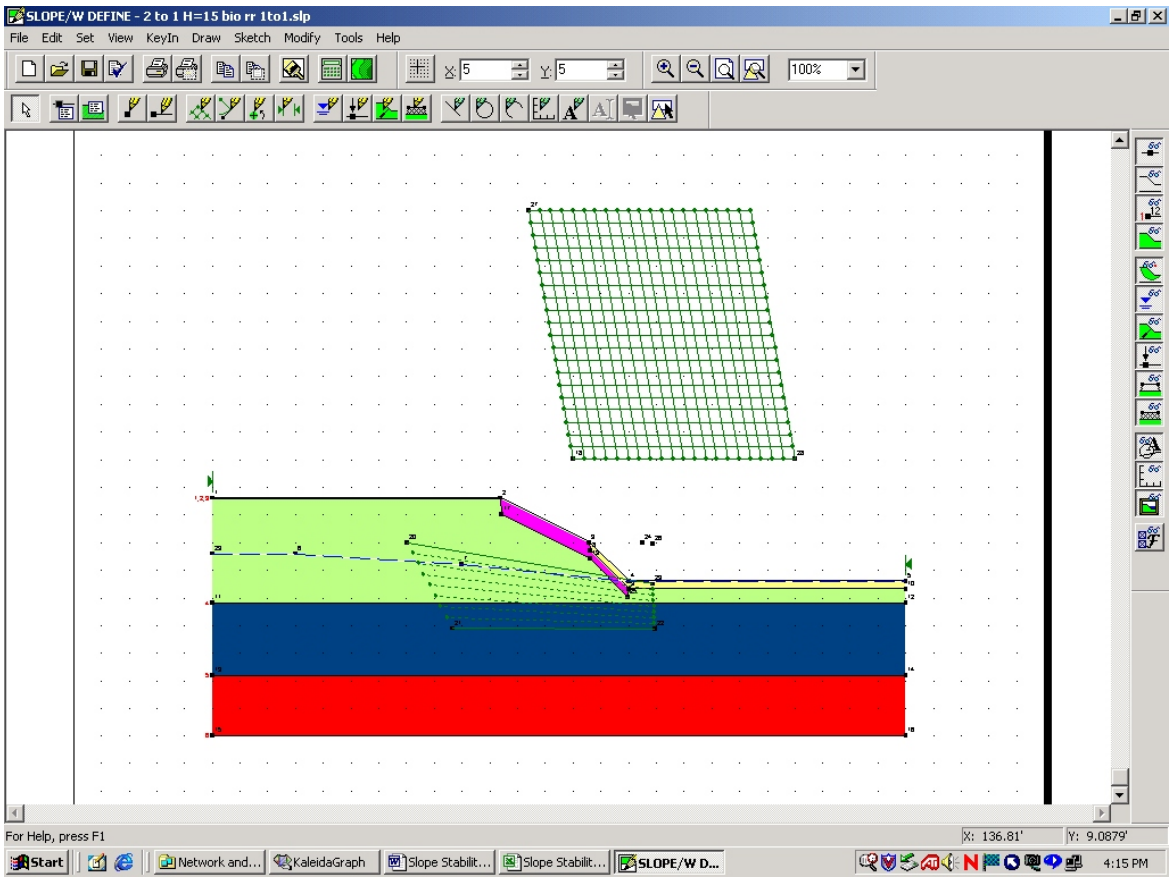
Figure 2-6.8

RAR 1/25/02 738510 Fig 2-6-8.cdr

Slope/W Analyses Set-Up for Case D1 Analyses: Riprap at Constant 1H:1V Slope, Varying Slope above Rip-Rap to Top of Bank



RAR 1/25/02 738510 Fig 2-6-9.cdr

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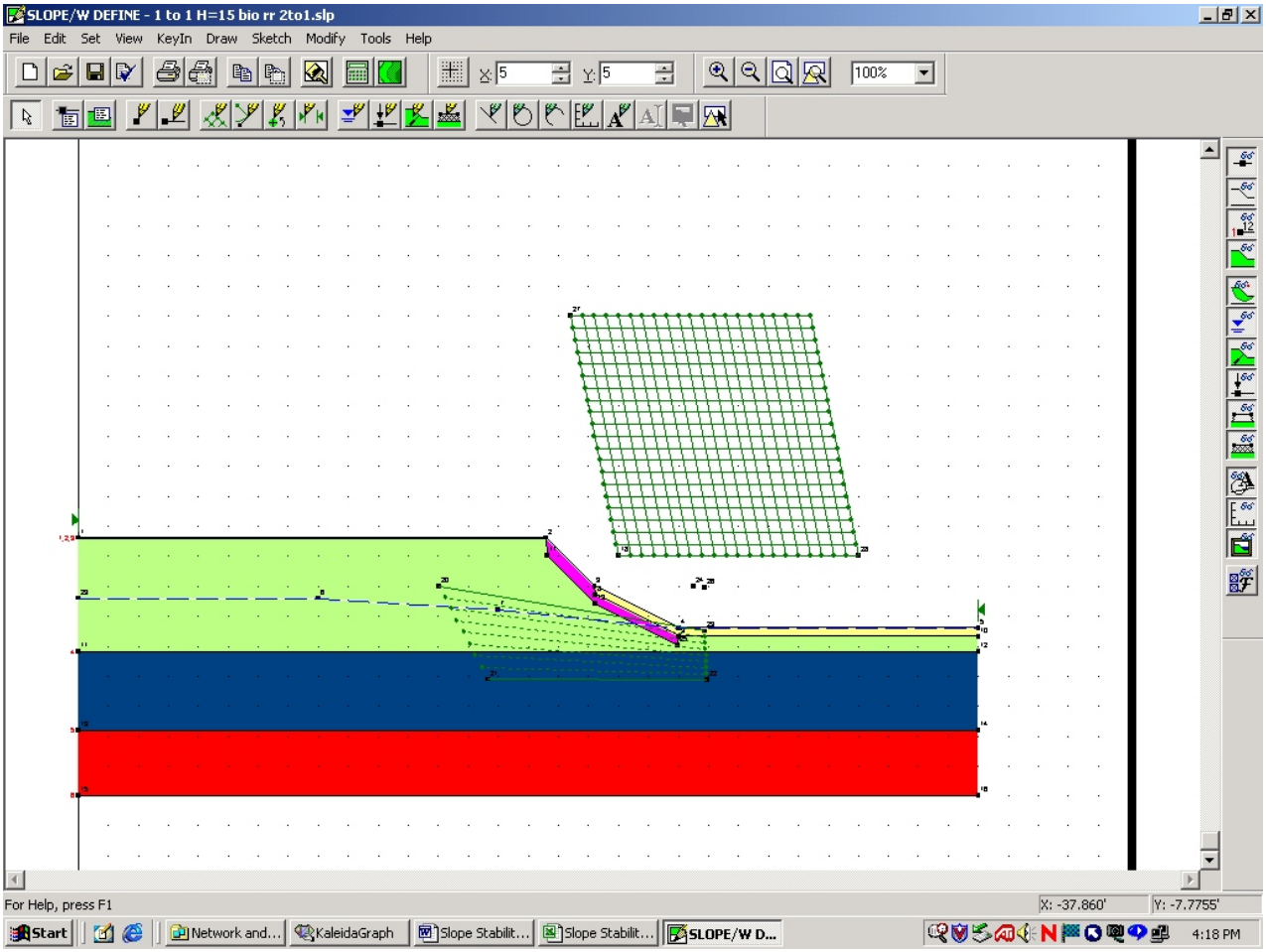
J-7385-07 *2/02*

Figure 2-6.9

Slope/W Analyses Set-Up for Case D2 Analyses: Rip-Rap at Constant 2H:1V Slope, Varying Slope above Rip-Rap to Top of Bank



RAR 1/25/02 738510 Fig 2-6-10.cdr

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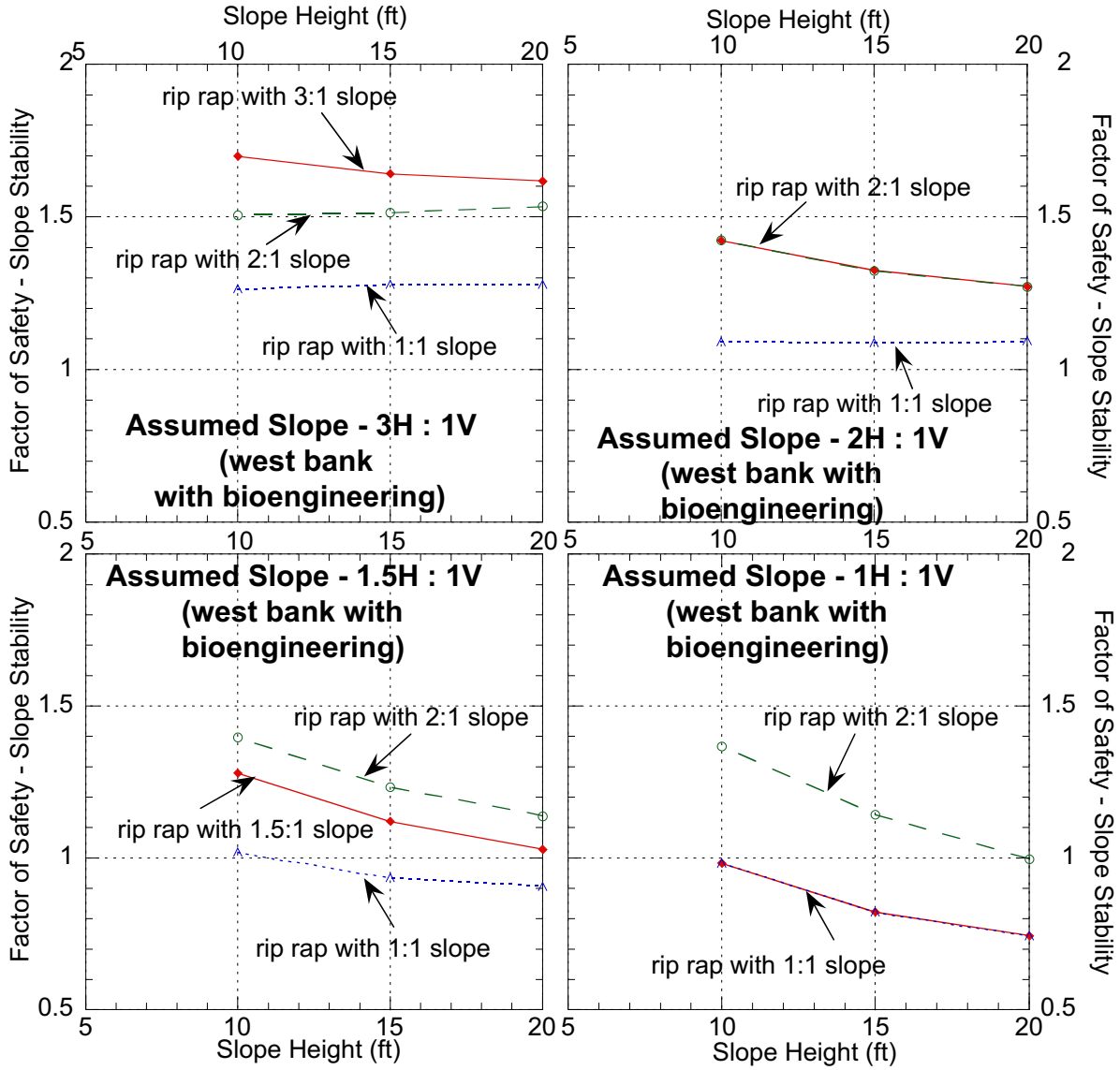
J-7385-07 2/02

Figure 2-6.10

Effects of Rip-Rap Slope (West Bank Properties)



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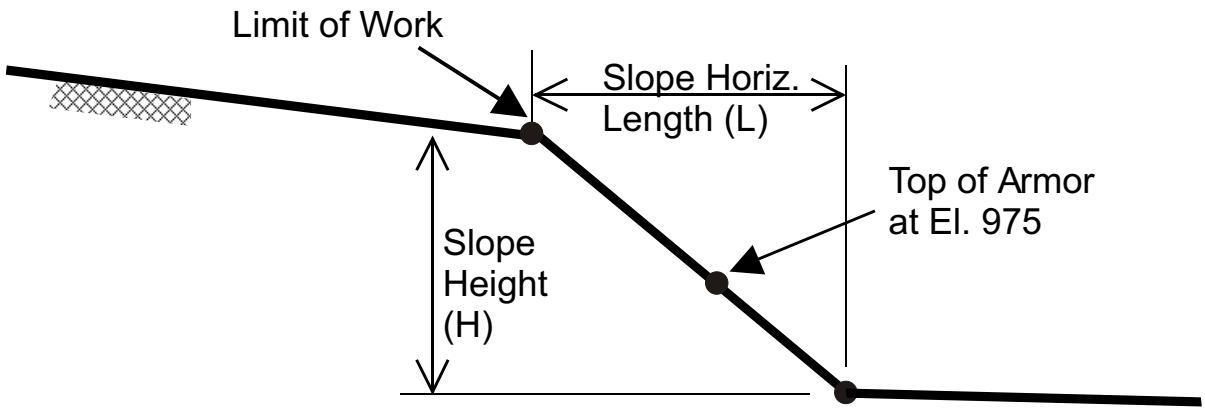
J-7385-07 2/02

Figure 2-6.11

RAR 1/25/02 738510 Fig 2-6-11.cdr

Slope Configuration for East and West Banks



Assumptions:

River water level at riverbed
Top of till at El. 951; top of bedrock at El. 940
No surcharge
1.5 ft thick rip rap along riverbed and along river bank up to El. 975
Constant slope from limit of work down to toe of the riverbank
For soil above El. 951 ′ = 32 degrees on the east bank and
28 degrees on the west bank.

(Properties for bioengineering and rep-rap are the same as those in the initial analyses.)

RAR 1/25/02 738510 Fig 2-6-12.cdr

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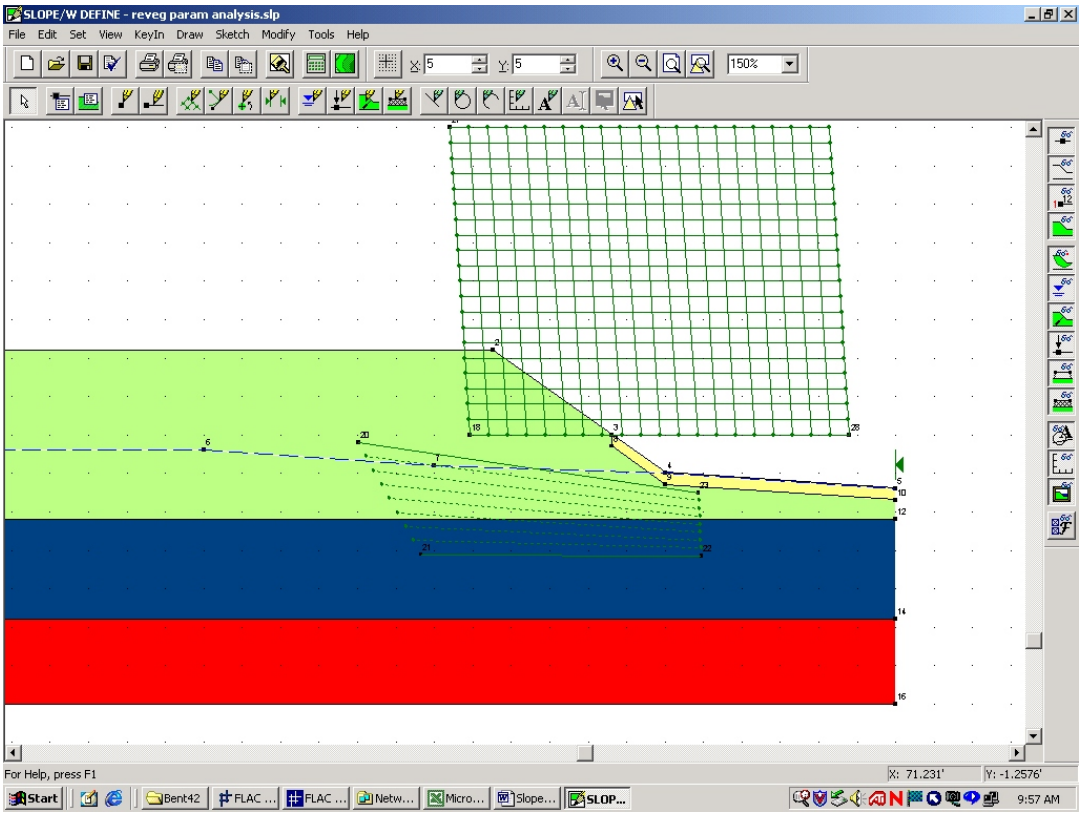
J-7385-07 *2/02*

Figure 2-6.12

Slope/W Analysis Set-up for Groups E and G Analyses: Re-Vegetation with Rip-Rap



RAR 1/25/02 738510 Fig 2-6-13.cdr

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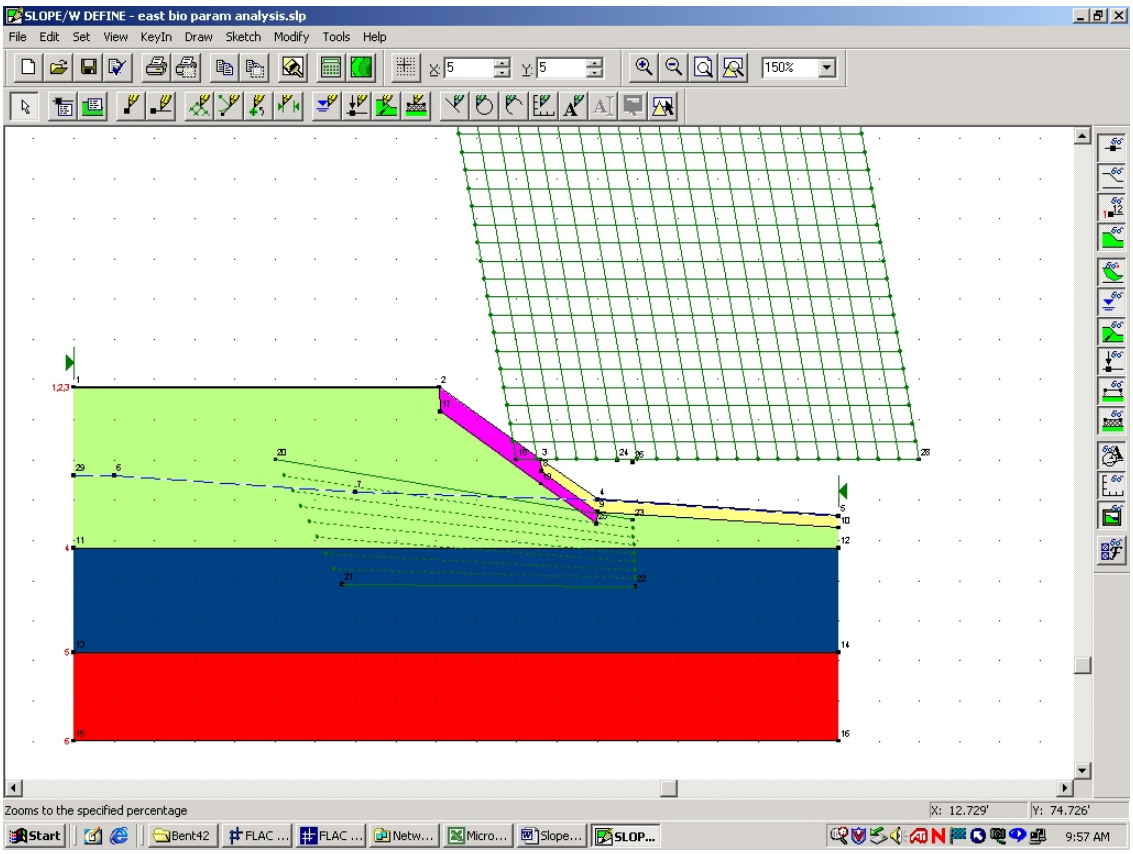
J-7385-07 2/02

Figure 2-6.13

Slope/W Analyses Set-up for Groups F and H Analyses: Bioengineering with Rip-Rap



RAR 1/25/02 738510 Fig 2-6-14.cdr

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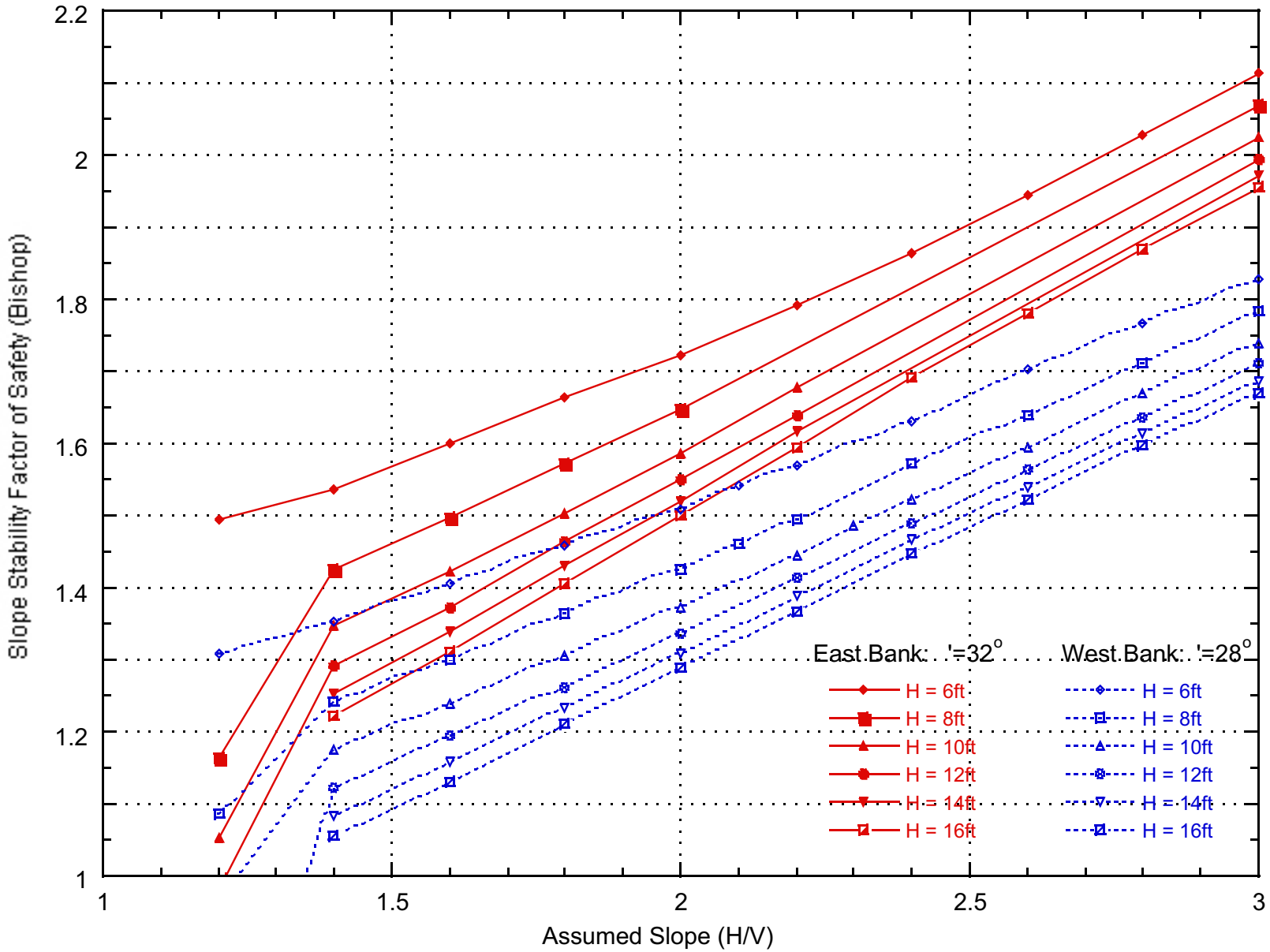
J-7385-07 *2/02*

Figure 2-6.14

Results of Group E and Group G Analyses

Revegetation (West and East banks)



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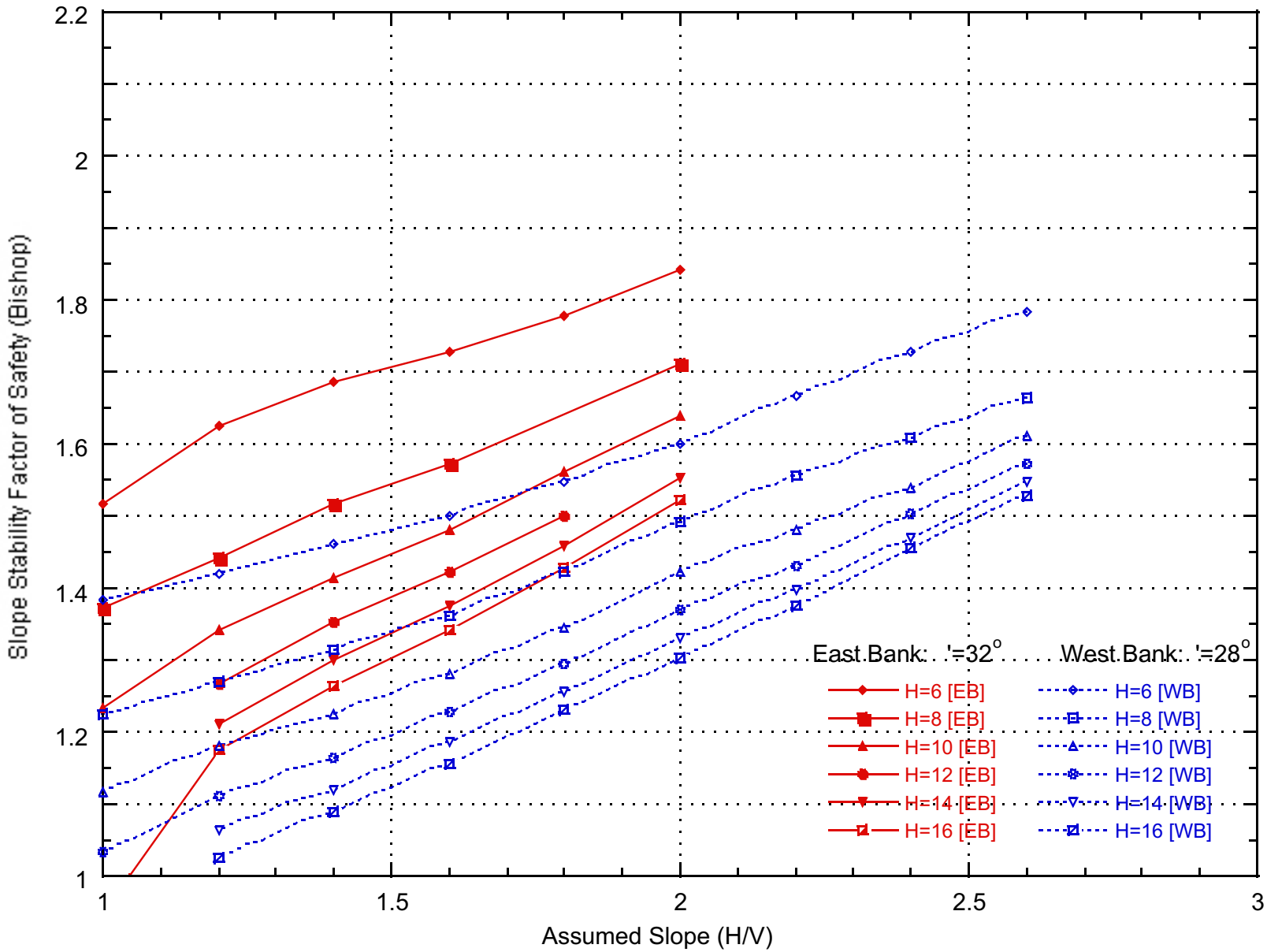
J-7385-07 2/02

Figure 2-6.15

RAR 1/25/02 738510 Fig 2-6-15.cdr

Results of Group F and Group H Analyses

Bioengineering (West and East banks)



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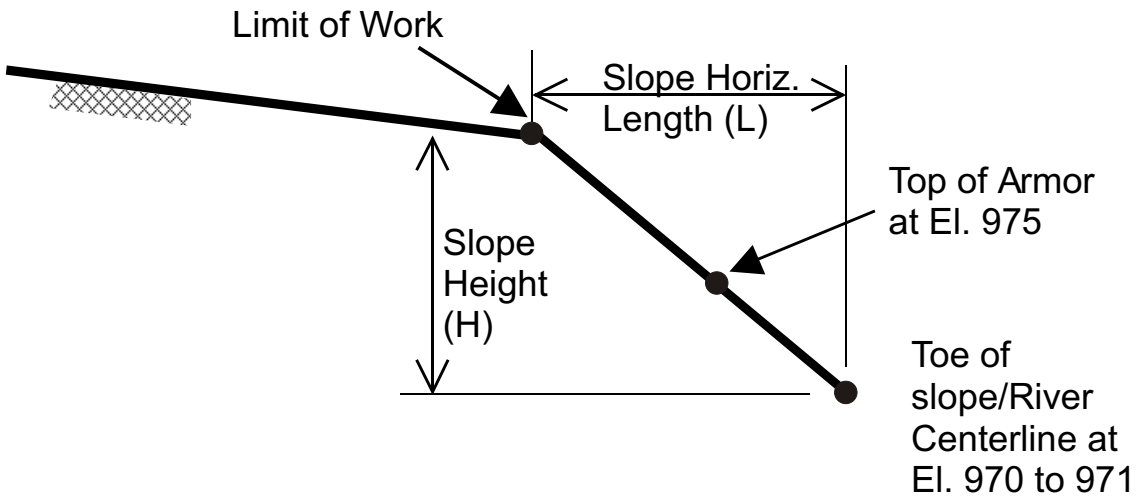
J-7385-07 2/02

Figure 2-6.16

RAR 1/25/02 738510 Fig 2-6-16.cdr

Slope Configuration for Drainage Swale



Assumptions:

river water level at riverbed
Top of till at El. 951; top of bedrock at El. 940
No surcharge
1.5 ft thick rip rap along riverbed and along river bank up to El. 975
Constant slope from limit of work down to toe of the riverbank
For soil above El. 951 ′ = 32 degrees

RAR 1/25/02 738510 Fig 2-6-17.cdr

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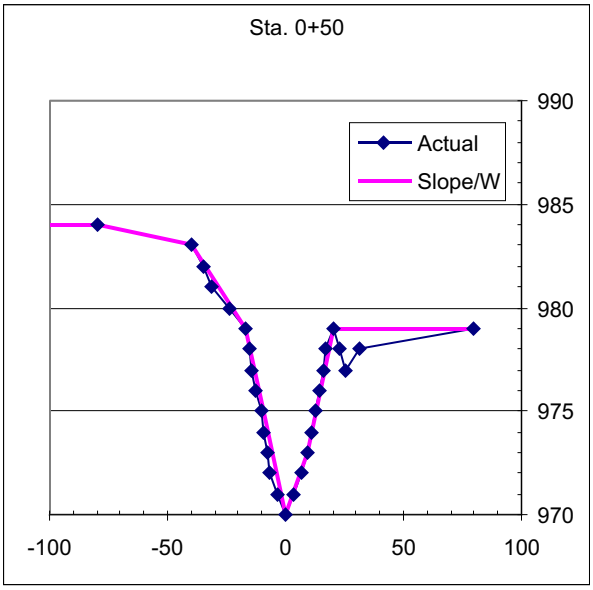
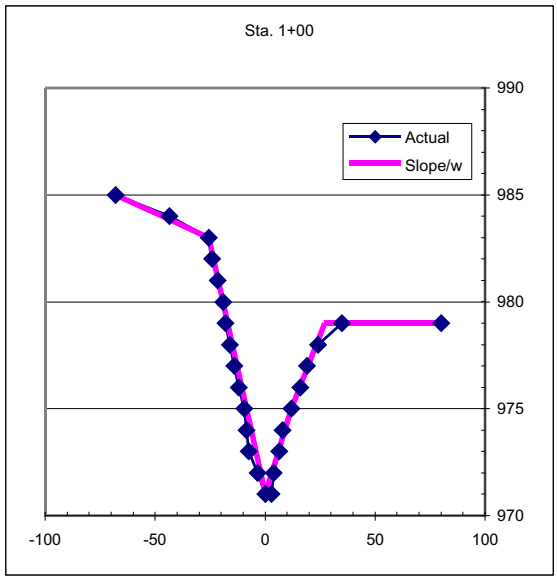
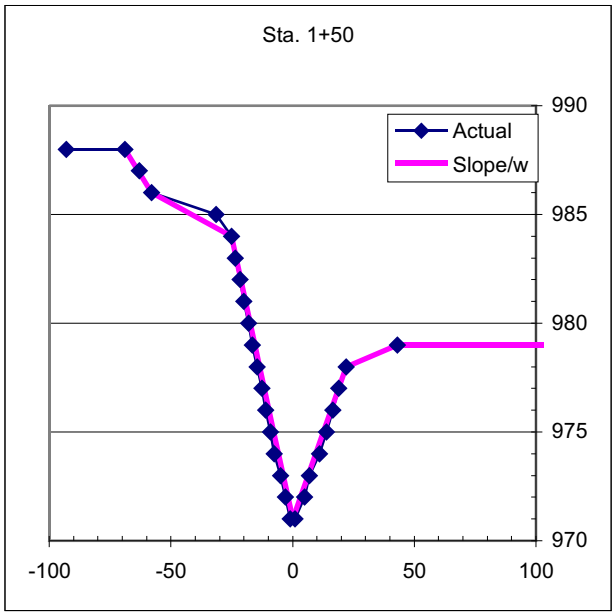
Figure 2-6.17

Actual Cross-sections and Assumed Cross-sections used in Slope/W







SJG 1/23/02 738510 Figure 2-6-18.cdr

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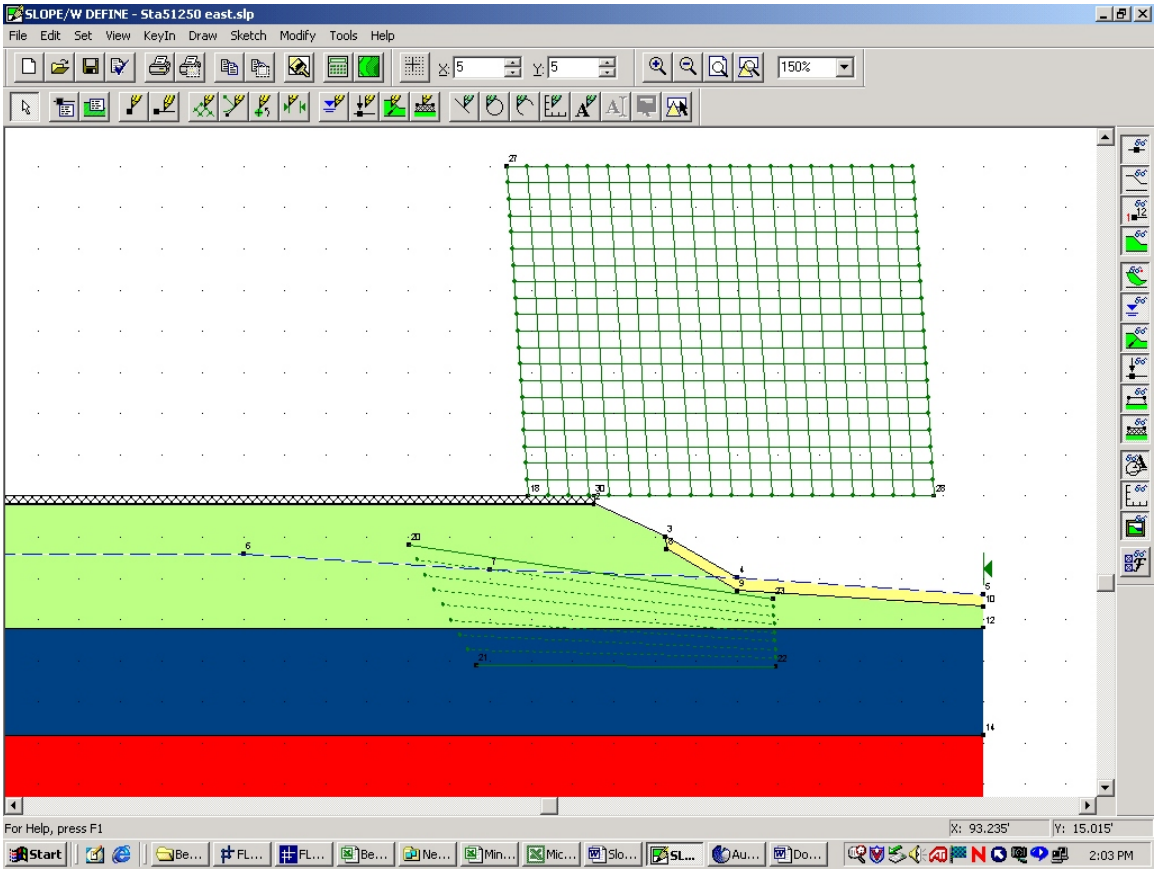
J-7385-07 2/02

Figure 2-6.18

Slope/W Analysis Set-Up for Cases A, B, and C



RAR 1/25/02 738510 Fig 2-6-19.cdr

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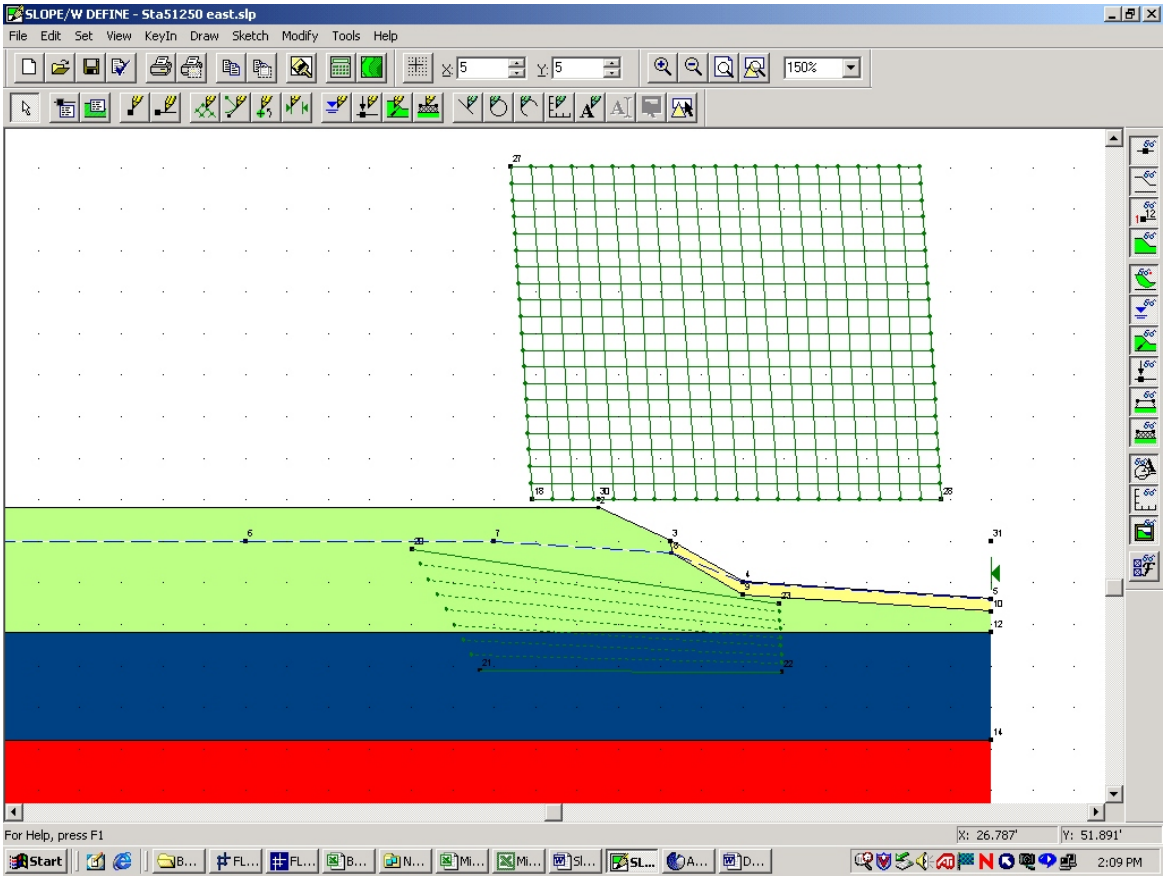
J-7385-07 2/02

Figure 2-6.19

Slope/W Analysis Set-Up for Cases D and E



RAR 1/25/02 738510 Fig 2-6-20.cdr

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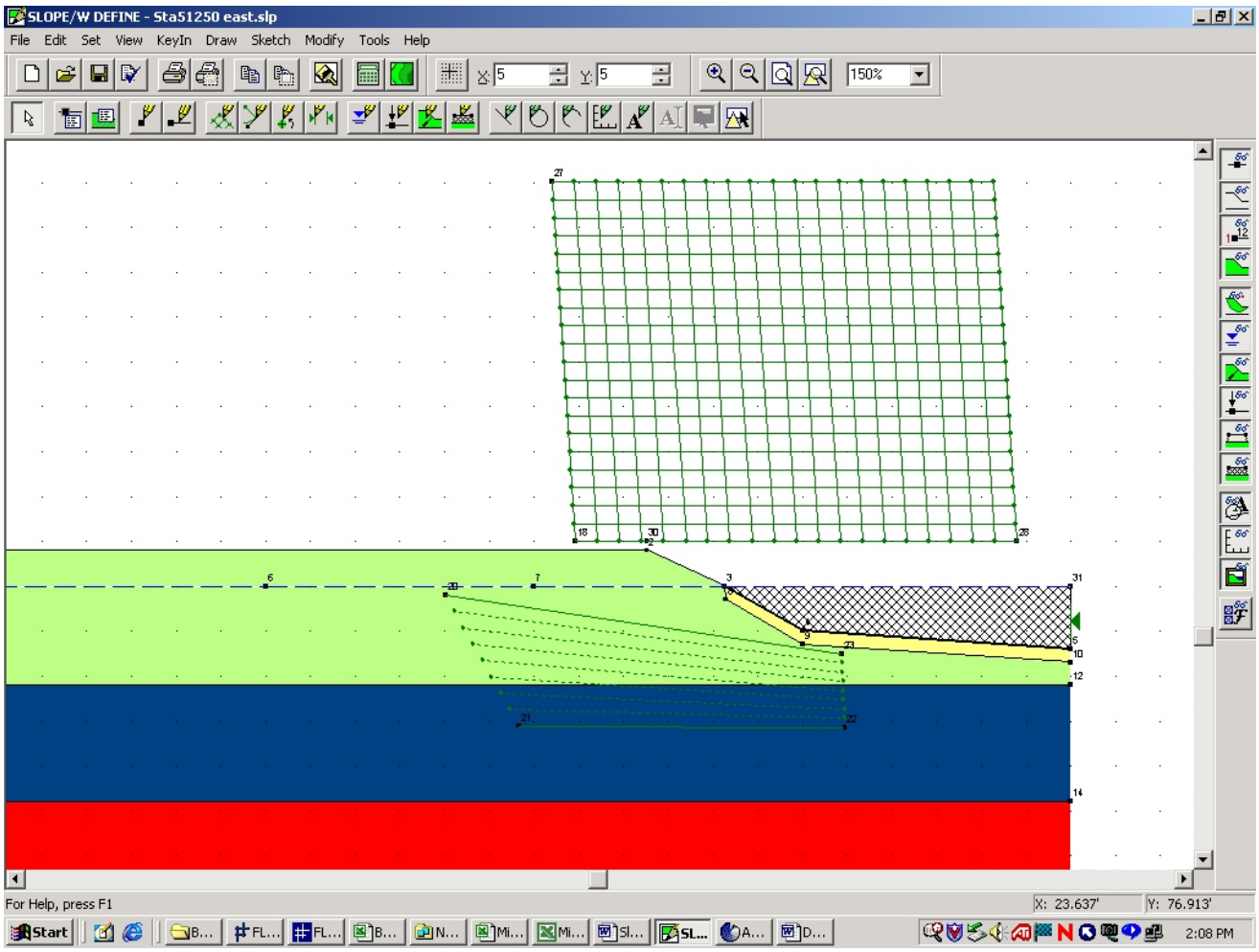
J-7385-07 2/02

Figure 2-6.20

Slope/W Analysis Set-Up for Case F



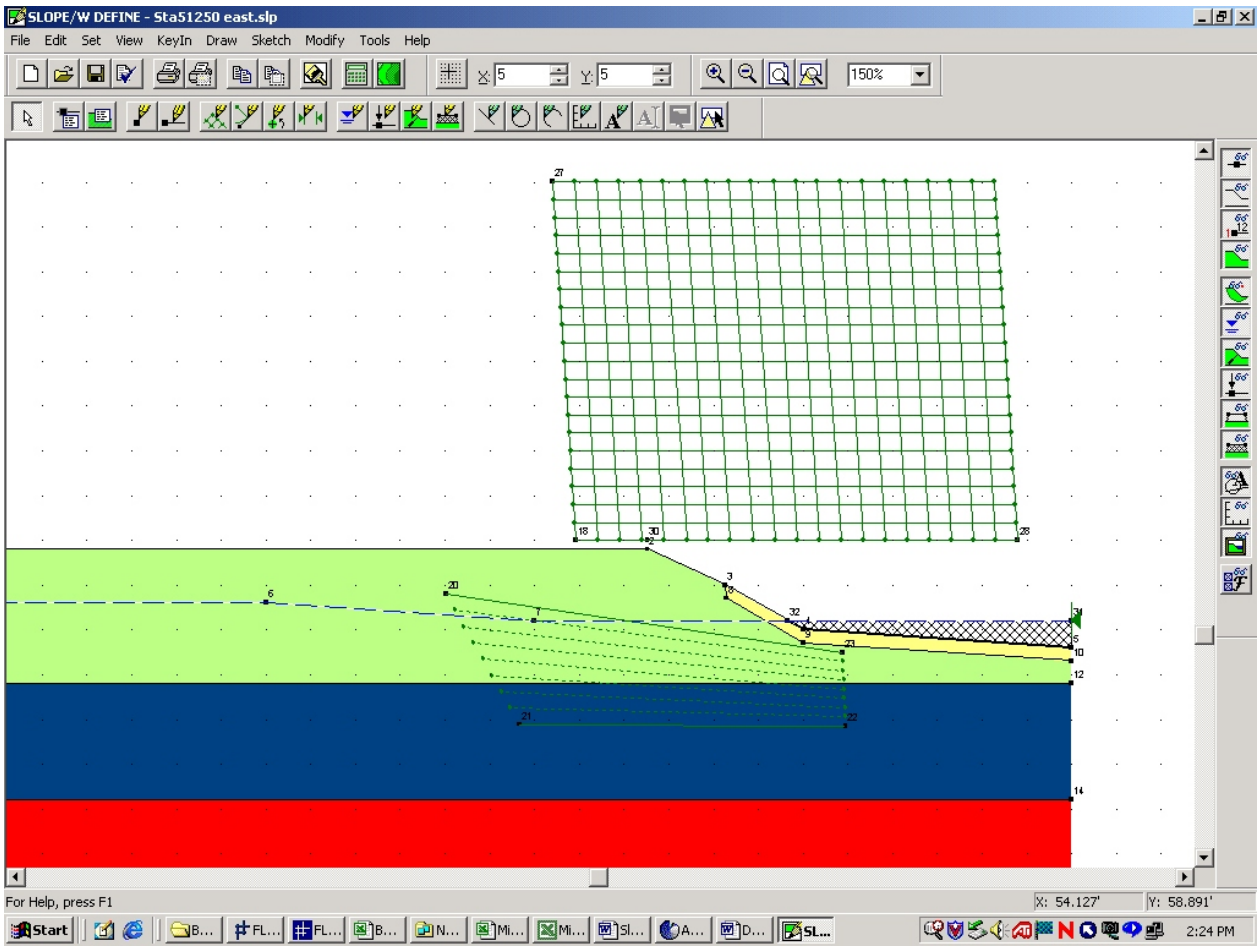
RAR 1/25/02 738510 Fi 2-6-21.cdr

HARTCROWSER

J-7385-07 2/02

Figure 2-6.21

Slope/W Analysis Set-Up for Case G



RAR 1/25/02 738510 Fig 2-6-22.cdr

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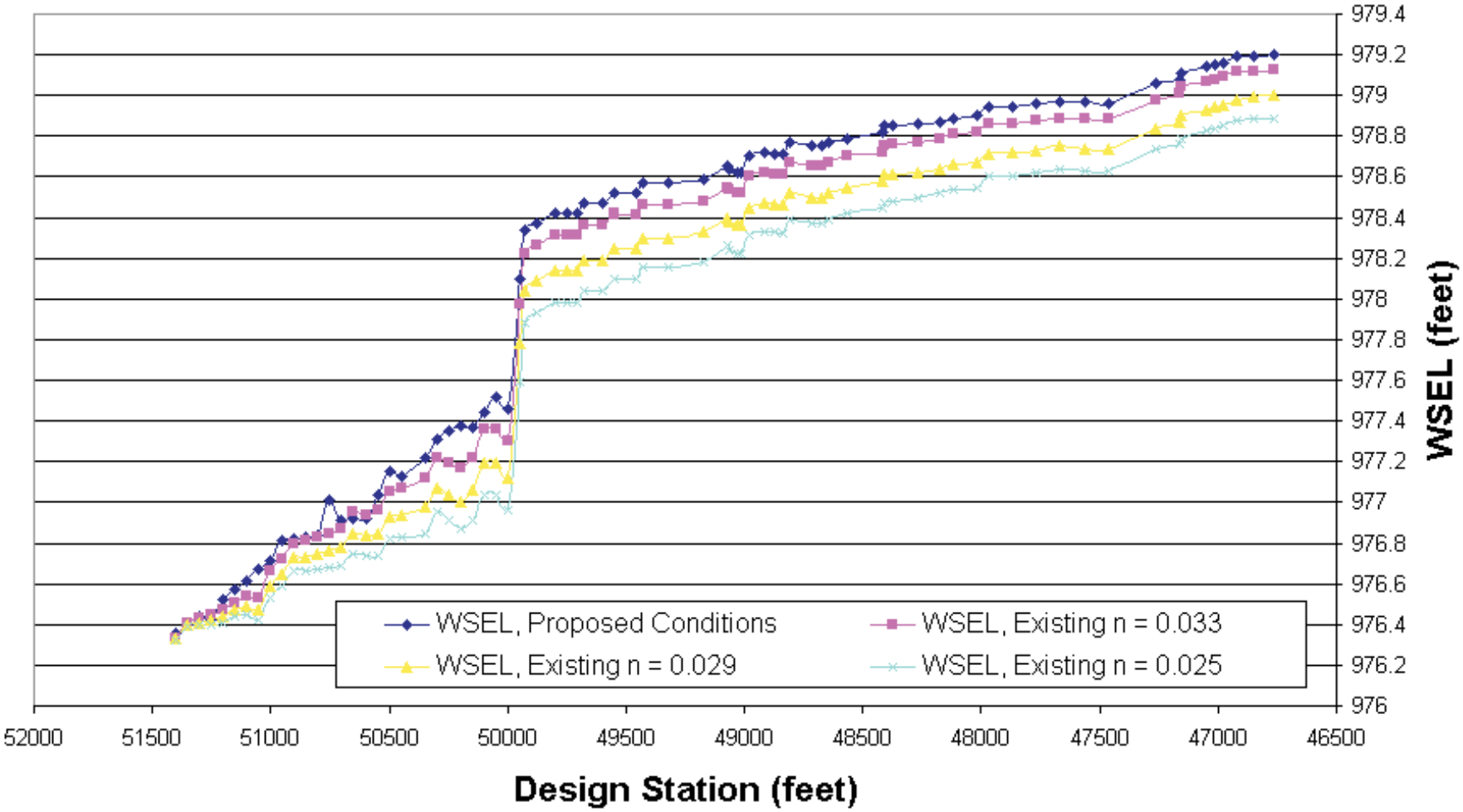
J-7385-07 *2/02*

Figure 2-6.22

Comparison WSEL for Existing and Proposed Conditions 2-yr Flood



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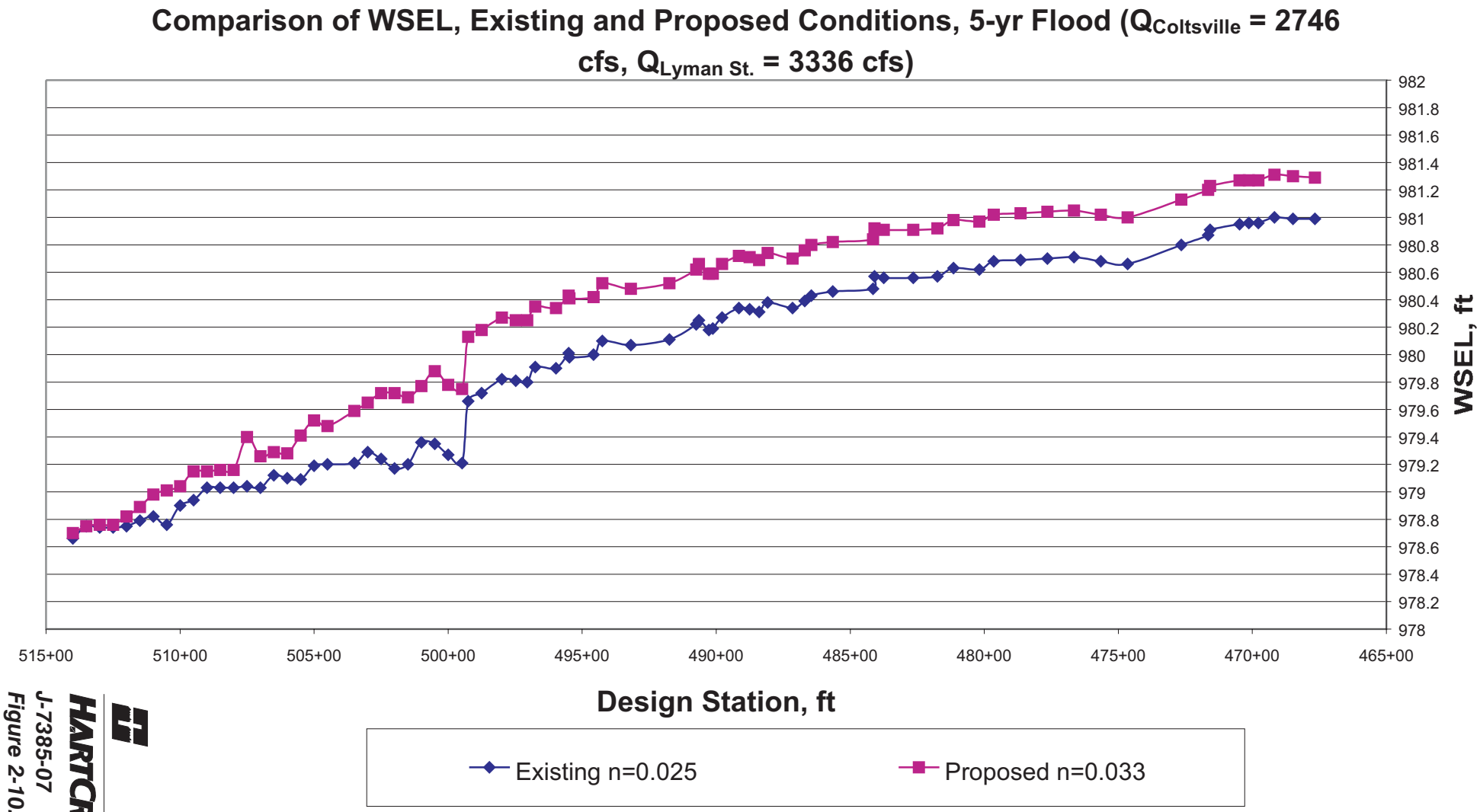
J-7385-07 2/02
Figure 2-10.1

RAR 1/25/02 738510 Fig 2-10-1.cdr

Comparison WSEL for Existing and Proposed Conditions 5-yr Flood



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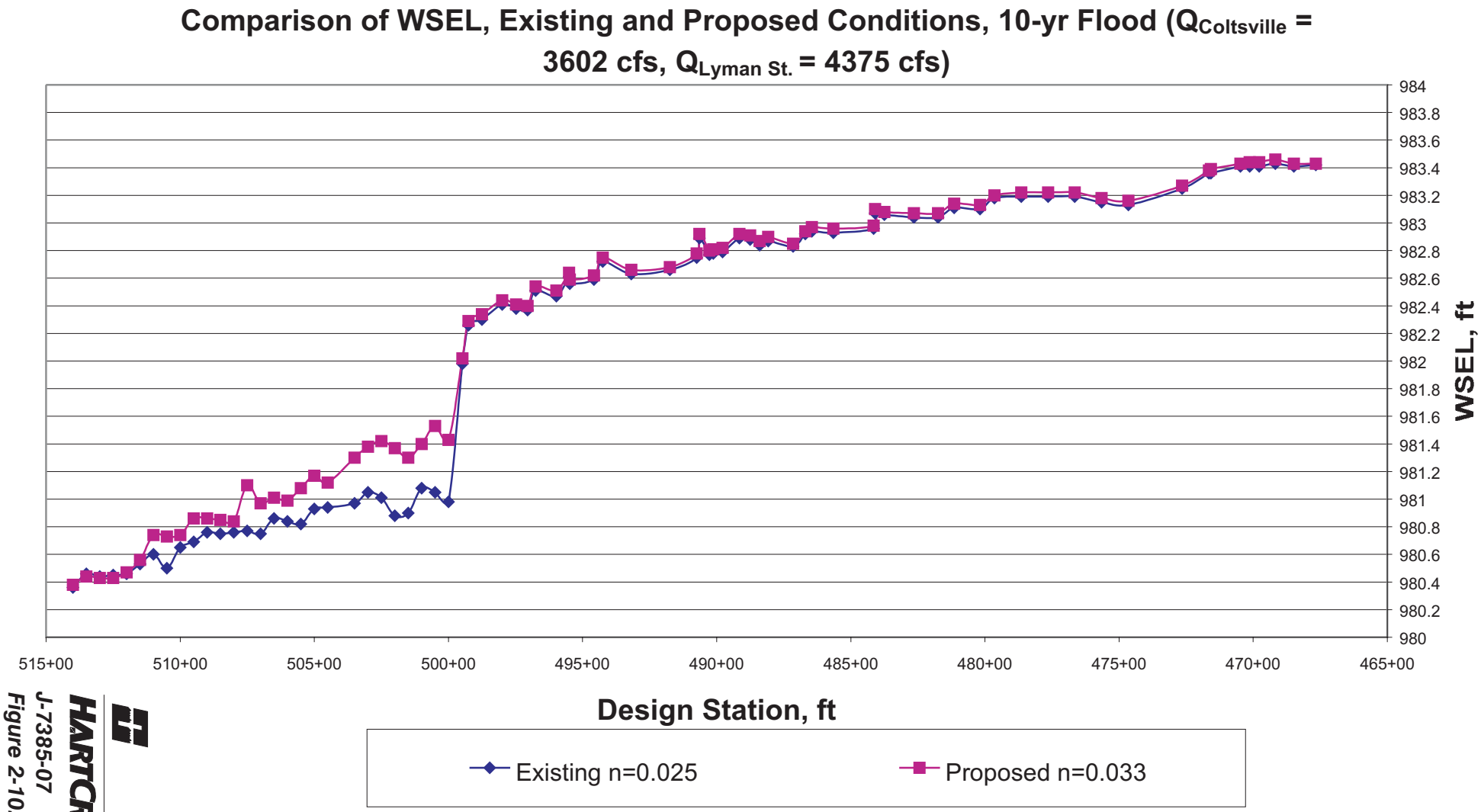
J-7385-07 2/02

Figure 2-10.2

RAR 1/25/02 738510 Fig 2-10-2.cdr

Comparison WSEL for Existing and Proposed Conditions 10-yr Flood



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J-7385-07 2/02

Figure 2-10.3

RAR 1/25/02 738510 Fig 2-10-3.cdr

APPENDIX A

DETAILED VOLUME CALCULATIONS

Table A-1 - 100% Design Volume Calculations for the East Bank

Station	Excav. Area, ft^2	Backfill Area, ft^2		Length ft	Excav. Volume, ft^3	Backfill Volume, ft^3
500+00						
500+50					0	0
501+00					0	0
501+50					0	0
502+00					0	0
502+30	**54.75**	**50.39**	*		0	0
502+50	54.75	50.39		20	1095	1008
503+00	36.96	37.32		50	2293	2193
503+50	43.01	43.62		50	1999	2024
503+70	**43.01**	**43.62**	*	20	860	872
504+10					0	0
504+30	**99.32**	**93.56**	*		0	0
504+50	99.32	93.56		20	1986	1871
505+00	100.16	79.34		50	4987	4323
505+50	107.87	104.33		50	5201	4592
506+00	71.27	71.22		50	4479	4389
506+50	117.48	119.62		50	4719	4771
507+00	142.88	149.52		50	6509	6729
507+50	135.61	143.07		50	6962	7315
508+00	120.38	112.35		50	6400	6386
508+50	128.81	137.74		50	6230	6252
509+00	142.14	142.14		50	6774	6997
509+50	139.06	139.71		50	7030	7046
510+00	110.48	103.57		50	6239	6082
510+50	138.76	130.79		50	6231	5859
511+00	92.69	96.68		50	5786	5687
511+50	79.65	76.75		50	4309	4336
512+00	70.05	64.08		50	3743	3521
512+50	69.3	69.76		50	3484	3346
513+00	69.57	66.77		50	3472	3413
513+50	59.96	61.69		50	3238	3212
514+00	84.28	71.43		50	3606	3328
				TOTAL ft^3	**107,630**	**105,549**
				TOTAL yd^3	**3,986**	**3,909**

Table A-2 - 100% Design Volume Calculations for the River Sediment

Station	Excav. Area, ft^2	Backfill Area, ft^2	Length ft	Excav. Volume, ft^3	Backfill Volume*, ft^3
500+00	143.94	143.94			
500+50	177.81	177.81	50	8044	8044
501+00	157.38	157.53	50	8380	8384
501+50	142.78	142.78	50	7504	7508
502+00	160.26	160.26	50	7576	7576
502+50	177.19	177.34	50	8436	8440
503+00	186.93	186.93	50	9103	9107
503+50	186.66	188.07	50	9340	9375
504+10	189.27	189.58	60	11278	11330
504+50	182.92	183.43	40	7444	7460
505+00	186.24	202.25	50	9229	9642
505+50	178.81	180.87	50	9126	9578
506+00	184.78	188.65	50	9090	9238
506+50	184.02	184.65	50	9220	9333
507+00	177.29	178.6	50	9033	9081
507+50	180.39	181.54	50	8942	9004
508+00	170.87	172.87	50	8782	8860
508+50	126.06	132.74	50	7423	7640
509+00	125.74	129.93	50	6295	6567
509+50	135.09	136.85	50	6521	6670
510+00	129.34	129.34	50	6611	6655
510+50	120.16	120.16	50	6238	6238
511+00	123.44	123.44	50	6090	6090
511+50	119.99	121	50	6086	6111
512+00	116.83	130.07	50	5921	6277
512+50	116.34	117	50	5829	6177
513+00	115.4	125.47	50	5794	6062
513+50	115.25	120.08	50	5766	6139
514+00	104.5	107.43	50	5494	5688
Additional Aggrading Bar Excavation at STA 508+00 to STA 510+50				7500	7500
			TOTAL ft^3	**222,092**	**225,769**
			TOTAL yd^3	**8,226**	**8,362**

* Note: the backfill volume presented here does not account for the proposed underfill. Total backfill, accounting for the proposed backfill is 7,100 yd^3.

Table A-3 - 100% Design Volume Calculations for the West Bank

Station	Excav. Area, ft^2	Backfill Area, ft^2	Length ft	Excav. Volume, ft^3	Backfill Volume, ft^3
500+00	82.25	83.65			
500+50	111.29	91.75	50	4839	4385
501+00	119.38	105.05	50	5767	4920
501+50	86.58	75.15	50	5149	4505
502+00	94.64	80.94	50	4531	3902
502+50	82.73	82.73	50	4434	4092
503+00	76.08	77.12	50	3970	3996
503+50	72.07	69.11	50	3704	3656
504+10	71.65	63.19	60	4312	3969
504+50	79.38	73.69	40	3021	2738
505+00	66.16	66.27	50	3639	3499
505+50	85.83	77.49	50	3800	3594
506+00	51.6	53.33	50	3436	3271
506+50	51.73	51.02	50	2583	2609
507+00	66.22	64.59	50	2949	2890
507+50		Silver Lake Outfall		14850	14850
507+80	**50**	**50** *		0	0
508+00	60.28	50.23	20	1103	1002
508+50	52.12	53.52	50	2810	2594
509+00	71.33	50.11	50	3086	2591
509+50	53.78	51.09	50	3128	2530
510+00	45.86	43.8	50	2491	2372
510+50	43.81	41.28	50	2242	2127
511+00	74.27	73.42	50	2952	2868
511+50	59.51	56.27	50	3345	3242
512+00	90.02	75.25	50	3738	3288
512+50	115.15	111.41	50	5129	4667
513+00	142.02	137.84	50	6429	6231
513+50	151.79	140.94	50	7345	6970
514+00	143.92	142.18	50	7393	7078
			TOTAL ft^3	**122,172**	**114,434**
			TOTAL yd^3	**4,525**	**4,238**

* Additional 120 yd^3 of backfill is required for the proposed Silverlake outfall structure

Table A-4 - Volume Calculations for the Drainage Swale

Excavation Area, ft^2					Excavation Volume, ft^3			
Station	**SOUTH**	**RIVER**	**NORTH**		**Length (ft)**	**SOUTH**	**RIVER**	**NORTH**
0+30	***47.27***	***86.74***	***41.49***	*				
0+50	47.27	86.74	41.49		20	945	1735	830
1+00	55.26	53.01	42.97		50	2563	3494	2112
1+50	63.86	70.88	40.19		50	2978	3097	2079
1+62	***63.86***	***70.88***	***40.19***	*	12	766	851	482
					Subtotal	7253	9176	5503
					Subtotal Excavation Volume in ft^3 =			21,932
					Subtotal Excavation Volume in cy =			812

Backfill Area, ft^2					Backfill Volume, ft^3			
Station	**SOUTH**	**RIVER**	**NORTH**		**Length (ft)**	**SOUTH**	**RIVER**	**NORTH**
0+30	***34.96***	***93.98***	***38.97***	*				
0+50	34.96	93.98	38.97		20	699	1880	779
1+00	55.27	55.61	42.22		50	2256	3740	2030
1+50	58.16	71.53	37.56		50	2836	3179	1995
1+62	***58.16***	***71.53***	***37.56***	*	12	698	858	451
					Subtotal	6489	9656	5254
					Subtotal Backfill Volume in ft^3 =			21,399
					Subtotal Backfill Volume in cy =			793

Note: Excavation and Backfill Volume Estimate based on 95% Draft Restoration Plan (4/24/01)

	Sta. 0+30 to 1+62	at the Junction	Total
Total Excavation Volume (yd^3)	812	340	1152
Total Backfill Volume (yd^3)	793	330	1123

APPENDIX B

HYDROLOGY ANALYSIS BACKUP

Table B-1 Log-Pearson Type III Hydrologic Analysis - East Branch Housatonic River at Coltsville

Water Year	Instantaneous Peak Discharge (cfs)	LogQ	Water Year	Instantaneous Peak Discharge (cfs)	LogQ
1936	6000	3.78	1968	1480	3.17
1937	1910	3.28	1969	3710	3.57
1938	6400	3.81	1970	1060	3.03
1939	3410	3.53	1971	1080	3.03
1940	1380	3.14	1972	2700	3.43
1941	832	2.92	1973	875	2.94
1942	1440	3.16	1974	3490	3.54
1943	1740	3.24	1975	2440	3.39
1944	1280	3.11	1976	2780	3.44
1945	1970	3.29	1977	2360	3.37
1946	1190	3.08	1978	1720	3.24
1947	1730	3.24	1979	2250	3.35
1948	1970	3.29	1980	4170	3.62
1949	5700	3.76	1981	1400	3.15
1950	1070	3.03	1982	2860	3.46
1951	3280	3.52	1983	2310	3.36
1952	2080	3.32	1984	3340	3.52
1953	1630	3.21	1985	1200	3.08
1954	1870	3.27	1986	982	2.99
1955	1640	3.21	1987	5000	3.70
1956	2010	3.30	1988	1680	3.23
1957	1120	3.05	1989	1150	3.06
1958	1090	3.04	1990	3850	3.59
1959	1730	3.24	1991	1440	3.16
1960	1920	3.28	1992	1220	3.09
1961	998	3.00	1993	2280	3.36
1962	1450	3.16	1994	1730	3.24
1963	582	2.76	1995	1200	3.08
1964	908	2.96	1996	1690	3.23
1965	394	2.60	1997	1250	3.10
1966	654	2.82	1998	1500	3.18
1967	1040	3.02	1999	1560	3.19

Table B-1 Log-Pearson Type III Hydrologic Analysis - East Branch Housatonic River at Coltsville, Cont.

Analytical Analysis

				A	B
Years of Data	64				
Xbar (Mean Log(Q)) =	3.239				
S (Standard Deviation) =	0.243	$MSEg_{ST}$	0.094	-0.311	0.887
Station Skew g=	0.232	$MSEg_{GEN}$	0.302		
Weighted Skew gw=	0.296	g_{GEN}	0.5		

Storm Return Interval	1.01	1.5	2	5	10	25	50	100
Approx Percentile	99%	67%	50%	20%	10%	4.0%	2.0%	1.0%
Standard Normal Deviate	-2.33	-0.43	0.00	0.84	1.28	1.75	2.05	2.33
Kt	-2.111	-0.469	-0.049	0.824	1.309	1.848	2.209	2.542
Kt*S	-0.513	-0.114	-0.012	0.200	0.318	0.449	0.536	0.617
LogQ=Kt*S +Xbar	2.726	3.125	3.227	3.439	3.557	3.688	3.775	3.856
Q	532	1333	1686	2746	3602	4870	5960	7180

Notes:

1. USGS records state that data collected after 1950 was likely affected by flow regulation.
2. Calculation method(Analytical Analysis by Log Pearson Type III Distribution)

a. Calculate log(Q) for all flows, plus Xbar (mean Log(Q)) and S (standard deviation of the Log(Q) list).

b. Calculate Station skew: g = [N*Sum(xi-Xbar)^3]/[(N-1)*(N-2)*S^3] where

xi = Log(Q)I

Xbar = average of all xi

N= number of records

c. Calculate MSEg and MSEgbar; mean square error for station skew and generalized skew, respectively.

MSEg = 10^(A-B*(log(N/10)) where

A = -0.33+0.08*g IF ABS(g) <=0.9

A = -0.52+0.3*g IF ABS(g) >0.9

B = 0.94-0.26*g IF ABS(g) <=1.5

B = 0.55 IF ABS(g) >1.5

MSEgbar = 0.302 for map (Figure 11.11) in Bras, 1990.

d. Calculate Weighted Skew: gw = (MSEgbar*g+MSEg*gbar)/(MSEgbar+MSEg) where

g = station skew

gbar = generalized skew from map (Figure 11.11) in Bras, 1990.

e. Calculate frequency factor for a given recurrence interval: Kt = (2/gw)*{[(Kt^n-gw/6)*(gw/6)+1]^3-1} where

Kt^n = standard normal deviate (Excel function =-NORMSINV(recurrence probability))

f. Log Q for specific recurrence interval = Xbar +Kt*S = Mean Log (Q) + Kt*(standard deviation)

g. Q = 10^(Log(Q))

References:

Bras, R.L., Hydrology: An Introduction to Hydrologic Science, Addison-Wesley, Menlo Park, CA, 1990.

Table B-2 Partial Duration Series Analysis - East Branch Housatonic River, Coltsville

Water Year	Event Date	Hourly Peak Discharge	LogQ	Ranking Position	Cum. Prob. Plot Position	Return Interval (event)	Prob. (Freq.)	Return Interval (year)
1988	5/26/1988	675	2.83	53	66%	1.5	0.66	0.210
1988	7/22/1988	975	2.99	29	36%	2.8	0.36	0.384
1988	3/27/1988	1385	3.14	15	19%	5.3	0.19	0.743
1989	5/26/1989	525	2.72	74	93%	1.1	0.93	0.151
1989	4/6/1989	625	2.80	59	74%	1.4	0.74	0.189
1989	8/13/1989	665	2.82	55	69%	1.5	0.69	0.203
1989	6/24/1989	670	2.83	54	68%	1.5	0.68	0.206
1989	11/21/1988	720	2.86	47	59%	1.7	0.59	0.237
1989	5/11/1989	770	2.89	44	55%	1.8	0.55	0.253
1989	3/29/1989	775	2.89	42	53%	1.9	0.53	0.265
1989	5/3/1989	775	2.89	42	53%	1.9	0.53	0.265
1989	5/6/1989	1025	3.01	25	31%	3.2	0.31	0.446
1990	5/11/1990	520	2.72	76	95%	1.1	0.95	0.147
1990	5/14/1990	545	2.74	71	89%	1.1	0.89	0.157
1990	2/24/1990	610	2.79	61	76%	1.3	0.76	0.183
1990	5/21/1990	610	2.79	61	76%	1.3	0.76	0.183
1990	5/18/1990	700	2.85	50	63%	1.6	0.63	0.223
1990	3/14/1990	710	2.85	48	60%	1.7	0.60	0.232
1990	3/21/1990	830	2.92	39	49%	2.1	0.49	0.286
1990	4/4/1990	970	2.99	30	37%	2.7	0.38	0.371
1990	10/21/1989	1626	3.21	6	7%	13.3	0.08	1.857
1990	3/18/1990	1797	3.25	3	3%	26.7	0.04	3.713
1990	8/7/1990	2357	3.37	1	1%	80.0	0.01	11.139
1991	3/4/1991	510	2.71	77	97%	1.0	0.96	0.145
1991	4/22/1991	570	2.76	69	87%	1.2	0.86	0.161
1991	10/14/1990	630	2.80	58	73%	1.4	0.73	0.192
1991	12/31/1990	640	2.81	57	71%	1.4	0.71	0.195
1991	11/11/1990	660	2.82	56	70%	1.4	0.70	0.199
1991	10/24/1990	1432	3.16	14	17%	5.7	0.18	0.796
1992	12/14/1991	550	2.74	70	88%	1.1	0.88	0.159
1992	6/6/1992	610	2.79	61	76%	1.3	0.76	0.183
1992	3/11/1992	760	2.88	45	56%	1.8	0.56	0.248
1992	5/3/1992	760	2.88	45	56%	1.8	0.56	0.248
1992	3/27/1992	1060	3.03	22	27%	3.6	0.28	0.506
1992	11/23/1991	1075	3.03	21	26%	3.8	0.26	0.530
1993	12/31/1993	510	2.71	77	97%	1.0	0.96	0.145
1993	4/27/1993	610	2.79	61	76%	1.3	0.76	0.183
1993	1/6/1993	1000	3.00	26	32%	3.1	0.33	0.428
1993	3/30/1993	1286	3.11	16	20%	5.0	0.20	0.696
1993	4/11/1993	1480	3.17	11	13%	7.3	0.14	1.013
1993	4/17/1993	1650	3.22	5	6%	16.0	0.06	2.228
1993	4/23/1993	2010	3.30	2	2%	40.0	0.03	5.570
1994	12/5/1993	540	2.73	72	90%	1.1	0.90	0.155
1994	11/29/1993	600	2.78	65	81%	1.2	0.81	0.171
1994	4/7/1994	1050	3.02	24	30%	3.3	0.30	0.464
1994	4/16/1994	1256	3.10	19	24%	4.2	0.24	0.586
1994	4/11/1994	1271	3.10	18	22%	4.4	0.23	0.619
1994	4/14/1994	1715	3.23	4	5%	20.0	0.05	2.785
1995	12/24/1994	530	2.72	73	92%	1.1	0.91	0.153
1995	3/8/1995	1000	3.00	26	32%	3.1	0.33	0.428
1996	9/18/1996	525	2.72	74	93%	1.1	0.93	0.151
1996	2/22/1996	600	2.78	65	81%	1.2	0.81	0.171
1996	4/14/1996	615	2.79	60	75%	1.3	0.75	0.186
1996	1/25/1996	825	2.92	40	50%	2.0	0.50	0.278
1996	6/9/1996	840	2.92	37	46%	2.2	0.46	0.301
1996	10/28/1995	855	2.93	36	45%	2.2	0.45	0.309
1996	4/24/1996	870	2.94	35	44%	2.3	0.44	0.318
1996	5/12/1996	940	2.97	31	39%	2.6	0.39	0.359
1996	5/1/1996	1000	3.00	26	32%	3.1	0.33	0.428
1996	10/21/1995	1275	3.11	17	21%	4.7	0.21	0.655
1996	10/22/1995	1433	3.16	13	16%	6.2	0.16	0.857
1996	7/13/1996	1498	3.18	10	12%	8.0	0.13	1.114
1996	1/19/1996	1591	3.20	9	11%	8.9	0.11	1.238
1996	1/19/1996	1608	3.21	8	10%	10.0	0.10	1.392
1996	10/22/1995	1616	3.21	7	8%	11.4	0.09	1.591
1997	2/27/1997	500	2.70	79	99%	1.0	0.99	0.141
1997	5/4/1997	580	2.76	68	85%	1.2	0.85	0.164
1997	11/9/1996	600	2.78	65	81%	1.2	0.81	0.171
1997	4/7/1997	680	2.83	52	65%	1.5	0.65	0.214
1997	5/20/1997	690	2.84	51	64%	1.6	0.64	0.218
1997	2/22/1997	710	2.85	48	60%	1.7	0.60	0.232
1997	12/25/1996	840	2.92	37	46%	2.2	0.46	0.301
1997	10/21/1996	920	2.96	33	41%	2.4	0.41	0.338
1997	12/2/1996	1251	3.10	20	25%	4.0	0.25	0.557
1998	3/10/1998	800	2.90	41	51%	2.0	0.51	0.272
1998	1/9/1998	920	2.96	33	41%	2.4	0.41	0.338
1998	3/29/1998	930	2.97	32	40%	2.5	0.40	0.348
1998	6/1/1997	1052	3.02	23	29%	3.5	0.29	0.484
1998	6/14/1998	1441	3.16	12	15%	6.7	0.15	0.928

Table B-2 Partial Duration Series Analysis - East Branch Housatonic River at Coltsville, Cont

Statistical Data

Total Events		79
Events /year		7.2
Linear Best Fit Coefficients	a	-0.59
Occurrence Probability vs.	r2	0.96
LogQ	b	3.23

Storm Return Frequency Based on Hourly Flow Data

Return Interval yrs	per year	Probability per event	Log Q	Q
2	0.5	0.07	3.2	1553
1.5	0.7	0.09	3.2	1505
1	1.0	0.14	3.2	1414
0.75	1.3	0.19	3.1	1328
0.50	2.0	0.28	3.1	1171
0.33	3.0	0.42	3.0	970
0.25	4.0	0.56	2.9	804
0.17	6.0	0.84	2.7	552
0.13	8.0	1.11	2.6	379
0.08	12.0	1.67	2.3	178

Estimate of 1-yr and 1.5-yr flows

Return Interval	Annual Series	Partial Duration Series	Representative Flow[3]
1-yr	450	1414	1375
1.5-yr	1333	1505	1450

Flow Data for Input into HEC-RAS

Station	Return Period (years)							Flow Dist.
	Avg	0.13	0.25	0.5	0.75	1.00	1.50	Coeff.
55258	110	379	804	1171	1328	1375	1450	
52023	134	460	976	1422	1612	1670	1761	1.21
44468	199	686	1455	2120	2404	2489	2625	1.81
37588	222	764	1622	2364	2679	2775	2926	2.02
17493	245	843	1789	2607	2955	3061	3228	2.23
12415	268	922	1956	2850	3231	3346	3529	2.43
9209	291	1000	2123	3094	3507	3632	3830	2.64

Notes:

1. Estimate of flow rate based on linear best fit of frequency vs. LogQ
2. Flows calculated in Tables B-1 and B-2 assumed at Station 55258. Downstream flows based on flow distribution coefficient related to contributing drainage area (coefficients development shown in Tables B-3 and B-4.2).
3. A representative flow based on information from both annual and partial duration series was calculated because of modeling limitiations. The annual series method generally underpredicts flow for return intervals near 1-yr. The partial duration series prediction is limited because there are only 11 data points from which to estimate flows greater than the 1-yr storm. Flow rates were calculated as follows:

1.5-yr storm: Representative Flow = average of the annual and partial duration series results, rounded up to the nearest 50 cfs.

1-yr storm: Representative Flow = average of 0.75-yr and 1.5-yr storms (as calculated above), rounded down to the nearest 25 cfs.
The annual series estimate was considered unreasonable compared to the partial duration series results.

Table B-3 Flow Increment Ratios and Drainage Areas

Contributing Drainage Areas	Total Drainage Areas (mi2)				Flow Ratio		
	Count 1		Count 2				
	Indiv.	Cum.	Indiv.	Cum.	Count 1	Count 2	Average
East Branch at Coltsville Gage Station	57.3	57.3	57.0	57.0	1.00	1.00	1.00
Design Reach	11.6	68.9	12.9	69.9	1.20	1.23	1.21
West Branch at Confluence	62.7	131.7	62.5	132.4	2.30	2.33	2.31
Sykes/Sacket Brooks	11.8	143.4	12.0	144.4	2.50	2.54	2.52
Sandwash/Farnham Brooks	11.6	155.0	12.9	157.3	2.70	2.76	2.73
Yokun Brook	6.8	161.8	7.5	164.9	2.82	2.89	2.86
Other, tributaries to Woods Pond Reservoir	7.9	169.7	5.8	170.7	2.96	3.00	2.98
All	169.7		170.7				

Table B-4.1 Comparison of Estimated Flow Rates used in HEC-RAS and HEC-2 Studies

		Flow Rate (cfs) at Each Station for Initial Evaluation[1]							Flow Adjustment at West Branch Confluence[2]	Flow Rate (cfs) After Adjustment[3]				
		Coltsville Gage Station	Design Reach	West Br. Conf.	Sykes/ Sackets	Sandwash/ Farnam	Yokun Brook	Woods Pond		West Br. Conf.	Sykes/ Sackets	Sandwash/ Farnam	Yokun Brook	Woods Pond
HEC-RAS Station		55258	52023	44468	37588	17493	12415	9209		44468	37588	17493	12415	9209
Discharge Factor[4]														
	HR[5]	1.00	1.21	2.31	2.52	2.73	2.86	2.98		1.81	2.02	2.23	2.36	2.48
	H2[6]	1.00	1.04	2.20		2.57		2.75						
Return Period (years)														
1	HR	1375	1670	3177	3463	3758	3930	4095	688	2489	2775	3070	3242	3407
	H2	440	458	968	-	1131	-	1208						
1.5	HR	1450	1761	3351	3652	3963	4144	4318	726	2625	2926	3238	3419	3593
	H2	-	-	-	-	-	-	-						
2	HR	1686	2048	3896	4246	4608	4819	5021	844	3052	3403	3765	3975	4177
	H2	1750	1820	3850	-	4498	-	4804						
5	HR	2746	3336	6347	6917	7507	7850	8179	1374	4972	5543	6132	6476	6805
	H2	3000	3120	6600	-	7710	-	8235						
10	HR	3602	4375	8324	9072	9845	10296	10727	1802	6521	7270	8043	8493	8925
	H2	3750	3900	8250	-	9638	-	10294						
50	HR	5960	7239	13772	15011	16289	17035	17749	2982	10790	12028	13307	14052	14767
	H2	-	-	-	-	-	-	-						
100	HR	7180	8721	16593	18085	19626	20523	21384	3593	13000	14492	16033	16930	17791
	H2	-	-	-	-	-	-	-						

Notes:

1. Flow rates for initial evaluation were calculated as described in Tables B-1 and B-2.
2. Flow Rates were adjusted to match the estimate reported in the FEMA flood insurance study for the Pittsfield area (FEMA, 1987). A new 100-year flow and discharge factor were calculated as shown in Table B-4.2. A new flow at the West Branch Confluence was then calculated for other return periods using the new discharge factor. Flow Adjustment was calculated by subtracting the new estimated flow from the initial estimated flow.
3. Flow Rate After Adjustment for stations downstream of the West Branch Confluence were calculated by subtracting the Flow Adjustment from the Initial Flow Estimate.
4. Discharge Factors for initial evaluation were calculated as Flow Rate for Initial Evaluation divided by the initial flow estimate at Coltsville Gauging Station. Discharge factors after adjustment were calculated as Flow Rate After Adjustment divided by Initial Flow Estimate at Coltsville Gauging Station.
5. HR refers to hydrologic analysis results for the HEC-RAS study reported in Tables B-1 and B-2.
6. H2 refers to flow estimates reported for a previous HEC-2 analysis (BBL, 2000a; BBL, 2000b).

Table B-4.2 FEMA Study vs. Areal Analysis Flow Rate

Station(1)		Mean Velocity(2) ft/s	Flow Area(3) ft2	Est. Flow Rate FEMA(4) cfs	HR cfs
West Br.	A	2.6	977	2540	
	B	0.3	7493	2248	
	C	4.6	425	1955	
SWest Br.		1743	1.3	2266	
Input at Confluence(5)				4514	7872
Estimated Flow at Confluence(6)				13000	16593
Discharge Factor at Confluence(7)				1.81	2.31

Notes:
1. Data from FEMA flood insurance study for Pittsfield area (FEMA, 1987), West and Southwest Branches of the Housatonic River. Data was reported for three crosssections (A,B, and C) on the West Branch and one cross section on the Southwest Branch.
2. Mean Velocity (V) for the 100-year flood
3. Cross-Sectional Flow Area (A) for the 100-year flood
4. Estimated flow rate (Q) = V*A
5. Input at Confluence (FEMA) = Qw+Qsw
where Qw = average flow from West Branch (Qaverage from stations A,B, and C)
Qsw = average flow from Southwest Branch
Input at Confluence(HEC-RAS) = Qdesign reach - Qwest br. conf. for the 100-year storm from Table B-4.1, "Flow Rate at Each Station for Initial Evaluation".
6. Estimated Flow at Confluence = Qdesign reach + Input at Confluence (FEMA estimate rounded to nearest thousand).
7. Discharge factor = Estimated flow at confluence/Estimated 100-year flow at Coltsville gage station (from Table B-4.1).

Table B-5 Estimated Work Suspension Duration of Individual Storm Events

Overall Average Duration (hours)

Flow cfs	Average	Range Low	High
800	25	10	80
600	35	10	120
400	50	10	360
200	88	10	880

Overall Average Duration (days)

Flow cfs	Average	Range Low	High
800	1.1	0.4	3.3
600	1.5	0.4	5.0
400	2.1	0.4	15.0
200	3.7	0.4	36.7

Work Suspension Duration (hours) by Water Year

Flow	1988			1989			1990		
cfs	Average	Range Low	High	Average	Range Low	High	Average	Range Low	High
800	30	20	40	40	-	-	20	10	40
600	40	20	60	30	10	50	40	10	120
400	30	10	80	50	40	80	50	20	160
200	90	10	320	90	20	400	80	20	320

Flow	1991			1992			1993		
cfs	Average	Range Low	High	Average	Range Low	High	Average	Range Low	High
800	20	-	-	20	20	20	40	20	70
600	20	10	40	20	10	30	50	10	100
400	40	20	60	40	30	60	80	20	240
200	50	10	140	50	10	200	160	10	800

Flow	1994			1995			1996		
cfs	Average	Range Low	High	Average	Range Low	High	Average	Range Low	High
800	40	20	80	20	20	20	20	10	30
600	50	20	120	30	30	30	40	10	50
400	100	10	360	30	10	40	20	10	200
200	110	20	720	60	20	240	140	10	880

Flow	1997			1998		
cfs	Average	Range Low	High	Average	Range Low	High
800	15	10	20	15	10	20
600	20	10	30	50	20	100
400	40	10	80	70	20	160
200	70	10	320	70	20	200

Notes:
1. Duration estimates from hourly flow record for Coltsville station, Housatonic River. Estimates represent potential duration of work suspension periods associated with individual events that exceed the listed threshold. Hours were estimated by inspection of water year hydrographs. Storm durations were rounded to the nearest 10 hours.

APPENDIX C

HYDRAULICS ANALYSIS BACKUP

Table C-1 Bridge Geometry Data Obtained from Proposed Construction Plans Housatonic River Project, Pittsfield, Massachusetts

Bridge	Deck Elevation HI	Deck Elevation LO	Bottom Chord Elevation HI	Bottom Chord Elevation LO	Comment	Description
Newell Street Bridge	989.7		985.9			HEC-2 Model
	989.5		985.8			FEMA Flood Insurance Study
	989.7		985.9		Elevations used in HEC-RAS model	
Foot bridge	995.7		983.9		Elevations used in HEC-RAS model	HEC-2 Model
Lyman Street Bridge	986.27		~981.7		Based on proposed construction plans	Reconstruction of Lyman Street Bridge over East Branch of Housatonic River, April 1986
	989.2		981.2			HEC-2 Model
	985.5		981.2			FEMA Flood Insurance Study
	986.2		981.2		Elevations used in HEC-RAS model	
Elm Street Bridge	994.3		988.15		(Road elev 990.9, top of solid bridge rail 994.3)	Elm Street Bridge Detail Sheet 3 of 6, March 20, 1911
	994.3		988.1		Bottom chord elevation is top of arch	HEC-2 Model
	990.7		987			FEMA Flood Insurance Study
	994.3		988.1		Elevations used in HEC-RAS model	
Dawes Avenue	978.4	978	971.2			HEC-2 Model
	978		968.8			FEMA Flood Insurance Study
	977.7	977	971.3		Based on proposed rehabilation plans	Bridge Rehabilitation Project - Dawes Avenue
					According to Design plans	Plans were not dated. Fiscal Year labeled as 1996
					Hydraulic Data	
					Drainage Area 70.25 sq. miles	
					Design Discharge 3863 cfs	
					Design Frequency 10 year	
					Design Velocity 6.05 fps	
					Design High Water 972.6 ft (NGVD)	
					Q (100-year) 9659 cfs	
					Water Surface Elev. 980.33 ft (NGVD)	
	977.7	977	972	971.3	Elevations used in HEC-RAS model	
Pomeroy Avenue(1)	974.94		970.94		Based on proposed rehabilation plans	
					According to Design plans	
					100-year flood elev. = 974.0	
	974.4		970.6			HEC-2 Model
	974.5		970.5			FEMA Flood Insurance Study
	975.7	974	971.7	970.0	Elevations used in HEC-RAS model	
Pomeroy Avenue(2)	973.4		968.3			HEC-2 Model
	973.5		968.25			FEMA Flood Insurance Study
	973.5		968.3		Elevations used in HEC-RAS model	
Holmes Bridge	977.2	975	969.8	969.8		HEC-2 Model
	976.25		969.75			FEMA Flood Insurance Study
	977.2	976	969.8	969.8	Elevations used in HEC-RAS model	

Table C-2 Control Point Evaluation

Downstream Control Point for Large Scale Model

Return Period (years)		2	10	50	100
Flow Rate (cfs)		4177	8925	14767	17791
Flow Area (ft2)				1638	1934
Top Width (ft)				400	431
D				4.1	4.5
Spillway width (ft)	140				
g (ft/s2)	32.2				
HEC-RAS data, Large Scale Model					
Alpha		1	1	1.9	2.0
Invert Elevation (ft)		948.3	948.3	948.3	948.3
Stage (ft)		951.31	953.29	954.26	954.97
Flow Depth (ft)		3.01	4.99	5.96	6.67
yc = (q^2/g)^(1/3)		3.02	5.02		
Q/(A*(g*D)^0.5)				1.08	1.08

Downstream Control Point for Design Scale Model at HEC-RAS Station 38568

Return Period (years)	2	10	50	100
Design Scale Stage	962.08	964.09	965.76	966.63
Large Scale Stage	961.82	963.68	965.53	966.37
Stage Difference	0.26	0.41	0.23	0.26

Woods Pond Dam Spillway Cross Section Data

Station	Elevation
1	970
15	960
25	958
75	950
150	950
165	946
175	942
176	954
177	948.3
317	948.3
318	954
373	954
374	948
389	950
439	954
514	956
534	960
634	970

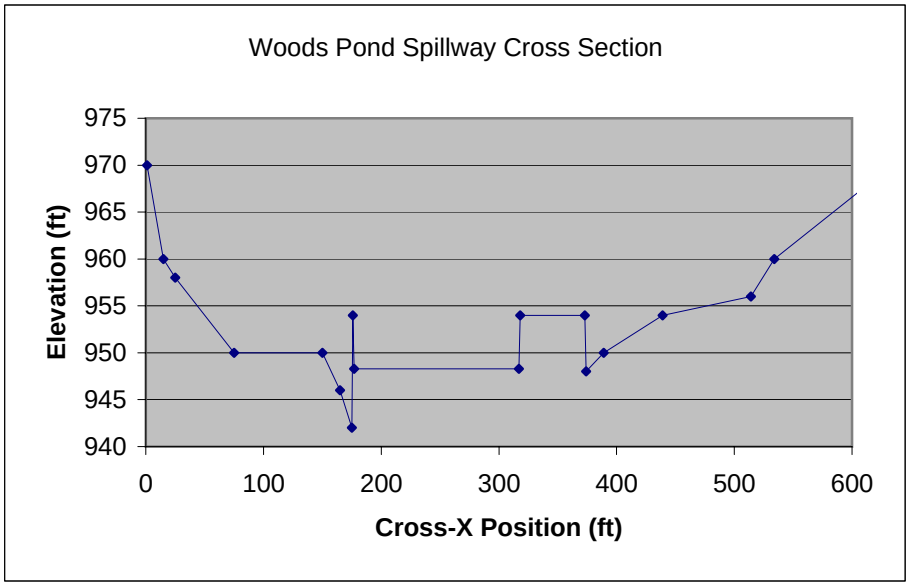


Table C-3 Sheet Pile Height vs. Lost Work Days Analysis

Q [cfs]	WSEL [ft]	Overtopping Frequency	Duration [Days]	Lost Days
215	973	12	4	48
460	974	8	2	16
550	975	6	2	12
975	976	4	1	4
1400	977	2	1	2
1675	978	1	1	1

Notes:

1. The flow in column 1 is the flow rate at the Lyman Street Bridge which corresponds to the elevation (WSEL) in column 2 predicted by the HEC-RAS model representing conditions during construction.
2. Overtopping frequency is the estimated number of flow events in a 12 month period in which the water surface elevation exceeds the elevation of the top of the wall. Estimates obtained from Table B-2.
3. Duration estimated from flow rate/duration relationship in Table B-5, Appendix B. The value is rounded up to the nearest day.

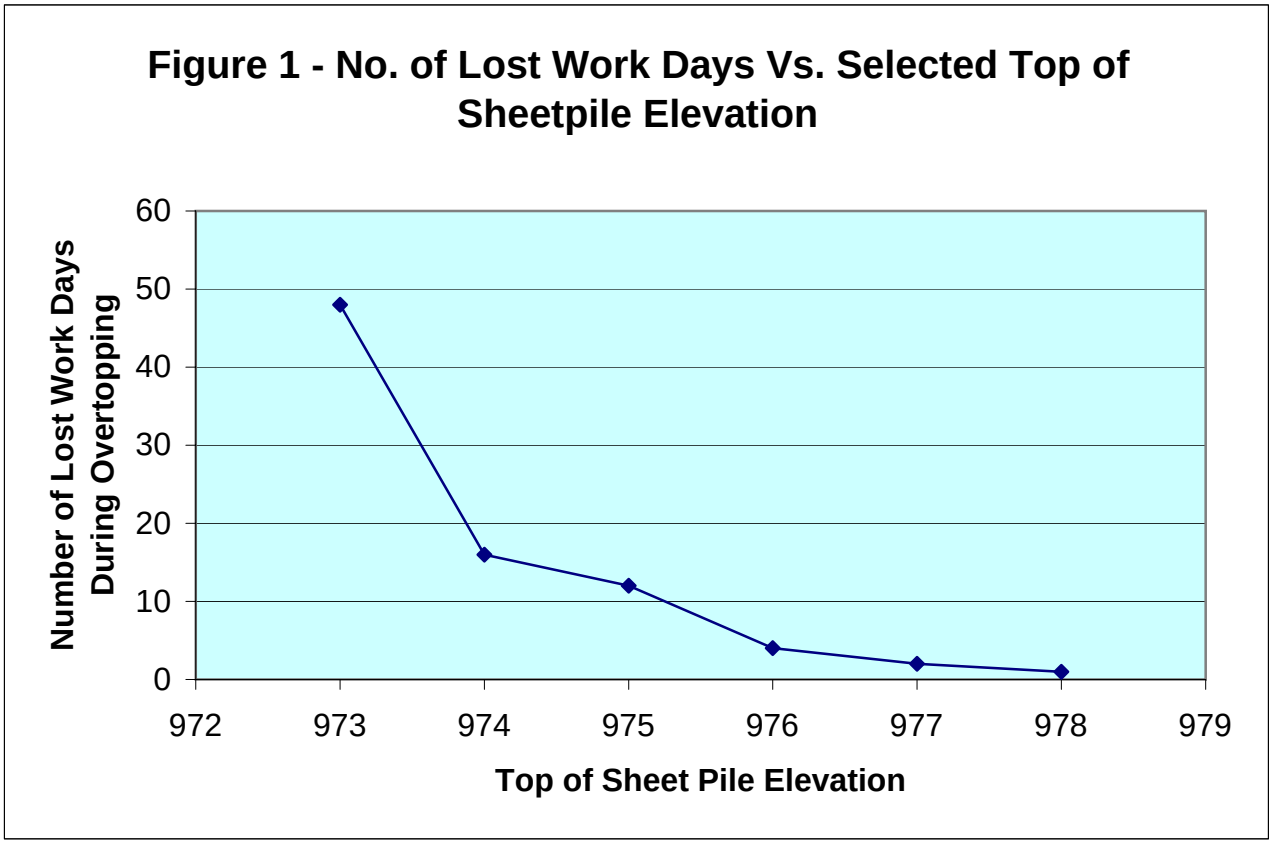


Table C-4 Estimation of Mannings's Roughness Coefficient Using Different Methods

Description	D90		Manning's 'n' by Estimation Method			
	mm	ft	Strickler[1]	USACE[2]	Chow	BBL[4]
Bed Roughness						
Existing bed material	25	0.083	0.021	0.024	0.027[3]	0.015 - 0.025
12-inch riprap	210	0.700	0.030	0.036		
18-inch riprap	318	1.060	0.032	0.038		
Proposed Condition[5]			0.027	0.033		
Floodplain Roughness						
Medium Vegetation[6]					0.05 - 0.07	0.04 - 0.06
Dense Vegetation[7]					0.1 - 0.15	0.1 - 0.15

Notes:

1. $n = (D_{90})^{1/6}/26$ where D_{90} is in meters
2. $n = K*(D_{90}min)^{1/6}$ where D90 is in feet, and
   K = 0.038 for capacity and freeboard calculations (used for riprap roughness estimation)
   K = 0.034 for velocity and stone size calculations
   K = 0.036 average of flume data (used for existing condition roughness evaluation)
3. Estimate reported in Chow (1959) for excavated or dredged channel, short grass with few weeds.
4. Roughness values used in the BBL HEC-2 analysis (BBL, 1991;BBL, 2000a; BBL, 2000b)
5. Proposed Condition roughness assumed to be a composite of the existing condition, and the proposed riprap material to be placed in the bed (12-inch; D90min = 0.7 feet) and on the bank (18-inch; D90min = 1.06 feet). The Manning's 'n' calculated for the Proposed Condition is the average of the values calculated for each of these materials. K = 0.038 was used to calculate riprap roughness.
6. Roughness values (Chow, 1959) reported for mature crops, cleared land, or light brush on the low end; dense brush or cleared land with heavy sprouts on the high end. In the BBL HEC-2 analysis roughness values were in this range from Coltsville to just upstream of New Lenox Road Bridge.
7. Roughness values (Chow, 1959) reported for heavy timber with little undergrowth on the low end; dense willows during summer on the high end. In the BBL HEC-2 analysis, roughness values were in this range from just upstream of New Lenox Road Bridge to the downstream end of the model.

Table C-5 Approximate Flood Stage for the Housatonic River at Pittsfield

Reported Stage Location	HEC-RAS station	WSEL(ft)[1]					Difference in Flood Stage Elevation[4]		
		FEMA[2]		HEC-RAS		HEC-2	FEMA	FEMA	HEC-2
		100-year flood avg	10-year flood avg	100-year flood avg	10-year flood avg	100-year flood avg[3]	100-yr	10-yr	100-yr
Newell St. Bridge	55196	990.95	985.25	990.22	982.7		0.7	2.6	
	54900			990.16	982.7	987.95			-2.2
	54183			989.87	982.4	987.57			-2.3
	52935			989.5	981.8	987.09			-2.4
	52921			988.29	981.8	986.24			-2.0
	52400			987.78	981.7	985.9			-1.9
Lyman St. Bridge	51973	988.8	983.35	987.58	980.9		1.2	2.4	
	51600			987.27	981.0	983.39			-3.9
Elm St. Bridge	49763	987.05	981.75	982.44	977.4		4.6	4.4	
	49538			980.04	974.4	979.75			-0.3
	49133			980.07	973.6	977.88			-2.2
Dawes Ave Bridge	47630	978.5	972	978.215	971.7		0.3	0.3	
	47033			977.7		971.2			-6.5
Pomeroy Bridge (upstm end)	45890	973.5	969	974.84	968.8		-1.3	0.2	
Confluence East and West Branch	44468	972.2	967.5	972.37	966.1		-0.2	1.4	
Pomeroy Bridge (dwnstm end)	39503	971.35	966.4	970.03	964.9		1.3	1.5	
Holmes Rd. Bridge	38988	969.75	965	965.5	963.8		4.3	1.2	

Notes:
1. WSEL at bridges = average of the estimated stage upstream and downstream of the bridge.
2. Elevations reported in FEMA study (FEMA, 1984) were reported in NGVD 29. Datum for HEC-RAS model is in NAVD 88. FEMA elevations were converted to NAVD 88 by adding 0.5 feet.
3. Because of differences with stationing, the HEC-2 values are taken from the closest station in that model. Reported stage at 51600 is within 60 feet. Reported stage at all other locations are within 10 feet.
4. Difference in Flood Stage Elevation = WSEL of listed model (FEMA or HEC-2) - WSEL from HEC-RAS

Table C-6 Stage vs. Overtopping Frequency and Elevation

Storm		W.S. Elev. at Upstream end of Sheet Pile[2]											
		sheet pile located d/s[3]						sheet pile located mid[4]			sheet pile located u/s[5]		
Ret. Per.[1]		W.S. Elev Sta 511+00			W.S. Elev Sta 500+02			W.S. Elev Sta 503+50			W.S. Elev Sta 500+50		
yr	Flow	with S.P.	w/o S.P.	Δ W.S.	with S.P.	w/o S.P.	Δ W.S.	with S.P.	w/o S.P.	Δ W.S.	with S.P.	w/o S.P.	Δ W.S.
Avg Annual	134	971.84	971.06	0.78	972	971.52	0.48	971.66	971.28	0.38	971.91	971.54	0.37
0.125	460	974.1	972.57	1.53	974.31	973.11	1.2	973.28	972.76	0.52	973.81	973.14	0.67
0.25	976	976	974.14	1.86	976.33	974.74	1.59	974.99	974.39	0.6	975.65	974.79	0.86
0.5	1422	977.27	975.19	2.08	977.6	975.81	1.79	976.43	975.48	0.95	977.12	975.87	1.25
0.75	1612	977.65	975.6	2.05	978	976.21	1.79	976.84	975.89	0.95	977.45	976.28	1.17
1.00	1670	977.77	975.72	2.05	978.11	976.33	1.78	976.97	976.02	0.95	977.56	976.4	1.16
1.50	1761	977.79	975.9	1.89	978.17	976.51	1.66	977.24	976.21	1.03	977.72	976.59	1.13
2.00	2047	978.14	976.46	1.68	978.56	977.06	1.5	977.75	976.78	0.97	978.05	977.14	0.91
5.00	3336	979.55	978.81	0.74	980.07	979.33	0.74	979.55	979.15	0.4	979.66	979.42	0.24
10.00	4375	981.01	980.58	0.43	981.45	981.01	0.44	981.19	980.92	0.27	981.16	981.09	0.07
50.00	7239	985.14	984.97	0.17	985.72	985.53	0.19	985.51	985.36	0.15	985.08	985.21	-0.13
100.00	8721	987.06	986.99	0.07	987.68	987.61	0.07	987.42	987.33	0.09	987.12	987.17	-0.05

Notes:
1. Minimum return period represents the statistical frequency, in years, that a given flow is expected to occur.
2. Analysis performed with top of sheet pile at El. 976 ft.
3. Sheet pile cell from station 511+00 to 514+00.
4. Sheet pile cell from station 503+50 to 506+50.
5. Sheet pile cell from station 500+50 to 503+50.

Table C-7 Total Static Head Analysis

Storm		sheet pile located d/s[3]		Centerline Elevation 966.84					
		Specific Force[6]				**Static Head**	W.S. Elev		**Total Static**
Ret. Per.[1]		510+50	511+00	$Force_{sp}$[7]	$Area_{sp}$[8]	**Equivalent**[9]	511+00	Depth[10]	**Head**[11]
yr	Flow								
Avg Annual	134	191	185	6	75	0.1	971.84	5	5.1
0.125	460	666	537	129	180	0.7	974.1	7.26	8.0
0.25	976	1399	1031	369	250	1.5	976	9.16	10.6
0.5	1422	2069	1500	569	250	2.3	977.27	10.43	2.3
0.75	1612	2311	1686	626	250	2.5	977.65	10.81	2.5
1.00	1670	2389	1746	642	250	2.6	977.77	10.93	2.6
1.50	1761	2421	1773	648	250	2.6	977.79	10.95	2.6
2.00	2047	2679	1989	689	250	2.8	978.14	11.3	2.8
5.00	3336	3922	3152	771	250	3.1	979.55	12.71	3.1
10.00	4375	5417	4705	712	250	2.8	981.01	14.17	2.8
50.00	7239	12344	12422	-77	250	0.0	985.14	18.3	0.0
100.00	8721	17946	18710	-764	250	0.0	987.06	20.22	0.0
Storm		sheet pile located mid[4]		Centerline Elevation 969.56					
		Specific Force[6]				**Static Head**	W.S. Elev		**Total Static**
Ret. Per.[1]		503+00	503+50	$Force_{sp}$[7]	$Area_{sp}$[8]	**Equivalent**[9]	503+50	Depth[10]	**Head**[11]
yr	Flow								
Avg Annual	134	144	48	95	70	1.4	971.66	2.1	3.5
0.125	460	560	225	335	180	1.9	973.28	3.72	5.6
0.25	976	1333	575	757	250	3.0	974.99	5.43	8.5
0.5	1422	2108	938	1169	250	4.7	976.43	6.87	11.5
0.75	1612	2420	1103	1317	250	5.3	976.84	7.28	5.3
1.00	1670	2507	1151	1356	250	5.4	976.97	7.41	5.4
1.50	1761	2637	1225	1412	250	5.6	977.24	7.68	5.6
2.00	2047	3065	1480	1585	250	6.3	977.75	8.19	6.3
5.00	3336	4856	2661	2195	250	8.8	979.55	9.99	8.8
10.00	4375	7074	4182	2892	250	11.6	981.19	11.63	11.6
50.00	7239	18208	13594	4614	250	18.5	985.51	15.95	18.5
100.00	8721	25941	20708	5233	250	20.9	987.42	17.86	20.9

Table C-7 Total Static Head Analysis

Storm		sheet pile located u/s[5]		Centerline Elevation 967.81					
		Specific Force[6]				**Static Head**	W.S. Elev		**Total Static**
Ret. Per.[1]		500+00	500+50	$Force_{sp}$[7]	$Area_{sp}$[8]	**Equivalent**[9]	500+50	Depth[10]	**Head**[11]
yr	Flow	ft^3water	ft^3water	ft^3water	ft^2	ft			
Avg Annual	134	99	117	-18	90	0.0	971.91	4.1	4.1
0.125	460	426	353	72	180	0.4	973.81	6	6.4
0.25	976	1020	755	265	250	1.1	975.65	7.84	8.9
0.5	1422	1617	1172	444	250	1.8	977.12	9.31	1.8
0.75	1612	1799	1314	485	250	1.9	977.45	9.64	1.9
1.00	1670	1857	1359	498	250	2.0	977.56	9.75	2.0
1.50	1761	1950	1433	517	250	2.1	977.72	9.91	2.1
2.00	2047	2186	1625	561	250	2.2	978.05	10.24	2.2
5.00	3336	3422	2675	747	250	3.0	979.66	11.85	3.0
10.00	4375	4687	3799	888	250	3.6	981.16	13.35	3.6
50.00	7239	12305	8031	4273	250	17.1	985.08	17.27	17.1
100.00	8721	25866	11750	14116	250	56.5	987.12	19.31	56.5

Notes:

1. Minimum return period represents the statistical frequency, in years, that a given flow is expected to occur.
2. Analysis performed with top of sheet pile at 976.
3. Sheet pile cell from station 511+00 to 514+00.
4. Sheet pile cell from station 503+50 to 506+50.
5. Sheet pile cell from station 500+50 to 503+50.
6. Specific Force (S.F.) (units = ft^3 of water) obtained from HEC-RAS analysis output.
7. $Force_{sp}$ = Force on sheet pile = $S.F._{510+50}$ - $S.F._{511+00}$
8. $Area_{sp}$ = Approximate area (ft^2) of sheetpile normal to flow. Estimated from blocked obstruction geometry in HEC-RAS.
9. Static Head Equivalent = $Force_{sp}/Area_{sp}$ = equivalent head (ft) representative of dynamic force.
10. Depth not included in the calculation above stage ~ 976 feet. It was assumed that the cell would begins flooding at that stage, quickly relieving the static force on the outside of the walls.
11. Total Static Head = water depth + static head equivalent

Table C-8 Estimation of Contraction Scour Associated with Sheet Pile

Input Parameters		Storm Interval 0.25-yr	.5-yr	5-yr	Data Source
Upstream flow stage		975.43	976.84	979.86	HEC-RAS analysis. Station 502+50
Upstream flow depth	y1	6.43	8	11	From flow stage assuming channel invert~969
Contraction flow	Qt	975	1319	1821	Assume Qover sheet pile by weir eqn (H = stage-976)
Main channel flow	Qc	975	1422	3336	HEC-RAS analysis. Station 502+50
Upstream flow width	W1	80	80	100	HEC-RAS cross-section. Station 502+50
Flow width through constriction	W2	40	40	40	HEC-RAS cross-section. Station 502+50
Upstream roughness	n1	0.025	0.025	0.025	
Roughness in constriction	n2	0.025	0.025	0.025	
Slope	S	0.0005	0.0005	0.0005	Used E.G. slope generally exceeded in reach

Scour Calculation

Shear velocity	U*	0.322	0.355	0.418	
	U*/w	3.42	3.78	4.45	
Scour Coefficients	A	0.69	0.69	0.69	Table 10.1 p717 for U*/w>2
	B	0.37	0.37	0.37	
	y2/y1	1.6	1.5	1.1	
Scour Depth	**y2**	**3.9**	**4.0**	**1.3**	

Median grain size fall velocity

F	D50	w
	ft	ft/s
0.79	0.003	0.094

Physical Parameters

ρ	ν	γs'	γw	γs	g
	ft2/s	lb/ft3	lb/ft3	lb/ft3	ft/s2
1.94	0.000012	102.96	62.4	165.36	32.2

Notes:
Laursen Equation: y2/y1 = (Qt/Qc)^(6/7)*(W1/W2)^A*(n2/n1)^B
Shear velocity (U*) used depth as surrogate for hydraulic radius because river is wide
Fall velocity based on Rubey equation w=F^2*D50*g*γs'/γw
where
F = 0.79 approximately constant for particles >1mm
γs' = submerged unit weight of sediment
γw = unit weight of water
D50 = median particle size = 0.85 mm (0.003 ft) from log BH000112. Assumed F constant since D50 ~1mm.

Table C-9 Estimation of Abutment Scour Associated with Sheet Pile

Calculations				Notes
	Sheet Pile Obstruction Width	a	40	
	Flow Depth	y1	7	HEC-RAS analysis. Station 502+50
		a/y1	**5.7**	
Liu equation				
				Equation is for Live Bed Scour at vertical wall abutments.
	ys/y1 = 2.15*(a/y1)^0.40*Fr1^0.33			Reportedly for sand bed rivers
		Fr1	0.2	HEC-RAS analysis. Station 502+50
		ys/y1	2.54	
		ys	**17.8**	
Laursen	ys/y1=1.5*(a/y1)^0.48			Equation is for Live Bed Scour at vertical wall abutments.
		ys/y1	3.46	
		ys	**24.2**	THIS ESTIMATE INCLUDES CONTRACTION SCOUR
Froelich	ys/y1=2.27*K1*K2*(a'/y1)^0.43*Fr1^0.61+1.0			"+1.0" is equation FOS
		K1	1	Abutment shape (K1 = 1 for vertical)
		K2	1	Abutment embankment angle (K2 = 1 for vertical)
	a' = constricted flow area/y1	a'	28.6	Approach flow area~200 ft2 at 503+50
		ys/y1	2.56	
		ys	**17.9**	ESTIMATE INCLUDING FOS
		ys/y1	1.56	
		ys	**10.9**	ESTIMATE WITHOUT FOS FROM ORIGINAL EQUATION

Table C-10.1 HEC-RAS Velocity Estimates with Elm St. Bridge in Place[1]

HEC-RAS Station	Design Station	Velocity (fps) Based on Storm Return Period .5-yr	0.75-yr	1-yr	1.5-yr	2-yr	5-yr	10-yr	50-yr	100-yr
52023	49927		3.02	3.07	3.13	3.34	4.37	4.76	5.28	4.97
52000	49950	4.47	4.68	4.74	4.83	5.09	6.57	6.94	4.39	2.93
51948	50002	4.4	4.61	4.67	4.76	5.02	5.82	6.19	4.76	3.03
51900	50050	3.35	3.55	3.6	3.69	3.95	4.86	5.37	6.09	5.93
51850	50100	3.12	3.31	3.37	3.46	3.71	4.58	5.07	5.72	5.65
51800	50150	3.87	4.08	4.14	4.23	4.49	5.39	5.91	6.02	5.79
51750	50200	4.02	4.21	4.26	4.35	4.59	5.41	5.86	5.79	5.57
51700	50250	3.42	3.6	3.65	3.73	3.96	4.65	4.7	4.22	4.11
51650	50300	2.8	2.95	3	3.06	3.26	3.9	4.04	3.71	3.63
51600	50350	4.9	4.95	4.96	4.98	5.03	5.16	5.08	4.12	3.89
51550	50400	3.78	3.91	3.95	4	4.15	4.7	4.96	5.06	5.06
51500	50450	3.38	3.52	3.55	3.61	3.78	4.34	4.66	4.2	3.93
51450	50500	3.21	3.37	3.42	3.49	3.68	4.35	4.72	5.23	5.28
51400	50550	3.62	3.78	3.83	3.9	4.11	4.82	5.2	5.75	4.97
51350	50600	3.52	3.68	3.72	3.79	3.98	4.58	4.91	5.16	4.45
51300	50650	3.1	3.25	3.3	3.36	3.54	4.15	4.41	4.61	4.06
51250	50700	3.43	3.59	3.64	3.71	3.92	4.62	4.91	4.87	4.39
51200	50750	3.26	3.4	3.45	3.51	3.7	4.27	4.54	4.76	4.27
51150	50800	3.04	3.2	3.25	3.32	3.53	4.22	4.58	4.78	4.37
51100	50850	3.07	3.22	3.27	3.33	3.53	4.18	4.52	4.69	4.25
51050	50900	2.86	3.03	3.07	3.15	3.35	4.05	4.38	4.64	4.27
51000	50950	3.38	3.54	3.58	3.65	3.86	4.53	4.79	4.77	4.42
50950	51000	3.61	3.79	3.84	3.91	4.12	4.74	5.02	4.8	4.38
50900	51050	4.17	4.35	4.4	4.48	4.7	5.42	5.73	5.6	5.21
50850	51100	3.58	3.74	3.79	3.86	4.07	4.64	4.74	4.54	4.3
50800	51150	3.43	3.6	3.65	3.72	3.93	4.63	5	5.07	4.84
50750	51200	3.49	3.67	3.72	3.8	4.02	4.79	5.24	5.29	4.9
50700	51250	3.44	3.63	3.68	3.76	3.99	4.73	5.16	5.53	5.39
50650	51300	3.32	3.53	3.59	3.68	3.94	4.74	5.19	5.73	5.53
50600	51350	3.29	3.45	3.49	3.56	3.77	4.42	4.8	5.02	4.74
50550	51400	3.58	3.77	3.82	3.91	4.14	4.88	5.28	5.78	5.54
50500	51450	3.55	3.75	3.8	3.89	4.13	4.94	5.39	6.14	6.16
50450	51500	3.85	4.04	4.1	4.18	4.42	5.21	5.65	6.31	6.44
50400	51550	3.42	3.63	3.69	3.78	4.04	4.91	5.42	6.21	6.26
50350	51600	3.63	3.81	3.86	3.94	4.18	4.95	5.4	6.07	6.07
50300	51650	3.94	4.17	4.23	4.33	4.62	5.58	6.13	7.14	7.33
50250	51700	4.06	4.33	4.41	4.52	4.86	6	6.63	7.71	7.58
50200	51750	3.79	4.02	4.08	4.18	4.48	5.46	6.02	7.03	7.4
50150	51800	3.63	3.85	3.91	4	4.28	5.2	5.72	6.72	6.94
50100	51850	3.25	3.43	3.48	3.56	3.78	4.51	4.92	5.67	5.87
50050	51900	4.23	4.44	4.49	4.58	4.82	5.57	5.98	6.71	6.98
50000	51950	5.05	5.25	5.31	5.39	5.64	6.4	6.8	7.47	7.7
49950	52000	4.7	4.94	5	5.1	5.38	6.27	6.75	7.61	7.91
49900	52050	3.85	4.07	4.13	4.21	4.47	5.29	5.74	6.58	6.88
49850	52100	4.42	4.65	4.71	4.8	5.06	5.87	6.32	7.16	7.46
49800	52150	5.69	5.97	6.05	6.17	6.51	7.59	8.22	9.51	10.03
49798	52152	9.04	9.06	9.06	9.06	9.08	9.15	9.38	10.17	10.55

Note:

1. Results are reported for HEC-RAS version 2.2.

Table C-10.2 HEC-RAS Velocity Estimates without Elm St. Bridge[1]

HEC-RAS Station	Design Station	Velocity (fps) Based on Storm Return Period .5-yr	0.75-yr	1-yr	1.5-yr	2-yr	5-yr	10-yr	50-yr	100-yr
52023	49927	2.94	3.09	3.13	3.2	3.39	4.43	4.82	5.47	5.24
52000	49950	4.63	4.82	4.88	4.96	5.2	6.69	7.08	4.84	3.26
51948	50002	4.56	4.75	4.81	4.89	5.13	5.92	6.3	5.34	3.4
51900	50050	3.44	3.63	3.69	3.77	4.02	4.92	5.44	6.55	6.71
51850	50100	3.2	3.39	3.44	3.53	3.77	4.64	5.14	6.08	5.95
51800	50150	4.01	4.19	4.25	4.33	4.58	5.47	6.01	6.63	6.12
51750	50200	4.17	4.34	4.39	4.46	4.69	5.5	5.96	6.09	5.88
51700	50250	3.53	3.7	3.75	3.82	4.04	4.74	4.81	4.43	4.32
51650	50300	2.9	3.03	3.07	3.14	3.32	3.96	4.12	3.89	3.81
51600	50350	5.23	5.22	5.22	5.22	5.21	5.28	5.22	4.35	4.11
51550	50400	3.98	4.07	4.1	4.14	4.27	4.79	5.06	5.27	5.29
51500	50450	3.55	3.65	3.69	3.73	3.88	4.42	4.74	5.17	4.17
51450	50500	3.35	3.49	3.53	3.59	3.77	4.42	4.8	5.41	5.53
51400	50550	3.8	3.93	3.97	4.03	4.22	4.9	5.29	5.96	6.13
51350	50600	3.69	3.82	3.86	3.92	4.09	4.66	4.99	5.38	4.82
51300	50650	3.25	3.37	3.41	3.47	3.63	4.22	4.49	4.74	4.37
51250	50700	3.6	3.73	3.77	3.84	4.02	4.7	5	5.24	4.75
51200	50750	3.43	3.54	3.58	3.63	3.8	4.35	4.63	5.06	4.62
51150	50800	3.18	3.32	3.36	3.43	3.62	4.29	4.66	5.06	4.71
51100	50850	3.22	3.35	3.39	3.44	3.62	4.25	4.6	4.92	4.6
51050	50900	2.99	3.13	3.18	3.24	3.43	4.12	4.46	4.78	4.6
51000	50950	3.56	3.68	3.72	3.78	3.96	4.62	4.9	5	4.78
50950	51000	3.81	3.95	3.99	4.06	4.24	4.84	5.14	5.08	4.74
50900	51050	4.43	4.56	4.6	4.67	4.86	5.53	5.88	5.89	5.62
50850	51100	3.79	3.92	3.96	4.02	4.19	4.75	4.86	4.76	4.61
50800	51150	3.62	3.76	3.8	3.86	4.05	4.72	5.12	5.29	5.19
50750	51200	3.69	3.83	3.88	3.94	4.15	4.88	5.35	5.58	5.29
50700	51250	3.64	3.79	3.83	3.9	4.11	4.83	5.26	5.77	5.74
50650	51300	3.48	3.67	3.72	3.81	4.04	4.83	5.28	5.99	5.94
50600	51350	3.49	3.61	3.65	3.71	3.89	4.51	4.89	5.3	5.08
50550	51400	3.8	3.95	4	4.07	4.27	4.98	5.39	6.02	5.96
50500	51450	3.77	3.92	3.97	4.05	4.26	5.04	5.49	6.39	6.54
50450	51500	4.11	4.26	4.3	4.37	4.57	5.32	5.76	6.58	6.8
50400	51550	3.62	3.79	3.84	3.92	4.16	5.01	5.52	6.49	6.62
50350	51600	3.88	4.02	4.06	4.13	4.32	5.05	5.5	6.32	6.43
50300	51650	4.19	4.38	4.44	4.53	4.78	5.7	6.26	7.41	7.77
50250	51700	4.31	4.54	4.61	4.71	5.02	6.12	6.77	7.95	8.13
50200	51750	4.03	4.22	4.28	4.37	4.63	5.57	6.14	7.28	7.79
50150	51800	3.87	4.05	4.1	4.18	4.43	5.31	5.84	6.95	7.34
50100	51850	3.47	3.62	3.66	3.73	3.92	4.61	5.03	5.86	6.18
50050	51900	4.59	4.74	4.78	4.85	5.04	5.71	6.13	6.97	7.39
50000	51950	5.63	5.72	5.75	5.8	5.95	6.6	6.99	7.81	8.14
49950	52000	5.19	5.34	5.38	5.45	5.65	6.45	6.93	7.94	8.34
49900	52050	4.2	4.36	4.4	4.47	4.68	5.42	5.89	6.84	7.23
49850	52100	4.9	5.04	5.08	5.15	5.34	6.04	6.49	7.46	7.87
49800	52150	5.62	5.77	5.81	5.88	6.09	6.87	7.38	8.48	8.94

Note:
1. Results are reported for HEC-RAS version 2.2.

Table C-10.3 HEC-RAS Velocity Estimates without Elm St. Catch Point[1]

HEC-RAS Station	Design Station	Velocity (fps) Based on Storm Return Period								
		.5-yr	0.75-yr	1-yr	1.5-yr	2-yr	5-yr	10-yr	50-yr	100-yr
52023	49927	3.2	3.38	3.43	3.51	3.76	4.66	5.63	6.57	6.61
52000	49950	5.19	5.45	5.52	5.64	5.98	7.21	8.98	8.9	5.74
51948	50002	5.12	5.38	5.46	5.57	5.92	7.15	7.88	8.86	8.09
51900	50050	3.93	4.19	4.26	4.38	4.73	6.07	6.93	8.5	9.08
51850	50100	3.5	3.73	3.79	3.9	4.2	5.36	6.1	7.42	7.89
51800	50150	4.5	4.74	4.81	4.92	5.25	6.52	7.32	8.51	8.81
51750	50200	4.76	4.99	5.06	5.16	5.47	6.64	7.39	8.31	8.22
51700	50250	3.97	4.19	4.26	4.36	4.65	5.75	6.34	6.22	5.88
51650	50300	3.25	3.43	3.48	3.56	3.8	4.7	5.26	5.36	5.13
51600	50350	7.06	7.07	7.07	7.07	7.09	7.2	7.36	6.56	5.91
51550	50400	4.92	5.05	5.09	5.15	5.33	6.02	6.52	6.92	6.93
51500	50450	4.33	4.48	4.53	4.59	4.79	5.54	6.03	6.74	6.85
51450	50500	3.99	4.18	4.23	4.32	4.57	5.46	6.02	6.92	7.15
51400	50550	4.69	4.87	4.92	5	5.24	6.18	6.79	7.75	7.99
51350	50600	4.56	4.74	4.79	4.87	5.11	5.95	6.48	7.19	7.29
51300	50650	3.99	4.15	4.2	4.27	4.49	5.31	5.83	6.39	6.4
51250	50700	4.5	4.67	4.73	4.8	5.04	5.97	6.58	7.17	7.21
51200	50750	4.31	4.47	4.52	4.59	4.8	5.61	6.1	6.68	6.8
51150	50800	3.92	4.1	4.15	4.23	4.47	5.39	5.97	6.75	6.83
51100	50850	4	4.18	4.23	4.31	4.54	5.39	5.94	6.65	6.72
51050	50900	3.66	3.84	3.9	3.98	4.23	5.15	5.73	6.4	6.44
51000	50950	4.57	4.75	4.81	4.88	5.11	5.99	6.57	6.93	6.84
50950	51000	4.95	5.15	5.21	5.3	5.56	6.49	7.02	7.28	7.13
50900	51050	6.23	6.43	6.49	6.57	6.82	7.73	8.32	8.53	8.22
50850	51100	5.17	5.37	5.43	5.51	5.76	6.6	7.11	6.92	6.62
50800	51150	4.96	5.15	5.2	5.28	5.52	6.4	6.97	7.6	7.41
50750	51200	5.1	5.29	5.35	5.43	5.68	6.63	7.25	8.12	7.95
50700	51250	4.99	5.21	5.28	5.36	5.64	6.6	7.21	8.01	8.06
50650	51300	4.61	4.86	4.93	5.03	5.36	6.53	7.21	8.15	8.44
50600	51350	4.96	5.15	5.21	5.28	5.51	6.28	6.78	7.48	7.62
50550	51400	5.45	5.69	5.76	5.85	6.14	7.1	7.69	8.33	8.56
50500	51450	5.44	5.68	5.75	5.85	6.15	7.15	7.79	8.61	8.9
50450	51500	6.72	6.89	6.95	7	7.23	8	8.54	9.14	9.47
50400	51550	5.39	5.63	5.71	5.8	6.11	7.16	7.85	8.77	9.13
50350	51600	6.51	6.72	6.78	6.84	7.07	7.73	8.19	8.76	9.02
50300	51650	6.89	7.26	7.37	7.5	7.93	9.14	9.77	10.39	10.77
50250	51700	7	7.45	7.59	7.77	8.31	10.22	11.17	11.76	12.19
50200	51750	7.1	7.46	7.56	7.71	8.14	9.59	10.21	10.5	10.84
50150	51800	7.33	7.6	7.68	7.8	8.14	9.36	9.83	9.94	10.24
50100	51850	6.93	7.11	7.16	7.24	7.47	8.31	8.56	8.43	8.63
49188	52762	7.25	7.57	7.66	7.8	8.19	9.79	9.5	9.84	10.39
49133	52817	9.26	9.66	9.78	9.95	10.46	11.84	10.02	10.08	10.6

Note:
1. Results are reported for HEC-RAS version 2.2.

Table C-11.1 HEC-RAS Depth Estimates with Elm St. Bridge in Place[1]

HEC-RAS Station	Design Station	Depth (ft) Based on Storm Return Period								
		.5-yr	0.75-yr	1-yr	1.5-yr	2-yr	5-yr	10-yr	50-yr	100-yr
52023	49927	8.2	8.62	8.75	8.94	9.52	11.19	12.89	17.04	18.97
52000	49950	6.78	7.19	7.31	7.5	8.06	9.57	11.24	15.99	17.95
51948	50002	6.38	6.78	6.9	7.08	7.63	9.9	11.58	16.1	18.18
51900	50050	8.36	8.77	8.89	9.08	9.63	11.91	13.58	17.7	19.66
51850	50100	7.85	8.25	8.37	8.56	9.12	11.4	13.08	17.22	19.16
51800	50150	7.37	7.77	7.89	8.07	8.62	10.87	12.53	16.81	18.78
51750	50200	6.89	7.3	7.41	7.6	8.15	10.41	12.09	16.39	18.37
51700	50250	6.72	7.12	7.24	7.43	7.99	10.28	12.02	16.35	18.3
51650	50300	6.43	6.83	6.96	7.14	7.71	10.01	11.74	16.05	18
51600	50350	6.13	6.54	6.67	6.86	7.43	9.8	11.57	16.01	17.98
51550	50400	6.21	6.63	6.75	6.94	7.51	9.85	11.59	15.88	17.83
51500	50450	6.1	6.51	6.63	6.82	7.39	9.74	11.46	15.83	17.8
51450	50500	7.68	8.09	8.21	8.4	8.97	11.31	13.02	17.21	19.14
51400	50550	6.87	7.28	7.4	7.59	8.15	10.48	12.19	16.37	18.46
51350	50600	6.99	7.4	7.52	7.7	8.27	10.61	12.33	16.56	18.63
51300	50650	7.22	7.63	7.75	7.94	8.51	10.86	12.59	16.83	18.87
51250	50700	6.96	7.37	7.49	7.68	8.24	10.57	12.3	16.61	18.64
51200	50750	7.83	8.24	8.36	8.55	9.11	11.46	13.2	17.47	19.5
51150	50800	7.83	8.23	8.36	8.54	9.11	11.45	13.17	17.45	19.48
51100	50850	7.88	8.29	8.41	8.6	9.17	11.51	13.23	17.52	19.55
51050	50900	9.52	9.93	10.05	10.24	10.81	13.15	14.88	19.16	21.19
51000	50950	7.74	8.14	8.27	8.45	9.02	11.35	13.09	17.43	19.46
50950	51000	7.67	8.07	8.19	8.38	8.94	11.29	13.03	17.41	19.44
50900	51050	7.35	7.75	7.87	8.05	8.61	10.93	12.66	17.06	19.11
50850	51100	8.35	8.76	8.88	9.06	9.62	11.97	13.74	18.13	20.15
50800	51150	7.34	7.75	7.87	8.05	8.61	10.95	12.66	17.02	19.05
50750	51200	7.02	7.42	7.54	7.72	8.28	10.61	12.3	16.67	18.75
50700	51250	8.9	9.3	9.42	9.61	10.17	12.49	14.19	18.51	20.54
50650	51300	8.33	8.73	8.85	9.04	9.59	11.92	13.62	17.91	19.96
50600	51350	8.52	8.92	9.04	9.23	9.79	12.13	13.84	18.17	20.23
50550	51400	9.06	9.46	9.58	9.76	10.32	12.64	14.34	18.62	20.68
50500	51450	8.85	9.24	9.36	9.54	10.1	12.41	14.1	18.32	20.33
50450	51500	8.5	8.9	9.02	9.2	9.75	12.06	13.75	17.98	19.97
50400	51550	9	9.39	9.51	9.69	10.25	12.55	14.24	18.46	20.46
50350	51600	8.19	8.59	8.71	8.89	9.45	11.77	13.46	17.7	19.72
50300	51650	9.67	10.06	10.17	10.35	10.9	13.17	14.84	18.97	20.94
50250	51700	9.85	10.23	10.34	10.52	11.05	13.28	14.93	19.05	21.14
50200	51750	8.85	9.23	9.35	9.53	10.07	12.32	13.98	18.12	20.09
50150	51800	8.84	9.23	9.34	9.52	10.06	12.33	14	18.14	20.15
50100	51850	8.85	9.24	9.36	9.54	10.09	12.38	14.07	18.27	20.28
50050	51900	7.7	8.08	8.2	8.37	8.91	11.18	12.86	17.04	19.02
50000	51950	7.03	7.4	7.52	7.69	8.22	10.48	12.16	16.36	18.36
49950	52000	7.52	7.89	8	8.18	8.71	10.96	12.63	16.78	18.76
49900	52050	8.07	8.44	8.56	8.73	9.27	11.55	13.23	17.41	19.39
49850	52100	7.46	7.83	7.94	8.11	8.64	10.91	12.59	16.75	18.73
49800	52150	6.19	6.54	6.64	6.81	7.31	9.47	11.07	15.03	16.9
49798	52152	4.21	4.61	4.73	4.92	5.49	7.89	9.59	13.68	15.59

Note:

1. Results are reported for HEC-RAS version 2.2.

Table C-11.2 HEC-RAS Depth Estimates without Elm St. Bridge[1]

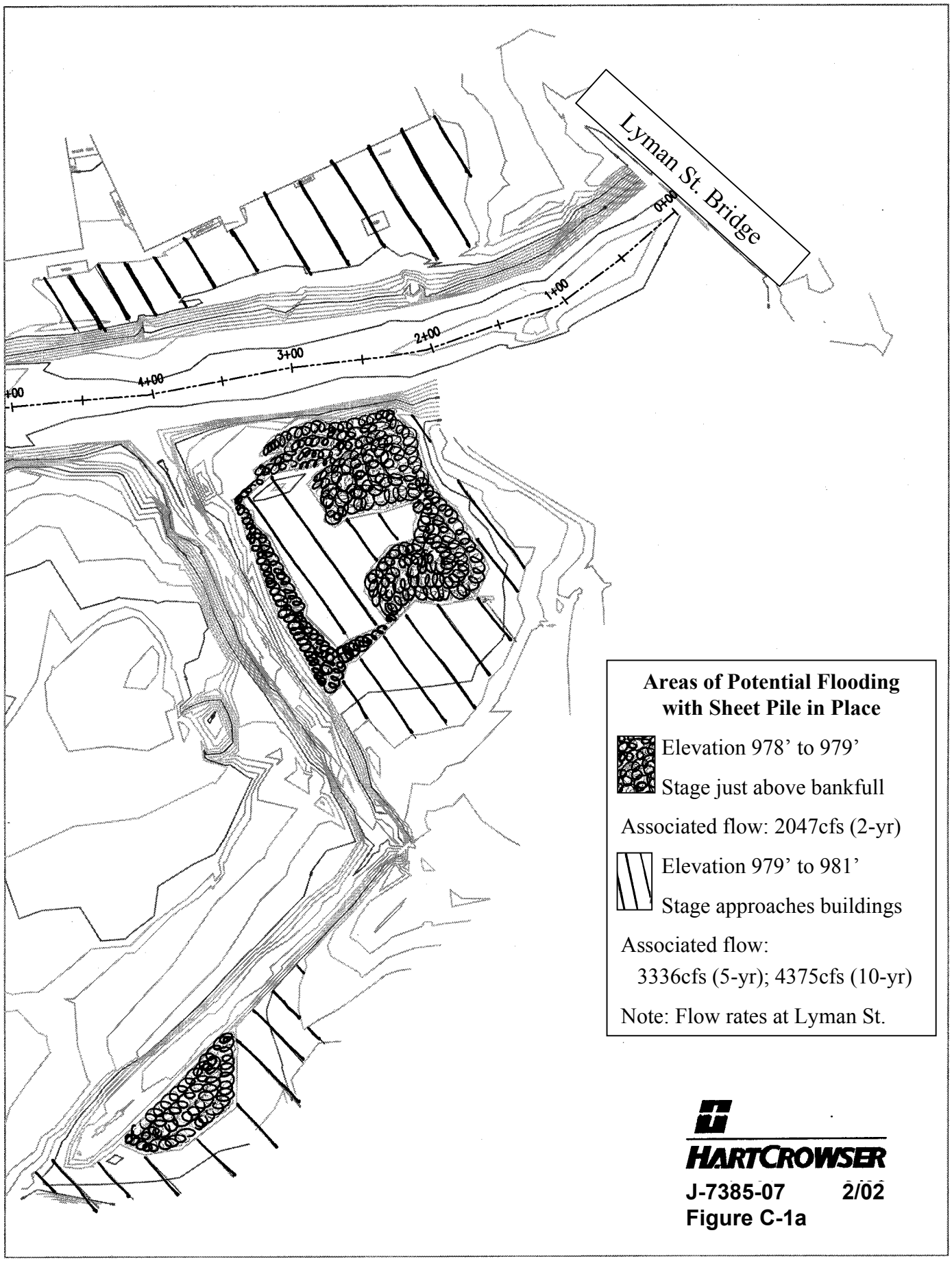
HEC-RAS Station	Design Station	Depth (ft) Based on Storm Return Period .5-yr	0.75-yr	1-yr	1.5-yr	2-yr	5-yr	10-yr	50-yr	100-yr
52023	49927	8.04	8.49	8.61	8.81	9.41	11.09	12.76	16.72	18.55
52000	49950	6.61	7.04	7.17	7.36	7.94	9.45	11.09	15.66	17.56
51948	50002	6.21	6.63	6.75	6.94	7.51	9.78	11.43	15.71	17.77
51900	50050	8.2	8.63	8.75	8.94	9.52	11.79	13.44	17.28	19.07
51850	50100	7.68	8.11	8.23	8.43	9	11.28	12.94	16.82	18.66
51800	50150	7.2	7.62	7.74	7.93	8.49	10.75	12.38	16.34	18.28
51750	50200	6.71	7.14	7.26	7.45	8.02	10.29	11.94	15.98	17.87
51700	50250	6.54	6.97	7.09	7.28	7.86	10.15	11.87	15.97	17.82
51650	50300	6.25	6.68	6.81	7	7.58	9.89	11.59	15.67	17.52
51600	50350	5.9	6.35	6.48	6.68	7.28	9.66	11.41	15.62	17.49
51550	50400	6	6.44	6.57	6.77	7.36	9.72	11.43	15.48	17.33
51500	50450	5.88	6.32	6.45	6.65	7.24	9.6	11.31	15.31	17.31
51450	50500	7.46	7.9	8.03	8.23	8.82	11.17	12.87	16.84	18.63
51400	50550	6.65	7.09	7.21	7.41	8	10.34	12.03	15.98	17.77
51350	50600	6.76	7.2	7.33	7.52	8.12	10.47	12.17	16.18	18.06
51300	50650	6.99	7.43	7.56	7.76	8.35	10.72	12.43	16.46	18.31
51250	50700	6.73	7.17	7.3	7.49	8.08	10.43	12.14	16.18	18.07
51200	50750	7.59	8.03	8.16	8.36	8.95	11.32	13.03	17.05	18.93
51150	50800	7.59	8.03	8.16	8.36	8.95	11.31	13.01	17.04	18.91
51100	50850	7.64	8.08	8.21	8.41	9	11.37	13.07	17.11	18.98
51050	50900	9.28	9.72	9.85	10.05	10.64	13.01	14.71	18.76	20.61
51000	50950	7.49	7.93	8.06	8.26	8.85	11.21	12.92	17.02	18.88
50950	51000	7.41	7.85	7.98	8.18	8.77	11.14	12.85	16.99	18.87
50900	51050	7.07	7.51	7.64	7.84	8.43	10.77	12.48	16.62	18.51
50850	51100	8.08	8.52	8.65	8.85	9.44	11.81	13.56	17.71	19.57
50800	51150	7.06	7.51	7.64	7.84	8.43	10.79	12.48	16.59	18.46
50750	51200	6.73	7.18	7.31	7.5	8.1	10.45	12.11	16.22	18.14
50700	51250	8.61	9.06	9.19	9.38	9.98	12.34	14.01	18.06	19.93
50650	51300	8.05	8.49	8.62	8.81	9.41	11.76	13.44	17.46	19.34
50600	51350	8.22	8.67	8.8	9	9.6	11.97	13.66	17.72	19.61
50550	51400	8.76	9.21	9.34	9.53	10.12	12.48	14.15	18.17	20.04
50500	51450	8.54	8.99	9.11	9.31	9.9	12.25	13.91	17.86	19.68
50450	51500	8.19	8.63	8.76	8.96	9.55	11.89	13.56	17.52	19.33
50400	51550	8.68	9.13	9.26	9.45	10.04	12.38	14.05	17.99	19.82
50350	51600	7.87	8.31	8.44	8.64	9.24	11.6	13.27	17.23	19.07
50300	51650	9.34	9.77	9.9	10.1	10.68	12.99	14.63	18.5	20.25
50250	51700	9.51	9.94	10.07	10.26	10.83	13.1	14.71	18.58	20.41
50200	51750	8.51	8.94	9.07	9.26	9.84	12.14	13.77	17.65	19.4
50150	51800	8.5	8.93	9.06	9.25	9.84	12.15	13.79	17.68	19.45
50100	51850	8.51	8.95	9.07	9.27	9.86	12.2	13.86	17.81	19.6
50050	51900	7.33	7.76	7.89	8.08	8.66	10.98	12.63	16.55	18.31
50000	51950	6.59	7.03	7.16	7.35	7.94	10.26	11.91	15.84	17.62
49950	52000	7.08	7.52	7.64	7.84	8.43	10.74	12.38	16.27	18.02
49900	52050	7.64	8.08	8.21	8.4	9	11.34	13	16.91	18.67
49850	52100	6.99	7.43	7.56	7.75	8.35	10.69	12.34	16.23	17.98

Note:
1. Results are reported for HEC-RAS version 2.2.

Table C-11.3 HEC-RAS Depth Estimates without Elm St. Catch Point[1]

HEC-RAS Station	Design Station	Depth (ft) Based on Storm Return Period .5-yr	0.75-yr	1-yr	1.5-yr	2-yr	5-yr	10-yr	50-yr	100-yr
52023	49927	7.58	7.96	8.07	8.24	8.75	10.67	11.34	14.8	16.7
52000	49950	6.08	6.43	6.54	6.7	7.17	8.93	9.28	13.05	15.72
51948	50002	5.67	6.02	6.12	6.27	6.73	8.47	9.67	12.89	14.79
51900	50050	7.68	8.03	8.13	8.29	8.75	10.51	11.71	14.86	16.36
51850	50100	7.17	7.53	7.63	7.79	8.26	10.05	11.27	14.49	16.01
51800	50150	6.64	6.98	7.08	7.24	7.69	9.41	10.59	13.8	15.38
51750	50200	6.13	6.47	6.57	6.72	7.18	8.9	10.09	13.37	15.05
51700	50250	5.96	6.31	6.41	6.57	7.03	8.78	10.01	13.51	15.21
51650	50300	5.68	6.03	6.13	6.29	6.76	8.55	9.79	13.25	14.93
51600	50350	4.96	5.33	5.44	5.61	6.1	8	9.31	13.02	14.81
51550	50400	5.18	5.55	5.65	5.82	6.3	8.16	9.44	12.95	14.6
51500	50450	5.05	5.41	5.52	5.68	6.17	8.02	9.3	12.74	14.36
51450	50500	6.63	6.99	7.1	7.26	7.74	9.59	10.86	14.25	15.85
51400	50550	5.75	6.1	6.21	6.37	6.85	8.66	9.91	13.28	14.87
51350	50600	5.84	6.2	6.3	6.47	6.95	8.78	10.04	13.47	15.1
51300	50650	6.07	6.44	6.54	6.71	7.19	9.04	10.32	13.79	15.44
51250	50700	5.76	6.12	6.22	6.39	6.86	8.68	9.92	13.4	15.05
51200	50750	6.6	6.96	7.07	7.23	7.72	9.55	10.83	14.31	15.94
51150	50800	6.6	6.96	7.07	7.23	7.71	9.55	10.81	14.26	15.91
51100	50850	6.63	6.99	7.09	7.26	7.74	9.58	10.85	14.31	15.97
51050	50900	8.27	8.63	8.73	8.9	9.38	11.22	12.49	15.98	17.64
51000	50950	6.39	6.75	6.85	7.02	7.49	9.32	10.57	14.14	15.84
50950	51000	6.26	6.61	6.71	6.87	7.34	9.14	10.41	14.02	15.75
50900	51050	5.72	6.06	6.16	6.32	6.78	8.56	9.8	13.44	15.25
50850	51100	6.75	7.1	7.2	7.36	7.82	9.64	10.91	14.66	16.45
50800	51150	5.71	6.06	6.16	6.33	6.79	8.62	9.88	13.4	15.19
50750	51200	5.33	5.67	5.78	5.94	6.41	8.21	9.46	12.91	14.71
50700	51250	7.18	7.52	7.62	7.79	8.25	10.07	11.32	14.8	16.55
50650	51300	6.61	6.95	7.05	7.21	7.67	9.47	10.72	14.19	15.86
50600	51350	6.7	7.05	7.15	7.32	7.79	9.65	10.93	14.45	16.15
50550	51400	7.15	7.49	7.58	7.74	8.2	10	11.25	14.79	16.47
50500	51450	6.88	7.22	7.31	7.47	7.93	9.73	10.96	14.46	16.11
50450	51500	6.24	6.58	6.68	6.85	7.31	9.15	10.4	13.97	15.6
50400	51550	6.81	7.14	7.24	7.4	7.86	9.68	10.93	14.46	16.1
50350	51600	5.73	6.07	6.17	6.33	6.8	8.71	10.01	13.65	15.32
50300	51650	7.06	7.36	7.44	7.59	8	9.73	10.97	14.6	16.21
50250	51700	7.15	7.41	7.48	7.61	7.99	9.45	10.56	14.23	15.82
50200	51750	5.99	6.27	6.36	6.49	6.88	8.43	9.64	13.44	15.07
50150	51800	5.79	6.09	6.18	6.32	6.73	8.33	9.6	13.5	15.15
50100	51850	5.7	6.02	6.11	6.26	6.71	8.4	9.74	13.74	15.43
49188	52762	6.01	6.34	6.44	6.59	7.03	8.67	10.79	15.41	17.07
49133	52817	5.15	5.43	5.51	5.63	6.01	7.64	10.42	15.19	16.86

Note:
1. Results are reported for HEC-RAS version 2.2.



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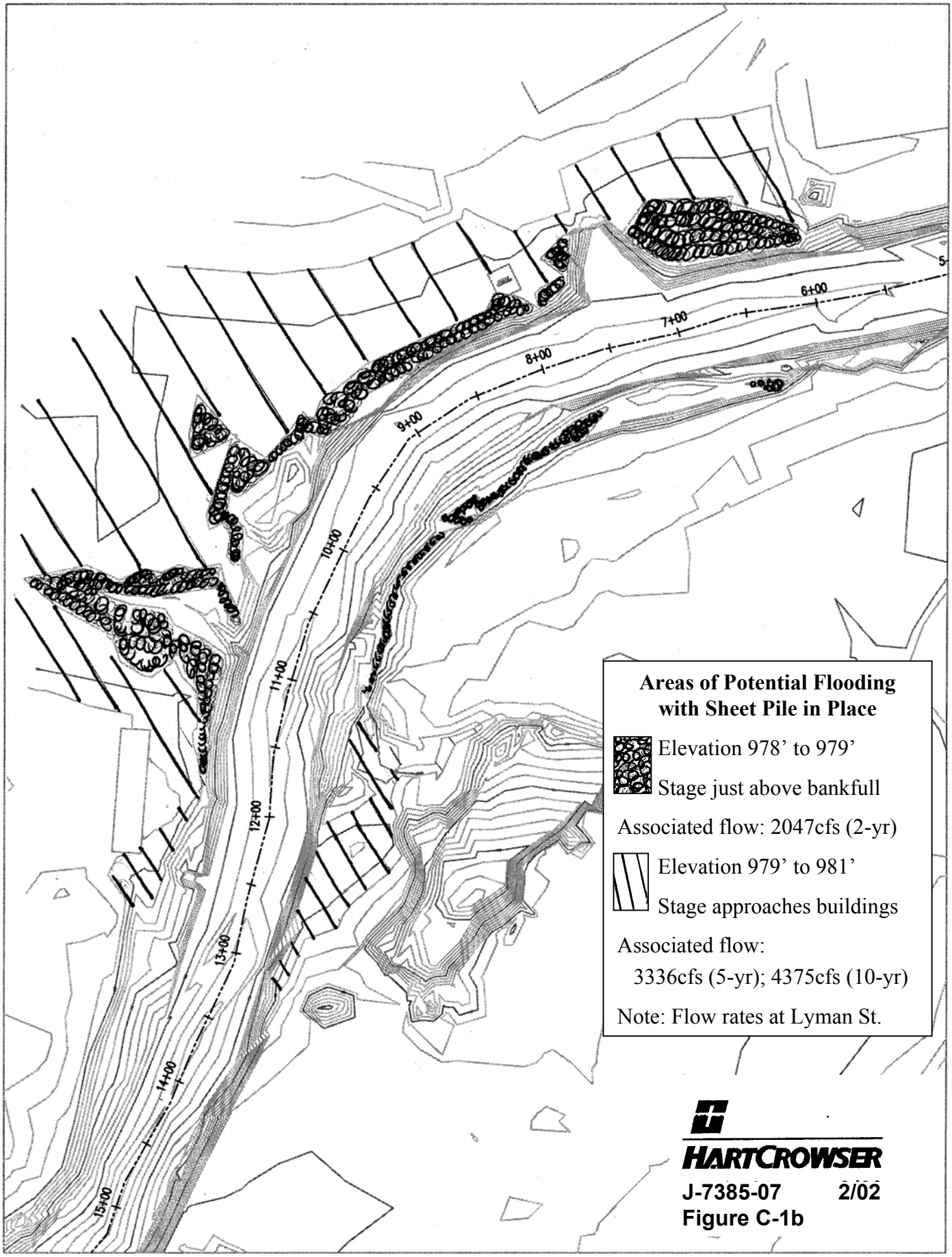
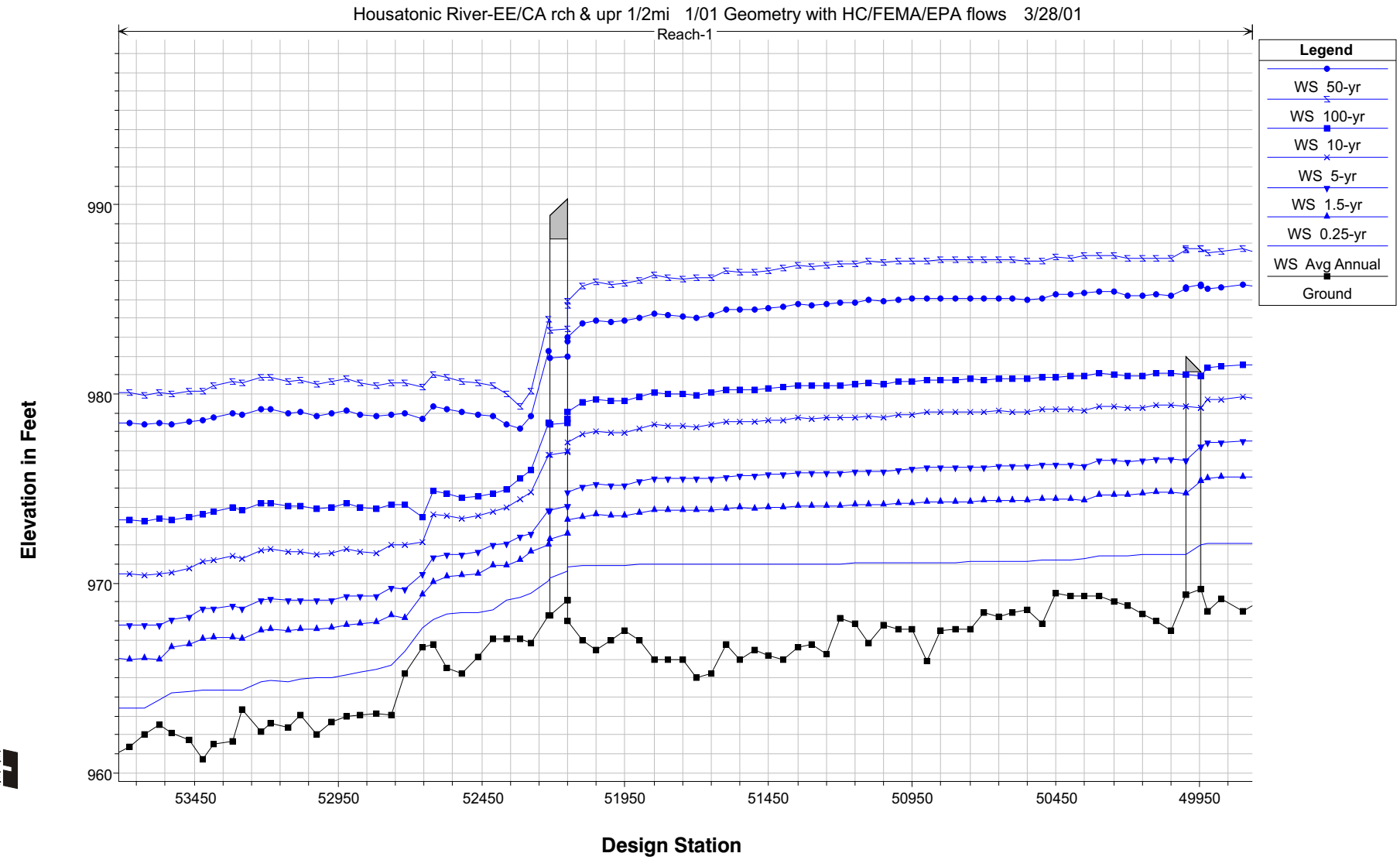
J-7385-07 2/02

Figure C-1a


5
6+00
7+00
8+00
9+00
10+00
11+00
12+00
13+00
14+00
15+00
Areas of Potential Flooding with Sheet Pile in Place
Elevation 978' to 979'
Stage just above bankfull
Associated flow: 2047cfs (2-yr)
Elevation 979' to 981'
Stage approaches buildings
Associated flow:
3336cfs (5-yr); 4375cfs (10-yr)
Note: Flow rates at Lyman St.
HARTCROWSER
J-7385-07 2/02
Figure C-1b

Elm Street Bridge in Place

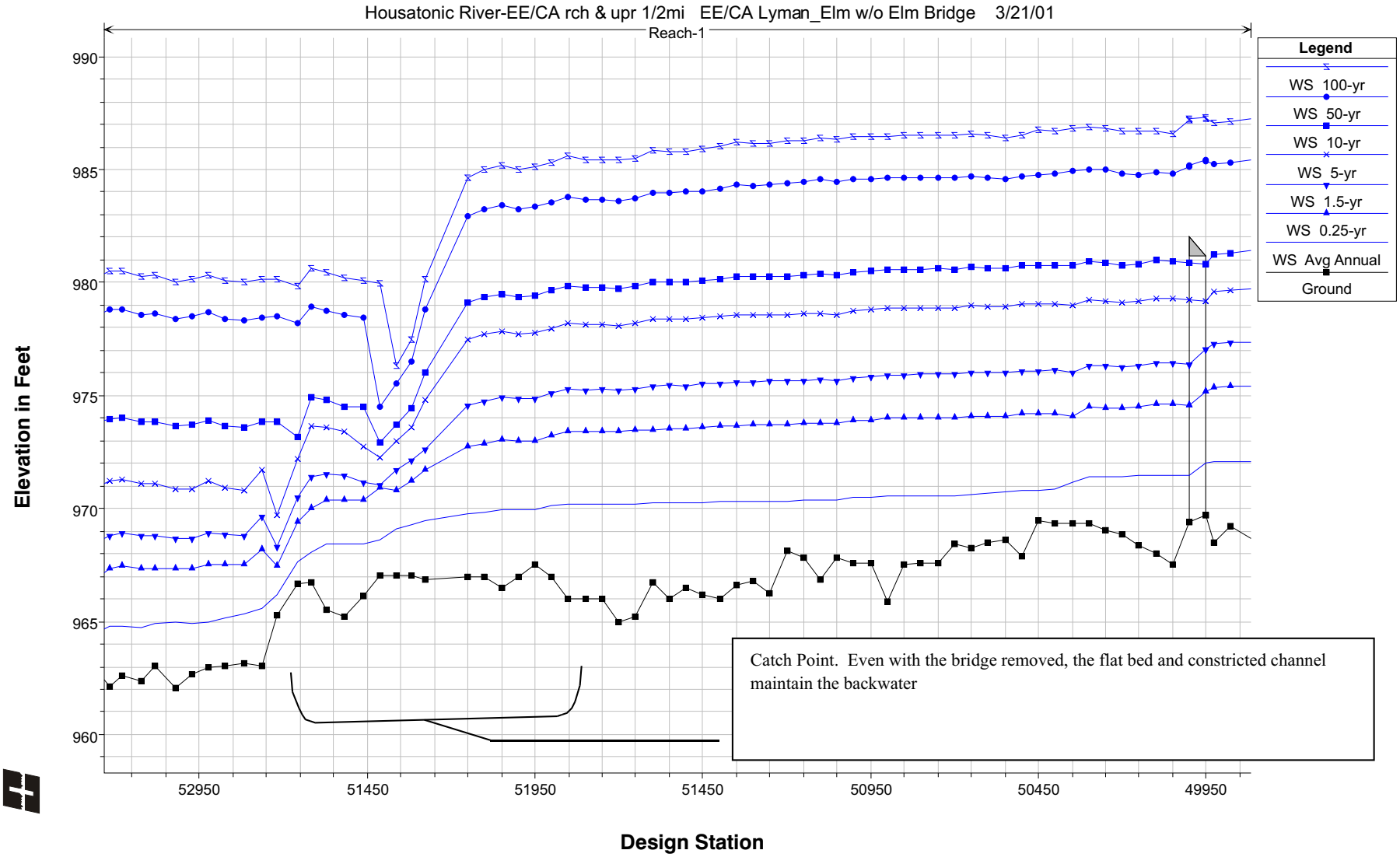


Note: Assumes that the current bridge geometry will remain. The profile shows water surface and river bed elevations under this condition.

HARTCROWSER
7385-10
4/02
Figure C-2

738510b.cdr HEL 4/1/02

Elm Street Bridge Removed

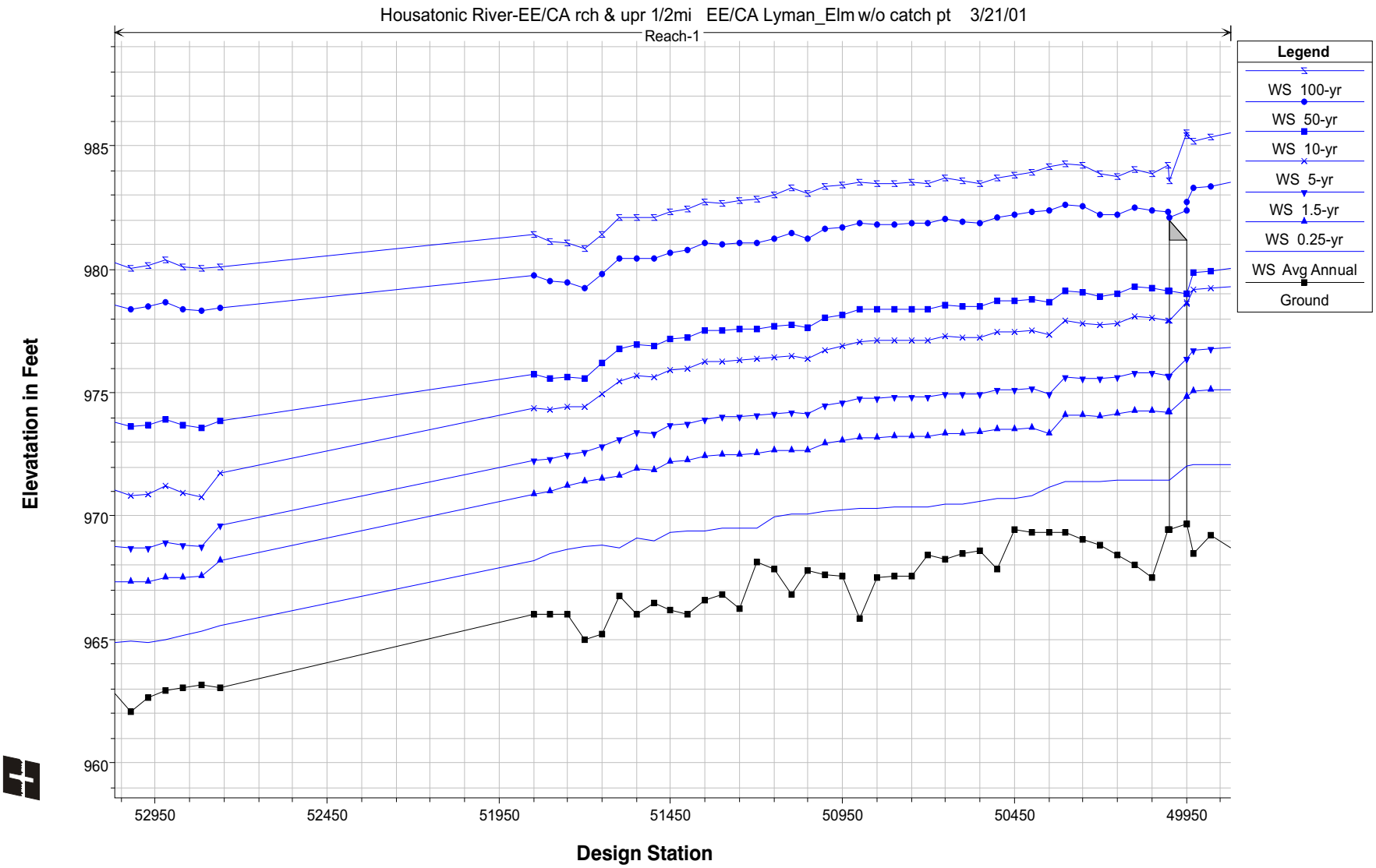


Note: Assumes that the bridge is removed, but current river cross-sections remain unchanged. The profile shows water surface and river bed elevations under this condition. Note that the catch point (the low gradient portion of the bed from HEC-RAS station 49300 to 50100) appears to maintain the backwater condition that existed with the bridge in place.

HARTCROWSER
7385-10 4/02
Figure C-3

738510a.cdr HEL 4/1/02

Elm Street Catch Point Removed

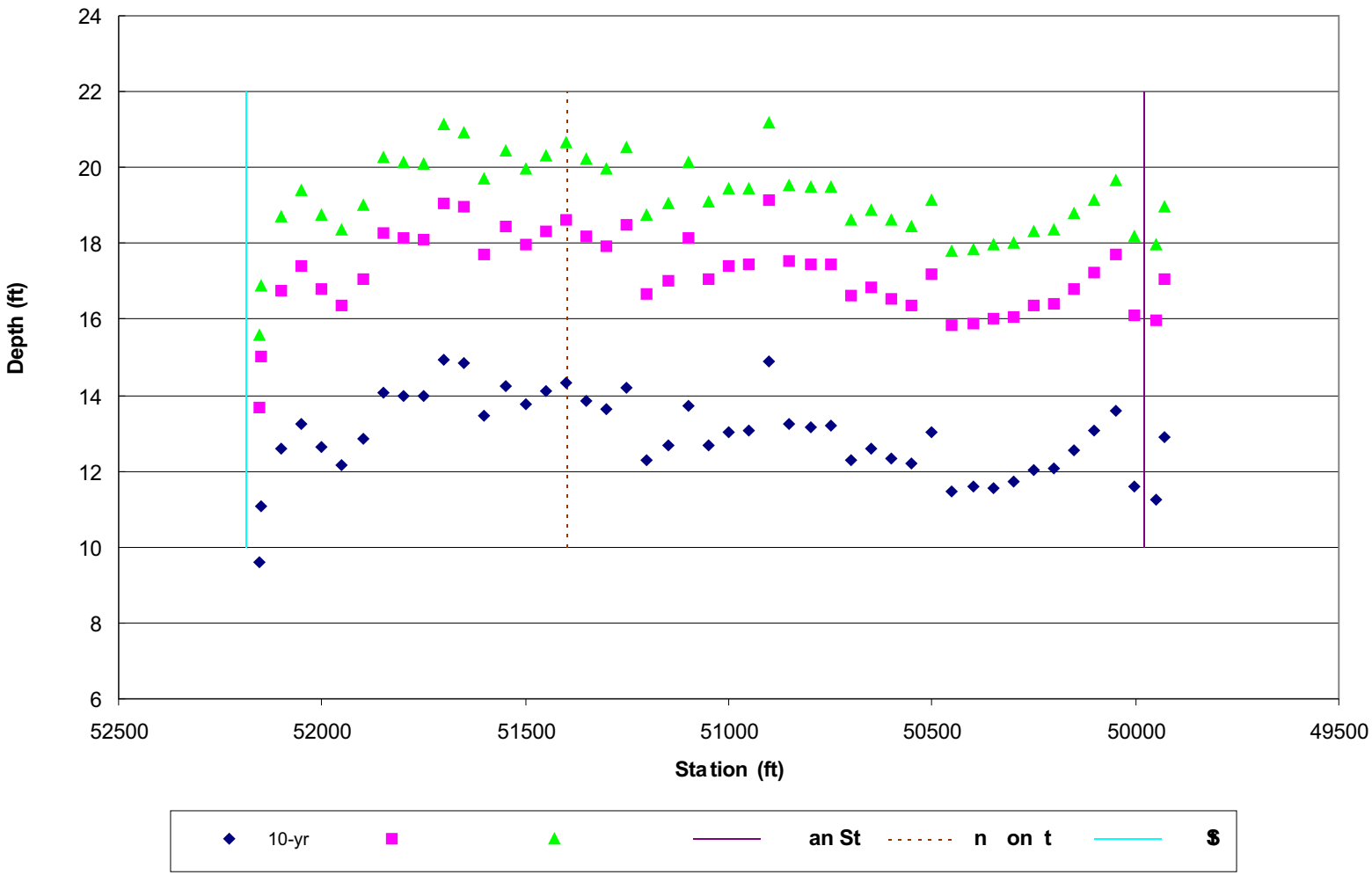


Note: Elm St. catch point removed. Assumes that the constriction near Elm St. is removed by natural or mechanical means. This third scenario was included to assess the control of the channel configuration. The profile shows water surface and river bed elevations under this condition. Note that without the catch point, the backwater is not established.

HARTCROWSER
7385-10 4/02
Figure C-4

738510c.cdr HEL 4/1/02

HEC-RAS Depth Analysis with Elm St. Bridge in Place



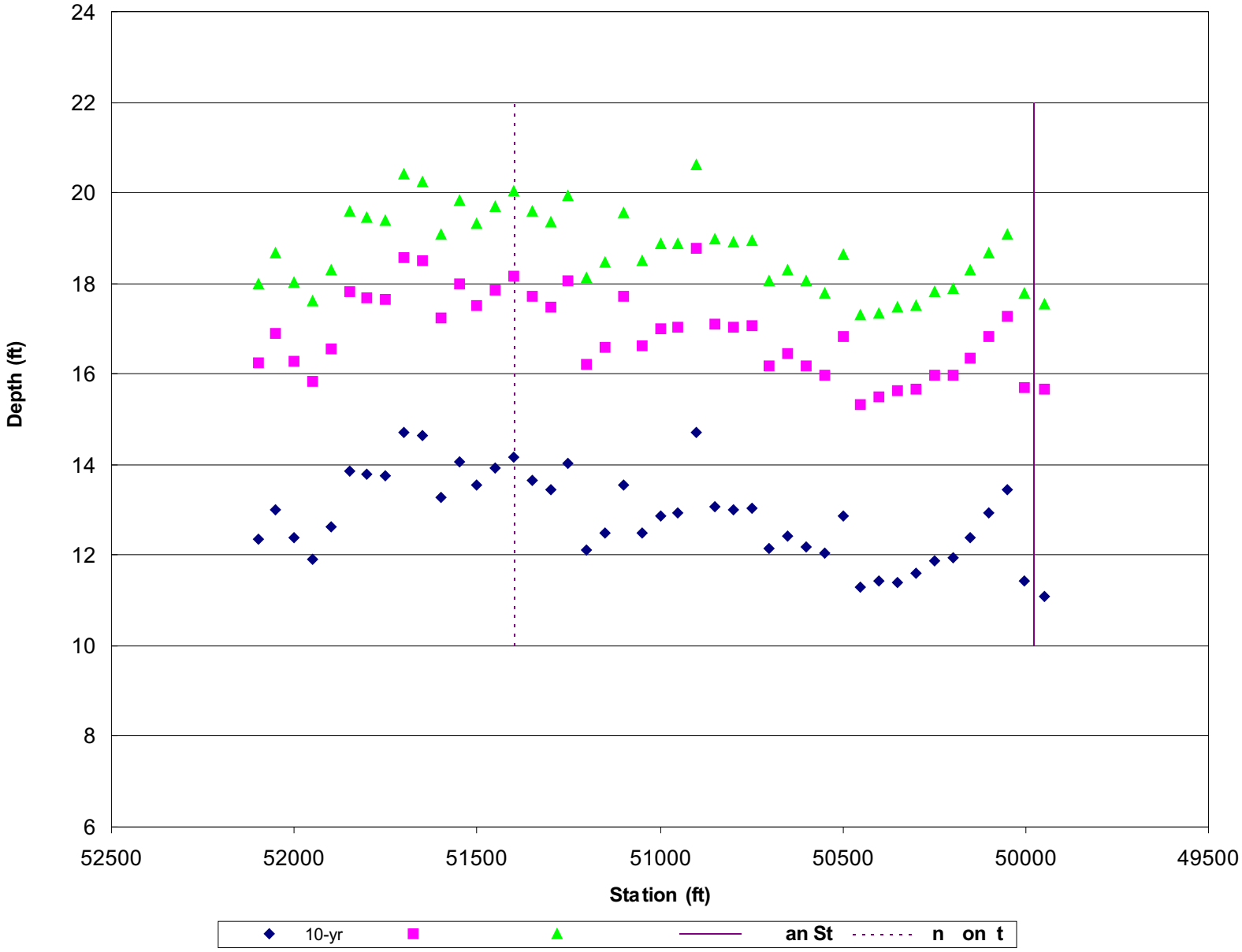
HARTCROWSER

J-7385-07 2/02

Figure C-5

RAR 1/25/02 738510 Fig C-5.cdr

HEC-RAS Depth Analysis with Elm St. Bridge Removed



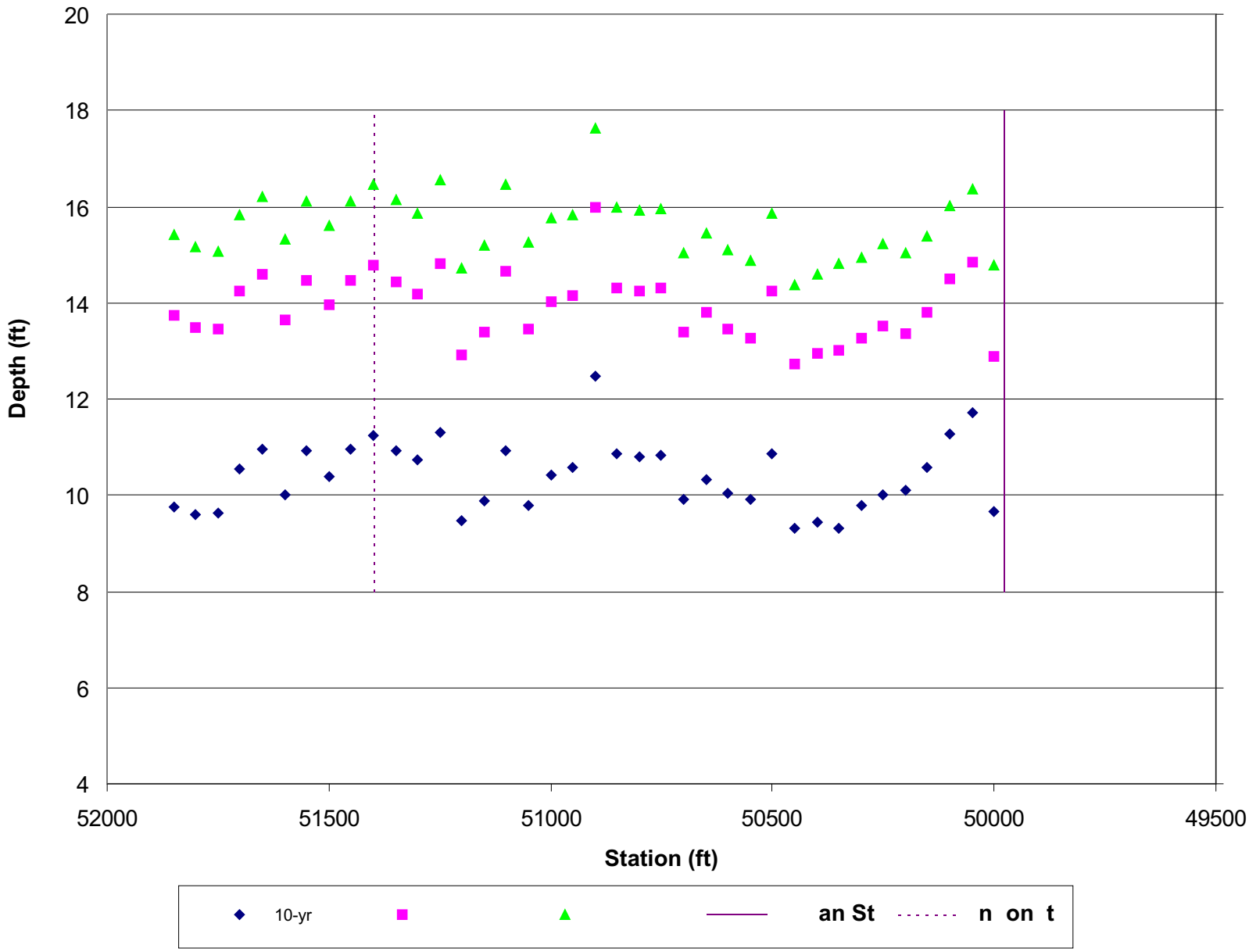
HARTCROWSER

J-7385-07 2/02

Figure C-6

RAR 1/25/02 738510 Fig C-6.cdr

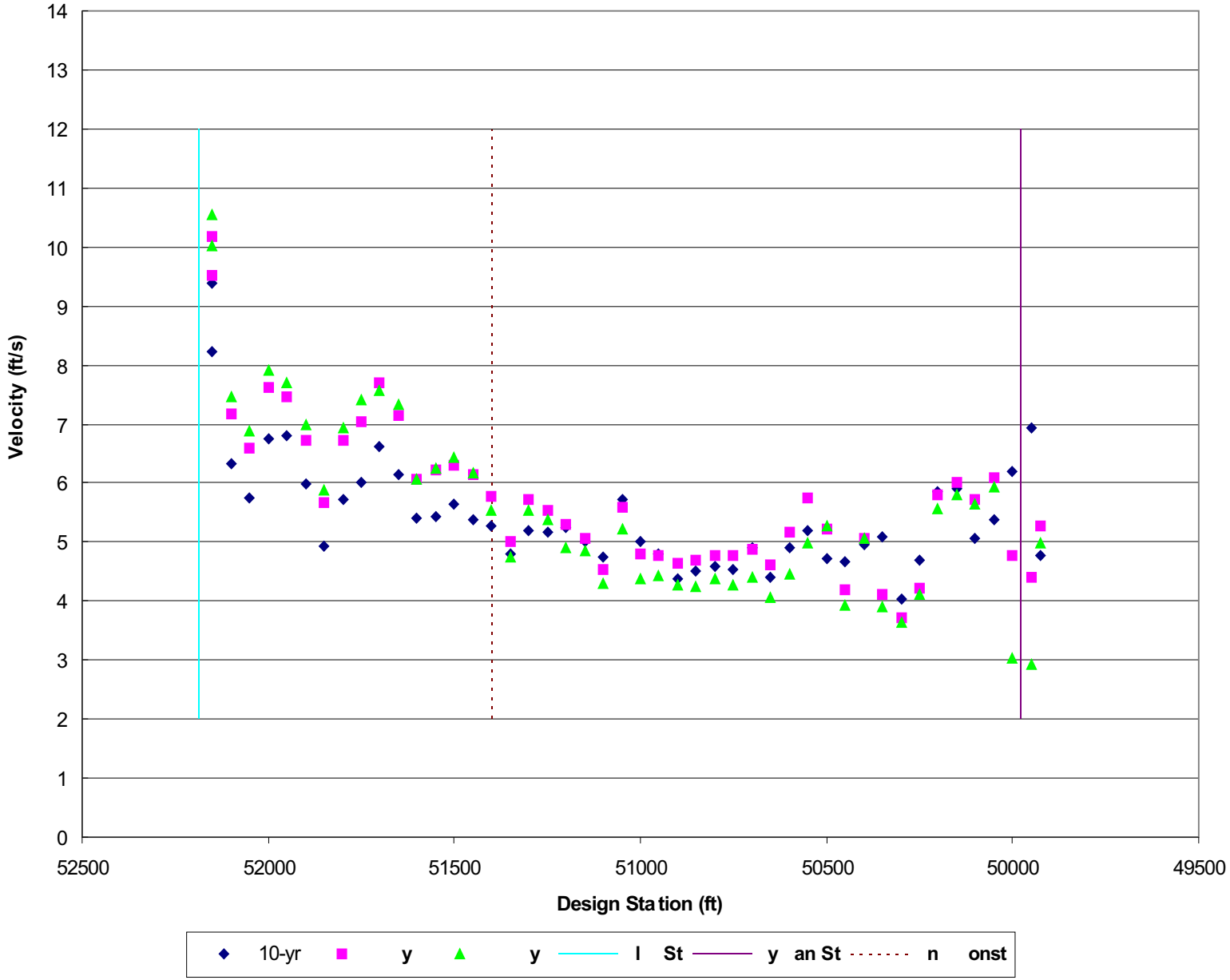
HEC-RAS Depth Analysis with Elm St. Catch Point Removed



HARTCROWSER
J-7385-07 2/02
Figure C-7

RAR 1/25/02 738510 Fig C-7.cdr

HEC-RAS Velocity Analysis with Elm St. Bridge in Place



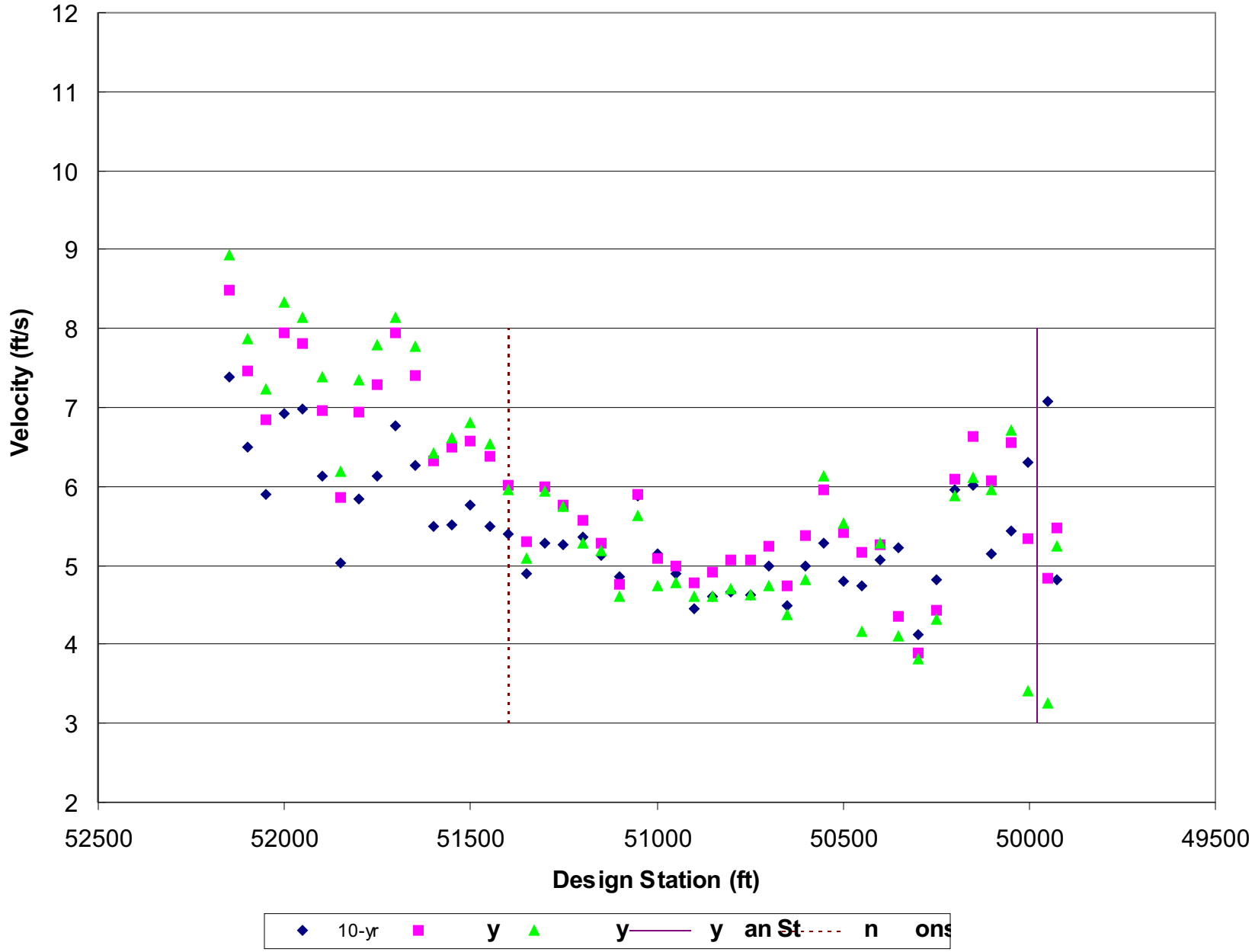
HARTCROWSER

J-7385-07 2/02

Figure C-8

RAR 1/25/02 738510 Fig C-8.cdr

HEC-RAS Velocity Analysis with Elm St. Bridge Removed



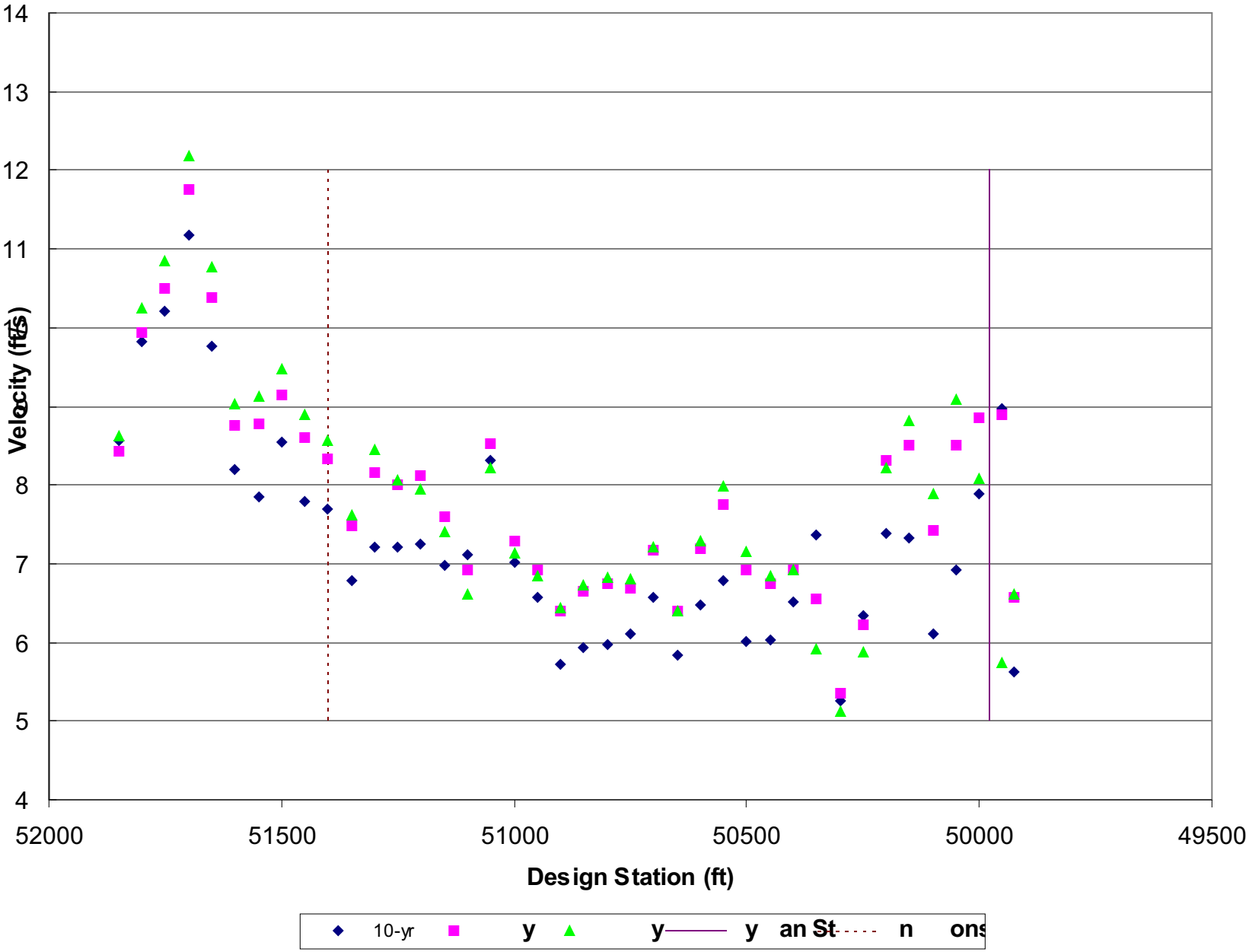
HARTCROWSER

J-7385-07 2/02

Figure C-9

RAR 1/25/02 738510 Fig C-9.cdr

HEC-RAS Velocity Analysis with Elm St. Catch Point Removed



HARTCROWSER

J-7385-07 2/02

Figure C-10

RAR 1/25/02 738510 Fig C-10.cdr

APPENDIX D

BED AND BANK PROTECTION ANALYSIS BACKUP

Table D-1 - Analysis of Riprap Size for Bend A
Part A

							Riprap Design: worst case velocity and depth		
Storm Year	10-yr	10-yr	50-yr	50-yr	100-yr	100-yr			
With Bridge							Approach	TK =1	TK=1.5
Station	500+02	501+50	500+50	500+02	500+50	503+00			
Velocity in fp	6.2	5.9	6.1	4.8	5.9	3.6	7	6.2	6.2
Flow Depth ii	11.6	12.5	17.7	16.1	19.7	18	11.6	11.5	11.5
D_{30} in inches							0.59	0.44	0.39
D_{100} in inches							15	12	12
Without Bridge									
Station	500+02	501+50	500+50	501+50	500+50				
Velocity in fp	6.3	6	6.6	6.6	6.7			6.6	6.6
Flow Depth ii	11.4	12.4	17.3	16.3	19.1			16.5	16.5
D_{30} in inches								0.47	0.42
D_{100} in inches								12	12
Without Catch Point									
Station	500+02	500+50	500+02		500+50				
Velocity in fp	7.9	6.9	8.9		9.1			9	9
Flow Depth ii	9.7	11.6	14.9		16.4			15	15
D_{30} in inches								1.04	0.92
D_{100} in inches								27	27

Part B

Assessment of bed armor size		TK=1.5
Velocity in fps	7	6.6
Flow Depth in ft	11.6	16.5
D_{30} in inches	0.44	0.35
D_{100} in inches	12	9

Notes: Used worst case velocity and depth without bridge. Assumed 5:1 slope to represent flat condition.

Table D-1 - Analysis of Riprap Size for Bend A, Cont.
Part C

Station d/s of bend at which D_{100} = 9 inch provides adequate protection.

sta	Vss/Vavg	Vavg in fps	Vss in fps	Depth in ft	D_{30} in inches	TK
503+00	1.47	6.6	9.70	16.5	0.42	1.5
504+00	1.37	6.6	9.04	16.5	0.35	1.5
504+00	1.37	6.6	9.04	16.5	0.4	1
504+50	1.32	6.6	8.71	16.5	0.36	1

Input Data Riprap Size at Bend A	
Side Slope	2
Bend Radius	330
Water Surface Width in ft	100
Layer Thickness (xD_{100}) in ft	1
Unit Weight of Stone in psf	165
Safety Factor	1.1
Station Start	500+00
Station End	502+50

Notes:
Part A: An array of potential velocity (fps)/depth(ft) combinations from HEC-RAS analysis (see workbook "hydraulics.xls"). Right most columns show assumed worst case conditions chosen from array. BANK riprap sizing based on these conditions. The column labeled "Approach" is an analysis of conditions just u/s of Lyman Bridge.
Part B: To estimate required bed riprap size, assumed near flat slope and estimated riprap size based on worst case, "No Bridge" scenario from Part A.
Part C: To estimate station at which turbulence decay zone ends. End point defined as location at which turbulence has decreased such that required riprap size and thickness = requirement size and thickness in straight section.
Riprap 15 program used to iterate calcaluations.

Table D-2 - Analysis of Riprap Size for Bend B

Storm Year	10-yr	10-yr	50-yr	50-yr	100-yr	100-yr	Riprap design: worst case velocity and depth	
With Bridge								
Station	510+50	514+00	510+50	514+00	510+50	514+00	TK =1	TK=1.5
Velocity in fps	5.73	5.28	5.6	5.78	5.21	5.54	5.75	5.75
Flow Depth in ft	12.66	14.34	17.06	18.62	19.11	20.68	12.7	12.7
D_{30} in inches							0.44	0.39
D_{100} in inches							12	12
Without Bridge								
Station	510+50	514+00	510+50	514+00	510+50	514+00		
Velocity in fps	5.9	5.4	5.9	6	5.6	6	5.9	5.9
Flow Depth in ft	12.5	14.2	16.6	18.2	18.5	20	12.5	12.5
D_{30} in inches							0.47	0.42
D_{100} in inches							12	12
Without Catch Point								
Station	510+50	514+00	510+50	514+00	510+50	514+00		
Velocity in fps	8.3	7.7	8.5	8.3	8.2	8.6	8.3	8.3
Flow Depth in ft	9.8	11.3	13.5	14.8	15.3	16.5	9.8	9.8
D_{30} in inches							1.18	1.05
D_{100} in inches							30	27

Part B

Assessment of bed armor size	TK=1.5
Velocity in fps	5.9
Flow Depth in ft	12.5
D_{30} in inches	0.36
D_{100} in inches	9

Notes: Used worst case velocity and depth without bridge. Assumed 5:1 slope to represent flat condition.

Table D-2 - Analysis of Riprap Size for Bend B, Cont.
Part C

Station d/s of bend at which D_{100} = 9 inch provides adequate protection.

sta	Vss/Vavg	Vavg in fps	Vss in fps	Depth in ft	D_{30} in inches	TK
512+00	1.58	5.9	9.32	12.5	0.42	1.5
	1.48	5.9	8.73	12.5	0.35	1.5
	1.48	5.9	8.73	12.5	0.4	1
	1.43	5.9	8.44	12.5	0.37	1
	1.38	5.9	8.14	12.5	0.34	1

Input Data Riprap Size at Bend B	
Side Slope	2
Bend Radius	200
Water Surface Width in ft	100
Layer Thickness (xD_{100}) in ft	1
Unit Weight of Stone in psf	165
Safety Factor	1.1
Station Start	508+00
Station End	510+00

Notes:
Part A: An array of potential velocity (fps)/depth(ft) combinations from HEC-RAS analysis (see workbook "hydraulics.xls"). Right most columns show assumed worst case conditions chosen from array. BANK riprap sizing based on these conditions.
Part B: To estimate required bed riprap size, assumed near flat slope and estimated riprap size based on worst case, "No Bridge" scenario from Part A.
Part C: To estimate station at which turbulence decay zone ends. End point defined as location at which turbulence has decreased such that required riprap size and thickness = requirement size and thickness in straight section.
Riprap 15 program used to iterate calculations.

Table D-3 - Analysis of Riprap Size for Straight Segments

Storm Year	10-yr	10-yr	50-yr	50-yr	100-yr	100-yr	Riprap design: worst case velocity and depth
With Bridge							TK =1.5
Station							7.44
Velocity in fps			6.2 max				11.5
Flow Depth in ft			11.5 min				0.15
D_{30} in inches							
Without Bridge							
Station							8.04
Velocity in fps			6.7 max				11.3
Flow Depth in ft			11.3 min				0.19
D_{30} in inches							
Without Catch Point							
Station							
Velocity in fps			9.1 max				10.92
Flow Depth in ft		10.6 min (associated with reported vel.)					10.6
D_{30} in inches							0.4
D_{100} in inches							12"

Input Data Riprap Size in Straight Channels	
Side Slope	2
Bend Radius	100000
Water Surface Width in ft	1
Layer Thickness (xD_{100}) in ft	1
Unit Weight of Stone in psf	165
Safety Factor	1.1
Station Start	500+00
Station End	514+00

Table D-4 - Channel Sediment Gradation

Design Station	Sample	%Fines	Grain Size (mm) d5	d15	d25	d30	d40	d50	d60	% Passing #4	d15 adj	d85 adj	%Fines adj
			5%	15%	25%	30%	40%	50%	60%				
501+00	BH000112-0 0030	5%	0.075	0.18	0.3	0.35	0.55	0.85	2.5	67%	0.13	1.8	7%
	Adjusted % Passing		7%	22%	37%	45%	60%	75%	90%				
505+50	BH000124-0 0030	25%	0.008	0.04	0.075	0.25	4.75	6.5	9	40%	0.01	0.8	63%
	Adjusted % Passing		13%	38%	63%	75%	100%	125%	150%				
510+50	BH000125-0 0030	5%	0.075	0.3	0.5	0.7	1.1	2	3.5	66%	0.2	2.5	7%
	Adjusted % Passing		8%	23%	38%	45%	61%	76%	91%				
516+00	BH000128-0 0030	8%	0.050	0.3	0.7	1	2.5	4.5	7	50%	0.08	2.7	14%
	Adjusted % Passing		10%	30%	50%	60%	80%	100%	120%				
Assumed Representative Gradation											0.1	2.0	23%

Notes:
Gradation values based on curves developed from samples drilled in June 2000.
Only samples from 3' below grade in river borings were used to assess filter requirements.
Adjusted values were read from plots of grain size vs. adjusted percent passing stations approximate. Rounded to the nearest 50 feet.

Table D-5 - Filter Sizing Method

Listed below is the filter sizing method as described in EM 1110-2-1901.

1. Obtain Gradation of natural material.

2. Filter sizing based on fraction <#4 sieve. Adjust gradation curve for soil with particles greater than sieve #4 (4.75mm)

   Correction Factor = C = 100/(%passing #4)

   Adj. Percent Passing = C * Percent Passing

   Adjustment calculation shown on Sheet "Natural Material Gradation"

   All calculations will be based on the Adjusted Percent Passing

3. Categorize by %Fines (passing sieve #200) from adjusted gradation

Soil Category	Base Soil Description	Percent Fines Adj.	Filter Criteria
1	Fine silts and clays	>85	$D_{15filter} \leq 9 * d_{85native}$
2	Sands, silts, clays, and silty and clayey sands	40-85	$D_{15filter} \leq 0.7$mm
3	Silty and clayey sands and gravels	15-39	$D_{15filter} = 0.7$mm if $4*d_{85native} < 0.7$
			else $D_{15filter} \leq (40-A)/(40-15)$
			where A = Adjusted %Fines in native material
4	Sands and gravels	<15	$D_{15filter} \leq 4$ to $5 * d_{85native}$ (a)

(a) Use $D_{15filter} \leq 4 * d_{85}$ when filters beneath riprap subject to wave action and drains subject to volent surging/vibration

$D_{15filter}$ max need not be less than 0.2 mm

4. Determine $D_{15filter}$ based on underlying material soil category and material d_{85}.

5. Set limits to meet permeability requirements

   $D_{15filter} \geq 3$ to $5 * d_{15native}$ max

   $D_{15filter}$min ≥ 0.1 mm

6. Set $D_{90filter}$ and $D_{10filter}$ to minimize segregation

Minimum D10	Maximum D90
<0.5	20
0.5 - 1.0	25
1.0 2.0	30
2.0 - 5.0	40
5.0 - 10.0	50
10.0 - 50.0	60

Table D-5 - Filter Sizing Method, Cont.

7. Choose a D85min to be compared against the overlying layer. Value is arbitrary and adjusted to D90.

Steps 3 through 6 are repeated for each material in the riprap/filter cross section

The method also states the following upper and lower limits

D_{100max}=75 mm : This criteria disregarded if larger size required from steps 3 to 6

D_{05min}=0.075 mm : This criteria used in step 3 to categorize filter as a category 4

The portion of the filter material passing the No. 40 (0.425 mm) sieve must have a plasticity index (PI) of zero when tested in accordance with F.M 1110-2-1906, "Laboratory Soils Testing."

Gradation Chart:

Based on the above method, guidemarks are plotted on a gradation sheet. The guidemarks correspond with the D10, D15, D85, and D90

Gradation Specification

Input a gradation band to determine if the material meets the filter requirements. First choice is a MASS highway specification material. If none of the standard gradations meet the specification, input a modified gradation that meets the requirement.

Table D-6- Filter Sizing Calculations for 9-Inch Riprap

1. Obtain Gradation of natural material from Table C-9

2. Gradation curve adjusted. See "Channel Sediment Gradation" Sheet.
THIS ANALYSIS SHEET ASSUMES NATIVE MATERIAL HAS ADJ. FINE CONTENT OF 15% AND D85 = 2mm

Steps 3 to 6 are repeated for each required filter layer. The calculation sets represent the following:

a. Comparison between native material and the filter layer A
b. Comparison between filter layer A and filter layer B
c. Comparison between filter layer B and riprap

3. Categorize by %Fines

a. Native material will have 15% max fines==> CLASIFY AS CATEGORY 4
b. Filter A material will have 5% max fines==> CLASIFY AS CATEGORY 4

4. D_{15} based on soil category and d_{85} of underlying material

a.	Set $D_{15a} \leq 4 * D_{85nativemin}$	D_{15amax}=	8 mm		$D_{85nativemin}$=	2 mm
b.	Check $D_{15riprap} \leq 4 * D_{85bmin}$	$D_{15riprapmax}$=	120 mm	since	D_{85amin}=	30 mm

5. For permeability (D15min $\geq$ 0.1 mm)

a.	$D_{15a} \geq 3$ to $5 * d_{15native}$ max	D_{15amin}=	0.50 mm		$d_{15native}$=	0.10 mm
b.	$D_{15b} \geq 3$ to $5 * D_{15a}$ max	$D_{15riprapmin}$=	40 mm		D_{15a}=	8.00 mm

6. Set D_{90} and D_{10} to minimize segregation

a.	D_{10amin} =	5.0 mm		D_{90amax} =	50 mm

7. Assumed D85 for subsequent calculations

a.				D_{85amin}=	30 mm

Table D-6 - Filter Sizing Calculations for 9-Inch Riprap, Cont.

		Import Material Gradations (mm)								Native Adjusted	
		Riprap			Filter B			Filter A			
			min	max		min	max		min	max		
D5	5%											
	10%							□	*5.00*		0.01	15%
D15	15%	O	*86*	*116*	Δ			□		*8.00*	0.025	30%
D30	30%		*111*	135							0.055	50%
D50	50%		*130*	*151*							0.075	63%
D85	85%		150	200	Δ			□	*30.00*		0.8	85%
D90	90%		*159*	210	Δ			□		*50.00*	1.5	90%
D100	100%		170	*225*							4.75	100%

Notes:
For riprap, italicised numbers represent standard Corp of Engineers riprap gradation. Other points arbitrarily input to produce curves.
Riprap gradation from standard Corp of Engrs riprap gradations. Table 3-1, EM 1110-2-1601.

Gradation Specification

Based on the guides established by the above criteria, input a standard MASS highway spec for gradation or input a specialized gradation

Std Sieve Size		Percent Passing		
inch or #	Opening(mm)	Filter B Specialized		Filter A M1.03.0 modified*
2.5	62.5	100%		
1.5	37.5	70%	95%	
0.5	12.5	30%	50%	
0.25	6.25	5%	20%	
4	4.75			
50	0.3			
200	0.075			
100	0.15			
80	0.18			
100	0.15			
200	0.075			

*require that D100 = 3/4"
also required max 5% fines (passing#200)

Sieve Size Lookup Table

Std Sieve Size	
Number	Opening(mm)
4	4.75
6	3.35
8	2.36
10	2
20	0.85
30	0.6
40	0.425
60	0.25
80	0.18
100	0.15
140	0.106
170	0.088
200	0.075
270	0.053

Table D-7 - Filter Sizing Calculations for 12-Inch Riprap

1. Obtain Gradation of natural material from Table C-9

2. Gradation curve adjusted. See "Channel Sediment Gradation" Sheet.

%pass #4	% fine	Adjusted %fine
73%	0.13	18%

Steps 3 to 6 are repeated for each required filter layer. The calculation sets represent the following:

a. Comparison between native material and the filter layer A
b. Comparison between filter layer A and filter layer B
c. Comparison between filter layer B and riprap

3. Categorize by %Fines

a. Adjusted fine content for mean native = 18% ==>CLASIFY AS CATEGORY 3
b. Filter A material will have 5% max fines==> CLASIFY AS CATEGORY 4
c. Filter B material will have 5% max fines==> CLASIFY AS CATEGORY 4

4. D_{15} based on soil category and d_{85} of underlying material

a.	Set $D_{15a} \leq (40-A)/(40-15)$	D_{15amax}=	.89 mm			
b.	Set $D_{15b} \leq 4 * D_{85amin}$	D_{15bmax}=	24 mm	since	D_{85amin}=	6 mm
c.	Check $D_{15riprap} \leq 4 * D_{85bmin}$	$D_{15riprapmax}$=	160 mm	since	D_{85bmin}=	40 mm

5. For permeability (D15min $\geq$ 0.1 mm)

a.	$D_{15a} \geq 3$ to $5 * d_{15native}$ max	D_{15amin}=	0.10 mm	$d_{15native}$=	0.01 mm
b.	$D_{15b} \geq 3$ to $5 * D_{15a}$ max	D_{15bmin}=	4 mm	D_{15a}=	.89 mm
c.	$D_{15c} \geq 3$ to $5 * D_{15b}$ max	$D_{15riprapmin}$=	100 mm	D_{15b}=	20.0 mm

6. Set D_{90} and D_{10} to minimize segregation

a.	D_{10amin} =	.1 mm	D_{90amax} =	20 mm
b.	D_{10bmin} =	10.0 mm	D_{90bmax} =	60 mm

7. Assumed D85 for subsequent calculations

a.	D_{85amin}=	6 mm
b.	D_{85bmin}=	40 mm

Table D-7 - Filter Sizing Calculations for 12-Inch Riprap, Cont.

		Import Material Gradations (mm)									Native Adjusted	
		Riprap			Filter B			Filter A				
			min	max		min	max		min	max		
D5	5%											
	10%					*10*		□	*0.10*		0.01	15%
D15	15%	O	*116*	*160*	Δ		*24*	□		*0.89*	0.025	30%
D30	30%		*147*	185							0.055	50%
D50	50%		*174*	*201*							0.075	63%
D85	85%		200	240	Δ	*40*		□	*6.00*		0.8	85%
D90	90%		*210*	280	Δ		*60*	□		*20.00*	1.5	90%
D100	100%		240	*300*							4.75	100%

Note: For riprap, italicised numbers represent standard Corp of Engineers riprap gradation. Other points arbitrarily input to produce curve
Riprap gradation from standard Corp of Engrs riprap gradations. Table 3-1, EM 1110-2-1601

Gradation Specification

Based on the guides established by the above criteria, input a standard MASS highway spec for gradation or input a specialized gradatior

Std Sieve Size		Percent Passing Filter B		Filter A	
inch or #	Opening(m	specialized		M1.03.0 modified*	
3	75	100%			
2.5	62.5	95%	100%		
1	25	30%	60%		
0.75	18.75	0%	25%		
0.75	18.75			100%	
0.5	12.5			50%	85%
4	4.75			40%	75%
50	0.3			8%	28%
200	0.075				5%
50	0.3				
100	0.15				
80	0.18				
100	0.15				
200	0.075				

*require that D100 = 3/4"
also required max 5% fines (passing#200)

Sieve Size Lookup Table

Std Sieve Size	
Number	Opening(mm)
4	4.75
6	3.35
8	2.36
10	2
16	1.18
20	0.85
30	0.6
40	0.425
50	0.3
60	0.25
80	0.18
100	0.15
140	0.106
170	0.088
200	0.075
270	0.053

Table D-8 - Filter Sizing Calculations for 15-Inch Riprap

1. Obtain Gradation of natural material from Table C-9

2. Gradation curve adjusted. See "Channel Sediment Gradation" Sheet.

%pass #4	% fine	Adjusted %fine
73%	13%	18%

Steps 3 to 6 are repeated for each required filter layer. The calculation sets represent the following:

a. Comparison between native material and the filter layer A
b. Comparison between filter layer A and filter layer B
c. Comparison between filter layer B and riprap

3. Categorize by %Fines

a. Adjusted fine content for mean native = 18% ==>CLASIFY AS CATEGORY 3
b. Filter A material will have 5% max fines==> CLASIFY AS CATEGORY 4
c. Filter B material will have 5% max fines==> CLASIFY AS CATEGORY 4

4. D_{15} based on soil category and d_{85} of underlying material

a.	Set $D_{15a} \leq (40-A)/(40-15)$	D_{15amax}=	.89 mm			
b.	Set $D_{15b} \leq 4 * D_{85amin}$	D_{15bmax}=	32 mm	since	D_{85amin}=	8 mm
c.	Check $D_{15riprap} \leq 4 * D_{85bmin}$	$D_{15riprapmax}$=	200 mm	since	D_{85bmin}=	50 mm

5. For permeability (D15min $\geq$ 0.1 mm)

a.	$D_{15a} \geq 3$ to $5 * d_{15native}$ max	D_{15amin}=	0.10 mm	$d_{15native}$=	0.01 mm
b.	$D_{15b} \geq 3$ to $5 * D_{15a}$ max	D_{15bmin}=	4 mm	D_{15a}=	.89 mm
c.	$D_{15c} \geq 3$ to $5 * D_{15b}$ max	$D_{15riprapmin}$=	100 mm	D_{15b}=	20.0 mm

6. Set D_{90} and D_{10} to minimize segregation

a.	D_{10amin} =	.1 mm	D_{90amax} =	20 mm
b.	D_{10bmin} =	10.0 mm	D_{90bmax} =	60 mm

7. Assumed D85 for subsequent calculations

a.	D_{85amin}=	8 mm
b.	D_{85bmin}=	50 mm
c.		

Table D-8 - Filter Sizing Calculations for 15-Inch Riprap, Cont.

		Import Material Gradations (mm)									Native Adjusted	
		Riprap			Filter B			Filter A				
			min	max		min	max		min	max		
D5	5%											
	10%					*10*		□	*0.10*		0.01	15%
D15	15%	○	*151*	*198*	Δ		*32*	□		*0.89*	0.025	30%
D30	30%		*183*	230							0.055	50%
D50	50%		*220*	*250*							0.075	63%
D85	85%		240	320	Δ	*50*		□	*8.00*		0.8	85%
D90	90%		*264*	350	Δ		*60*	□		*20.00*	1.5	90%
D100	100%		290	*375*							4.75	100%

Notes:
For riprap, italicised numbers represent standard Corp of Engineers riprap gradation. Other points arbitrarily input to produce curves.
Riprap gradation from standard Corp of Engrs riprap gradations. Table 3-1, EM 1110-2-1601

Gradation Specification

Based on the guides established by the above criteria, input a standard MASS highway spec for gradation or input a specialized gradation as necessary.

Std Sieve Size		Percent Passing			
		Filter B		Filter A	
inch or #	Opening(mm)	specialized		M1.03.0 modified*	
3.5	87.5	100%			
2.5	62.5	95%	100%		
1.5	37.5	40%	70%		
0.75	18.75	0%	25%		
0.75	18.75			100%	
0.5	12.5			50%	85%
4	4.75			40%	75%
50	0.3			8%	28%
200	0.075			0%	5%
50	0.3				
100	0.15				
80	0.18				
100	0.15				
200	0.075				

*require that D100 = 3/4"
also required max 5% fines (passing#200)

Sieve Size Lookup Table

Std Sieve Size	
Number	Opening(mm)
4	4.75
6	3.35
8	2.36
10	2
16	1.18
20	0.85
30	0.6
40	0.425
50	0.3
60	0.25
80	0.18
100	0.15
140	0.106
170	0.088
200	0.075
270	0.053

Table D-9 - Summary Table for Riprap Design Details by Station for Slope Armor D_{100} of 18-Inches

Cross section	Section Type	Design Velocity[1] (ft/sec)	Design depth[2] (ft)	Flow (cfs)	Riprap Characteristics[3]																		
					D_{100} (in)			Thickness (in)			(in)			Excavation Depth (inches)			Finish grade-ex grade (in)			X-sectional Width, feet			
					Left bank	Centerline	Right bank	Left bank	Centerline	Right bank	Left bank	Centerline	Right bank	Left bank	Centerline	Right Bank	Left bank	Centerline	Right Bank	Left bank	Centerline	Right Bank	Excess Volume, cy
500+00	Bend	6.6	16.5	7239	NA	12	18	NA	20	24	NA	26	36	NA	36	36	NA	10	0				
500+50	Bend	6.6	16.5	7239	NA	12	18	NA	20	24	NA	26	36	NA	36	36	NA	10	0				
501+00	Bend	6.6	16.5	7239	NA	12	18	NA	20	24	NA	26	36	NA	36	36	NA	10	0				
501+50	Bend	6.6	16.5	7239	NA	12	18	NA	20	24	NA	26	36	NA	36	36	NA	10	0				
502+00	Bend	6.6	16.5	7239	NA	12	18	NA	20	24	NA	26	36	NA	36	36	NA	10	0				
502+50	Bend	6.6	16.5	7239	18	12	18	24	20	24	36	26	36	36	36	36	0	10	0				
503+00	Bend	6.6	16.5	7239	18	12	18	24	20	24	36	26	36	36	36	36	0	10	0				
503+50	Bend	6.6	16.5	7239	18	12	18	24	20	24	36	26	36	36	36	36	0	10	0				
504+00	Bend	6.6	16.5	7239	18	12	18	24	20	24	36	26	36	36	36	36	0	10	0				
504+50	Straight	8.04	11.3	4375	18	9	18	24	15	24	36	21	36	36	36	36	0	15	0				
505+00	Straight	8.04	11.3	4375	18	9	18	24	15	24	36	21	36	36	36	36	0	15	0				
505+50	Straight	8.04	11.3	4375	18	9	18	24	15	24	36	21	36	36	36	36	0	15	0				
506+00	Straight	8.04	11.3	4375	18	9	18	24	15	24	36	21	36	36	36	36	0	15	0				
506+50	Straight	8.04	11.3	4375	18	9	18	24	15	24	36	21	36	36	36	36	0	15	0				
507+00	Straight	8.04	11.3	4375	18	9	18	24	15	24	36	21	36	36	36	36	0	15	0				
507+50	Straight	8.04	11.3	4375	18	9	18	24	15	24	36	21	36	36	36	36	0	15	0				
508+00	Bend	5.9	12.5	4375	18	12	18	24	20	24	36	26	36	36	36	36	0	10	0				
508+50	Bend	5.9	12.5	4375	18	12	18	24	20	24	36	26	36	36	24	36	0	-2	0		65		20.1
509+00	Bend	5.9	12.5	4375	18	12	18	24	20	24	36	26	36	36	24	36	0	-2	0		65		
509+50	Bend	5.9	12.5	4375	18	12	18	24	20	24	36	26	36	36	24	36	0	-2	0		70		22.4
510+00	Bend	5.9	12.5	4375	18	12	18	24	20	24	36	26	36	36	24	36	0	-2	0		75		
510+50	Bend	5.9	12.5	4375	18	12	18	24	20	24	36	26	36	36	24	36	0	-2	0		60		18.5
511+00	Bend	5.9	12.5	4375	18	12	18	24	20	24	36	26	36	36	24	36	0	-2	0		60		
511+50	Bend	5.9	12.5	4375	18	12	18	24	20	24	36	26	36	36	24	36	0	-2	0		60		18.5
512+00	Bend	5.9	12.5	4375	18	12	18	24	20	24	36	26	36	36	24	36	0	-2	0		60		
512+50	Straight	8.04	11.3	4375	18	9	18	24	15	24	36	21	36	36	24	36	0	3	0				
513+00	Straight	8.04	11.3	4375	18	9	18	24	15	24	36	21	36	36	24	36	0	3	0				
513+50	Straight	8.04	11.3	4375	18	9	18	24	15	24	36	21	36	36	24	36	0	3	0				
514+00	Straight	8.04	11.3	4375	18	9	18	24	15	24	36	21	36	36	24	36	0	3	0				

Total excess volume[4] required to accommodate riprap + filter layers = 79

Notes:

1. Design Velocity = Velocity used to estimate stone size.
   Velocity, straight reaches = maximum center line velocity = 120% * Maximum average velocity in straight reach
   Velocity, bends = maximum average velocity in bend
2. Increase in stage from 500+00 to 504+00 is because worst-case is for 50-yr storm, due to higher banks in this reach.
3. Stone size is not solely a function of velocity. Secondary currents in bends may necessitate a higher degree of protection in spite of lower velocity
4. Excess volume calculated based on x-sectional thickness of riprap+filter layers compared to excavation depth.

• Bank riprap layers shown above require two 6-inch thick layers, total filter layer thickness = 12 inches
• Bed riprap layers shown above require one 6-inch thick layer, total filter layer thickness = 6 inches

Table D-10 - Summary Table for Riprap Design Details by Station for Slope Armor D_{100} of 21-Inches

Cross section	Section Type	Design Velocity[1] (ft/sec)	Design depth[2] (ft)	Flow (cfs)	Riprap Characteristics[3]																				
					D_{100} (in)			Thickness (in)			(in)			Excavation Depth (inches)			Finish grade-ex grade (in)			X-sectional Width, feet			Excess Volume, cy		
					Left bank	Centerline	Right bank	Left bank	Centerline	Right bank	Left bank	Centerline	Right bank	Left bank	Centerline	Right Bank	Left bank	Centerline	Right Bank	Left bank	Centerline	Right Bank	Left bank	Centerline	Right Bank
500+00	Bend	6.6	16.5	7239	NA	12	21	NA	20	27	NA	20	27	NA	36	36	NA	16	9	NA		24	NA		23.6
500+50	Bend	6.6	16.5	7239	NA	12	21	NA	20	27	NA	20	27	NA	36	36	NA	16	9	NA		10	NA		
501+00	Bend	6.6	16.5	7239	NA	12	21	NA	20	27	NA	20	27	NA	36	36	NA	16	9	NA		10	NA		13.9
501+50	Bend	6.6	16.5	7239	NA	12	21	NA	20	27	NA	20	27	NA	36	36	NA	16	9	NA		10	NA		
502+00	Bend	6.6	16.5	7239	NA	12	21	NA	20	27	NA	20	27	NA	36	36	NA	16	9	NA		10	NA		13.9
502+50	Bend	6.6	16.5	7239	21	12	21	27	20	27	27	20	27	36	36	36	9	16	9	10		10	13.9		
503+00	Bend	6.6	16.5	7239	21	12	21	27	20	27	27	20	27	36	36	36	9	16	9	10		10			13.9
503+50	Bend	6.6	16.5	7239	21	12	21	27	20	27	27	20	27	36	36	36	9	16	9	10		10	13.9		
504+00	Bend	6.6	16.5	7239	21	12	21	27	20	27	27	20	27	36	36	36	9	16	9	10		10			13.9
504+50	Straight	8.04	11.3	4375	21	9	21	27	15	27	27	15	27	36	36	36	9	21	9	10		10	13.9		
505+00	Straight	8.04	11.3	4375	21	9	21	27	15	27	27	15	27	36	36	36	9	21	9	10		10			13.9
505+50	Straight	8.04	11.3	4375	21	9	21	27	15	27	27	15	27	36	36	36	9	21	9	10		10	13.9		
506+00	Straight	8.04	11.3	4375	21	9	21	27	15	27	27	15	27	36	36	36	9	21	9	10		10			13.9
506+50	Straight	8.04	11.3	4375	21	9	21	27	15	27	27	15	27	36	36	36	9	21	9	10		10	13.9		
507+00	Straight	8.04	11.3	4375	21	9	21	27	15	27	27	21	27	36	36	36	9	15	9	10		10			13.9
507+50	Straight	8.04	11.3	4375	21	9	21	27	15	27	27	15	27	36	36	36	9	21	9	10		10	13.9		
508+00	Bend	5.9	12.5	4375	21	12	21	27	20	27	27	20	27	36	36	36	9	16	9	10		10			13.9
508+50	Bend	5.9	12.5	4375	21	12	21	27	20	27	27	20	27	36	24	36	9	4	9	10	65	10	13.9	40.1	
509+00	Bend	5.9	12.5	4375	21	12	21	27	20	27	27	20	27	36	24	36	9	4	9	10	65	10			13.9
509+50	Bend	5.9	12.5	4375	21	12	21	27	20	27	27	20	27	36	24	36	9	4	9	10	70	10	13.9	44.8	
510+00	Bend	5.9	12.5	4375	21	12	21	27	20	27	27	20	27	36	24	36	9	4	9	10	75	10			13.9
510+50	Bend	5.9	12.5	4375	21	12	21	27	20	27	27	20	27	36	24	36	9	4	9	10	60	10	13.9	37.0	
511+00	Bend	5.9	12.5	4375	21	12	21	27	20	27	27	20	27	36	24	36	9	4	9	10	60	10			13.9
511+50	Bend	5.9	12.5	4375	21	12	21	27	20	27	27	20	27	36	24	36	9	4	9	10	60	10	13.9	37.0	
512+00	Bend	5.9	12.5	4375	21	12	21	27	20	27	27	20	27	36	24	36	9	4	9	10	60	10			13.9
512+50	Straight	8.04	11.3	4375	21	9	21	27	15	27	27	15	27	36	24	36	9	9	9	10	60	10	13.9		
513+00	Straight	8.04	11.3	4375	21	9	21	27	15	27	27	15	27	36	24	36	9	9	9	10	60	10			13.9
513+50	Straight	8.04	11.3	4375	21	9	21	27	15	27	27	15	27	36	24	36	9	9	9	10	60	10	13.9		
514+00	Straight	8.04	11.3	4375	21	9	21	27	15	27	27	15	27	36	24	36	9	9	9	10	60	10			13.9
																							167	159	218

Total excess volume[4] required to accommodate riprap + filter layers = 544

Notes:

1. Design Velocity = Velocity used to estimate stone size.
   Velocity, straight reaches = maximum center line velocity = 120% * Maximum average velocity in straight reach
   Velocity, bends = maximum average velocity in bend
2. Increase in stage from 500+00 to 504+00 is because worst-case is for 50-yr storm, due to higher banks in this reach.
3. Stone size is not solely a function of velocity. Secondary currents in bends may necessitate a higher degree of protection in spite of lower velocity
4. Excess volume calculated based on x-sectional thickness of riprap+filter layers compared to excavation depth.

• Bank riprap layers shown above require two 6-inch thick layers, total filter layer thickness = 18 inches
• Bed riprap layers shown above require one 6-inch thick layer, total filter layer thickness = 6 inches

Filter Gradation for 9-Inch Rip-Rap

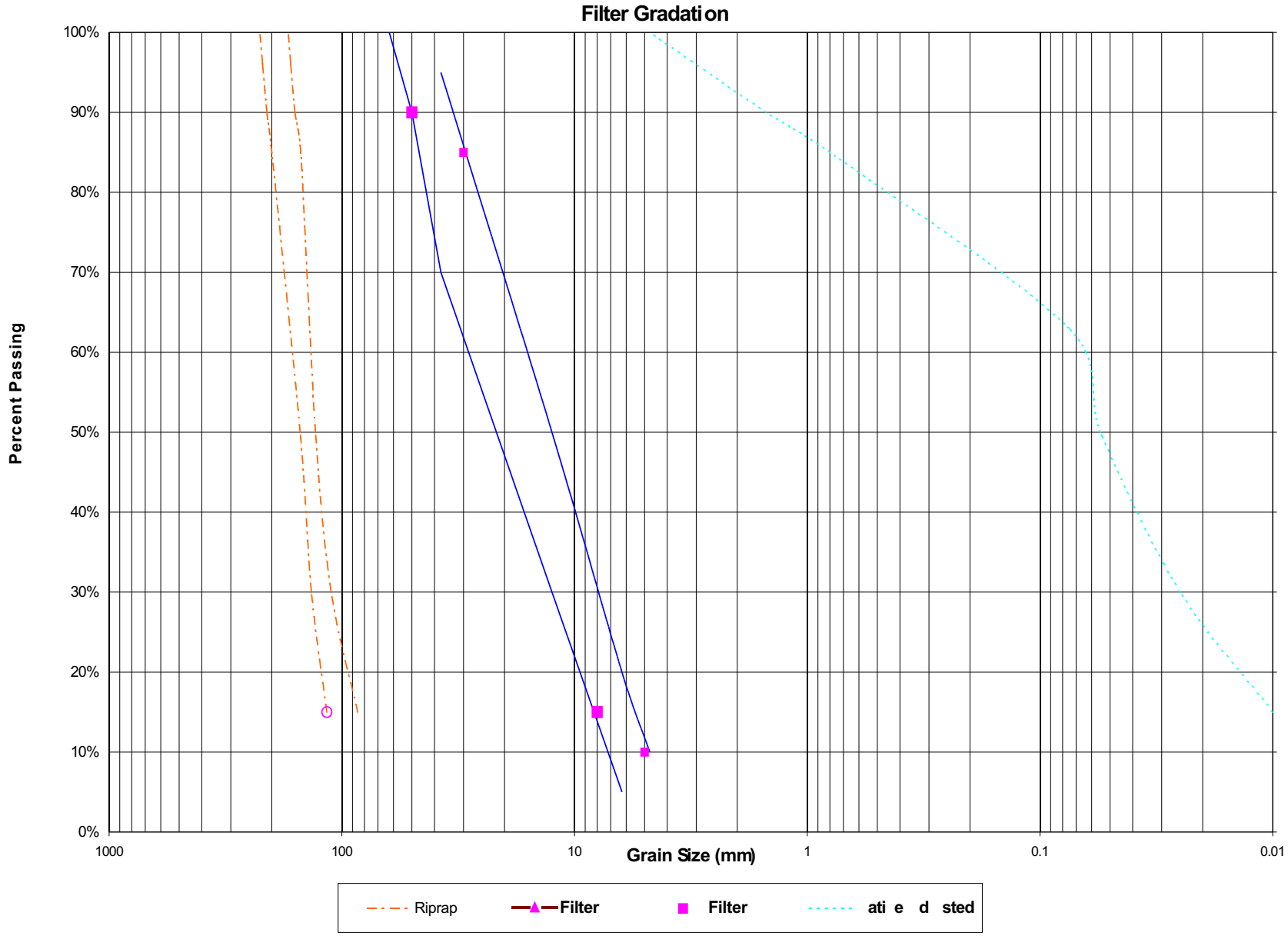


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Figure D-1

SJG 1/23/02 738510 Fig D-1.cdr

Filter Gradation for 12-Inch Rip-Rap

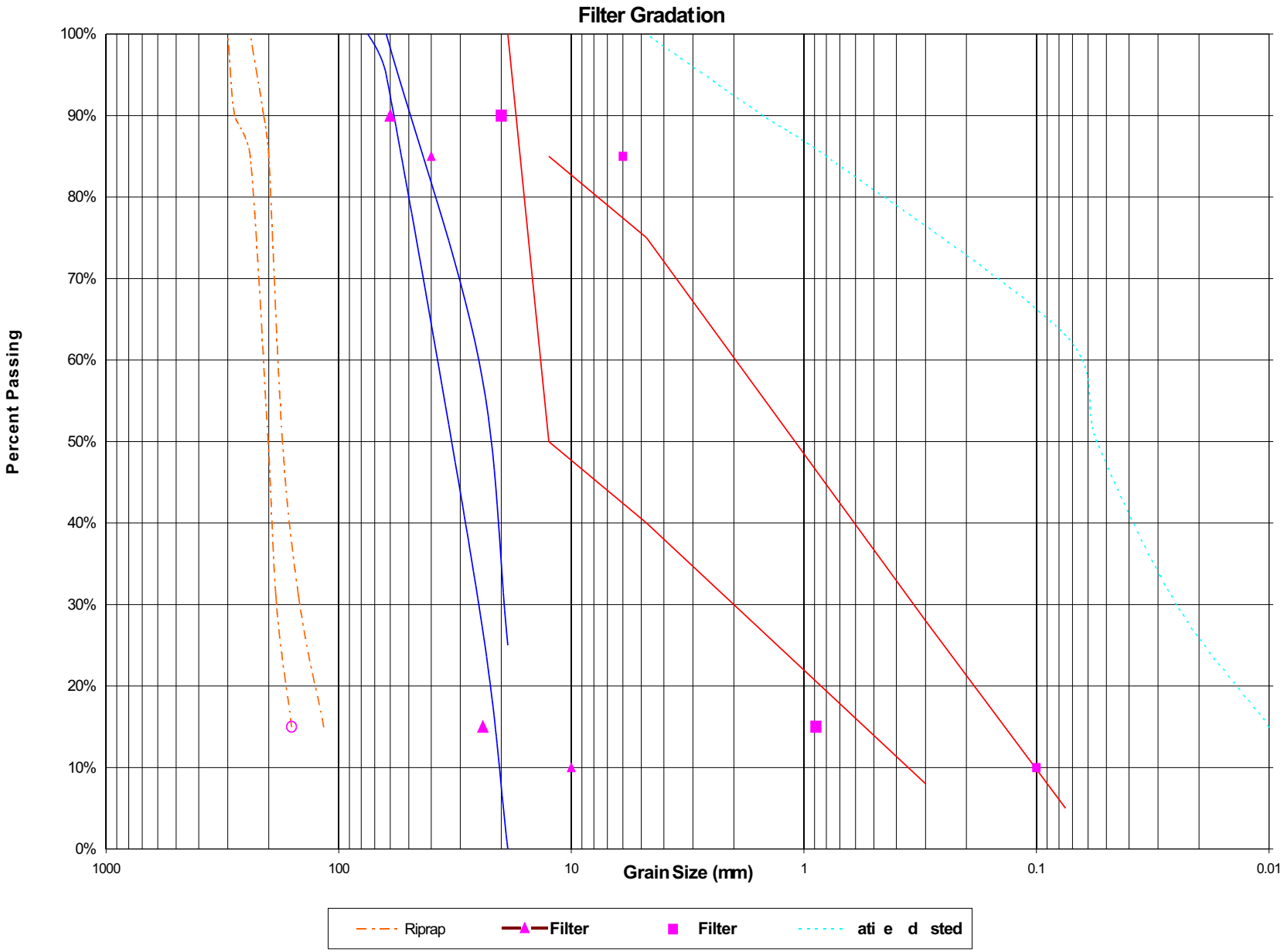

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Figure D-2

SJG 1/23/02 738510 Fig D-2.cdr

Filter Gradation for 15-Inch Rip-Rap

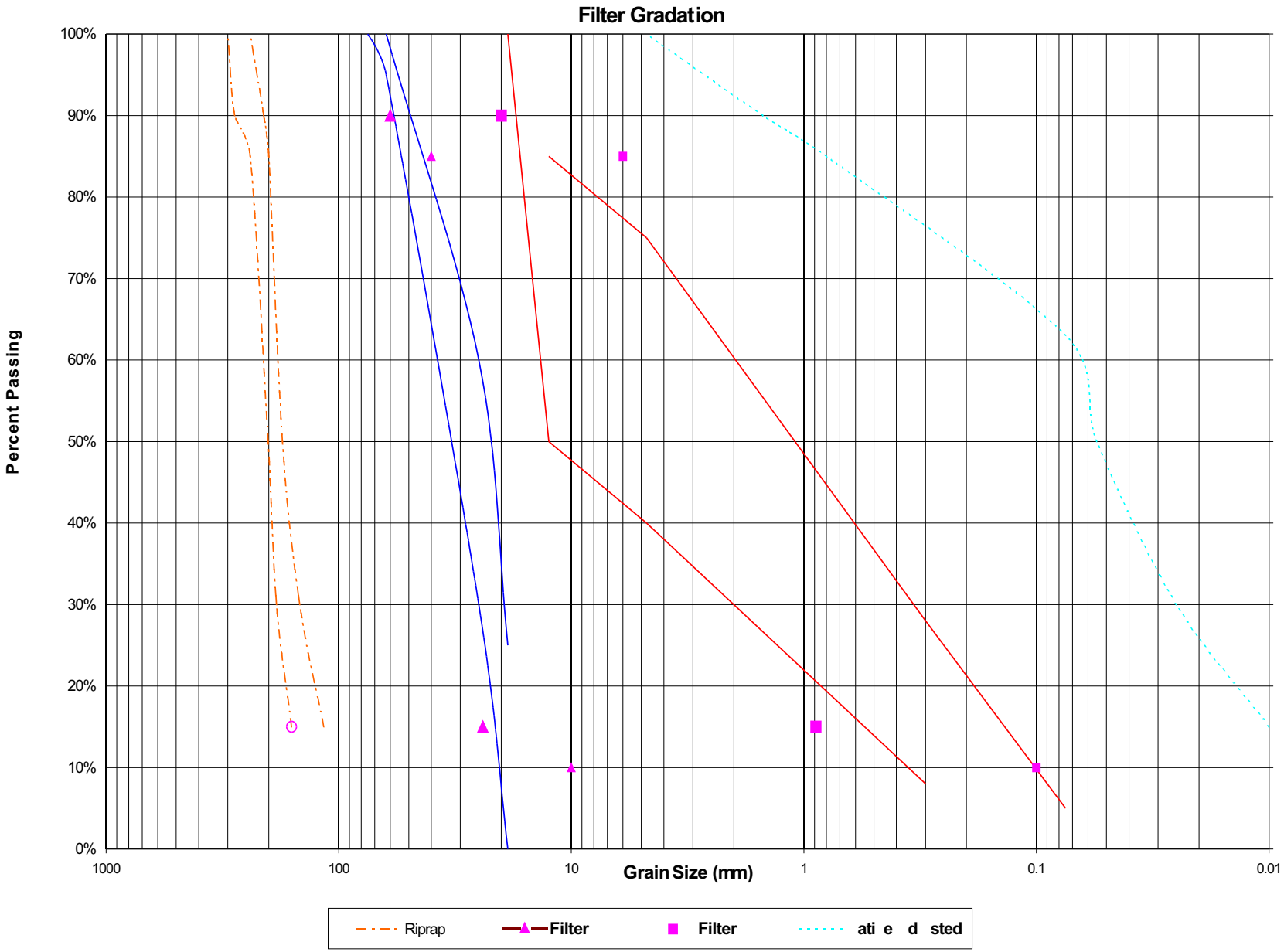

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Figure D-3

RAR 1/25/02 738510 Fig D-3.cdr

APPENDIX E

HEC-RAS MODELING OUTPUTS

Existing conditions cross sections used in the HEC-RAS modeling from Elm Bridge to Lyman Bridge.

500+00	Station	Elevation
51948	0	993
	698	990
	958	984.8
	981.4	983.73
	1006.5	983.32
	1049.2	984.38
	1099.7	985.83
	1124.5	970.53
	1148	969.43
	1172.8	970.73
	1196.9	985.33
	1232.9	985.05
	1254.2	984.07
	1264.8	984.38
	1278.2	983.98
	1315	983.04
	2188	985
	2348	986
	2523	985
	2993	982
	3213	985
	3548	990
	3698	995

500+50	Station	Elevation
51900	0	985.43
	160	982.93
	172	975.43
	180	970.43
	205	967.51
	230	970
	235	971
	245	976
	255	981
	260	983
	375	982.5

501+00	Station	Elevation
51850	0	986.61
	160	981.93
	171	975.3685
	180	970
	210	968.03
	240	970.03

	244	974.03
	280	984
	310	982
	380	982.5

501+50	Station	Elevation
51800	0	984.48
	150	983.33
	169	975.1727
	180	970.45
	190	968.4
	230	970.83
	239	975.1725
	250	980.48
	370	981.05

502+00	Station	Elevation
51750	0	983.53
	70	981.8
	110	984.45
	160	982
	178	975.298
	190	970.83
	200	970
	220	968.83
	240	970.93
	251	975.847
	260	979.87
	280	980.35
	340	980.71
	360	980.71
	370	980.71

502+50	Station	Elevation
51700	0	982.76
	110	979.11
	170	978.06
	250	978
	254	975.052
	260	970.63
	280	969.03
	290	969.03
	320	970.43
	333	976.0785
	340	979.12
	420	980.66

	430	980.66
	440	980.66

503+00	Station	Elevation
51650	0	982.12
	80	980.41
	180	978.41
	270	979.19
	300	979.61
	311	974.671
	320	970.63
	350	969.35
	400	970.55
	405	975.26
	410	979.97
	450	980.66
	470	980.66
	480	980.66

503+50	Station	Elevation
51600	0	983.29
	90	981.33
	180	979
	300	981
	320	978.63
	347	976.884
	350	977
	360	971
	400	969.35
	420	970.55
	444	976.148
	460	979.88
	490	980.56
	500	980.56
	510	980.56

504+50	Station	Elevation
51500	0	984
	20	983
	60	980
	75	975
	100	980
	160	982
	240	980.85
	300	985
	370	982

	410	980
	420	976.6967
	440	970.09
	470	969.45
	500	970.55
	515	975.775
	530	981
	560	981.41
	580	981.54
	590	981.54

505+00	Station	Elevation
51450	0	981
	60	975
	80	980
	120	982
	210	985
	230	985.63
	290	988
	320	987
	340	985
	410	983.33
	430	982.33
	443	976.987
	460	970
	490	969.58
	510	967.86
	520	970
	533	976.5
	540	980
	590	982.03
	610	981.09
	620	981.09

505+50	Station	Elevation
51400	0	981
	50	980
	60	975
	90	980
	130	982
	150	984
	260	986
	300	987
	370	986
	450	982
	465	981
	470	978

475	978
483	975.9
490	971
500	970
520	968.6
550	971
565	975.275
570	981
610	982
630	982
640	981.97

506+00	Station	Elevation
51350	0	979
	40	978
	50	975
	70	980
	140	985
	280	986.5
	400	985
	460	983
	470	982.59
	480	978
	490	978
	493	976.95
	510	971
	540	968.47
	570	970.55
	583	976.6925
	590	980
	650	982
	710	982
	730	981.97
	740	981.97

506+50	Station	Elevation
51300	0	977
	20	976
	30	980
	90	983
	150	985
	230	986.45
	270	985
	370	985.01
	460	981
	483	974.675
	500	970

530	968.25
560	970.55
576	976.51
580	978
650	980.05
710	982
740	982.86
750	982.86

507+00	Station	Elevation
51250	0	983
	90	983
	250	985
	390	983
	450	982
	460	981
	470	978
	475	974.325
	480	970.65
	520	968.45
	540	970.55
	558	975.026
	570	978.01
	610	979.04
	660	981
	710	983
	720	983

507+50	Station	Elevation
51200	0	983
	100	984.61
	420	984
	480	982
	500	981
	510	977
	530	978
	537	975.298
	550	970.28
	570	967.58
	600	970
	620	974
	627	975.05
	660	980
	720	982
	760	983.35
	770	983.35
	780	983.35

508+00	Station	Elevation
51150	0	983
	100	984.61
	380	984
	420	983
	480	982
	500	981
	510	979
	520	978.5
	527	975.525
	540	970
	570	967.58
	600	970.38
	614	974.5007
	630	979.21
	700	980.95
	720	982

508+50	Station	Elevation
51100	0	983
	100	984.61
	250	985
	400	984
	430	983
	500	982
	524	975.916
	540	971.86
	580	967.51
	610	970.28
	615	974.14
	620	978
	622	978.178
	640	979.78
	710	981
	780	983

509+00	Station	Elevation
51050	0	984.61
	240	985
	400	984
	420	983
	490	981
	500	982
	535	974.3
	550	971

	600	965.87
	610	970
	622	975.268
	630	978.78
	650	979
	700	980
	750	981

509+50	Station	Elevation
51000	0	984.61
	240	985
	290	985.44
	330	985
	430	984
	500	982
	510	980
	527	975.2287
	540	971.58
	570	967.58
	600	970.28
	612	974.912
	620	978
	650	979.4
	770	980

510+00	Station	Elevation
50950	0	984.61
	200	983
	320	986
	380	984
	450	983
	500	982
	510	980
	519	976.4
	530	972
	560	967.6
	590	970.28
	600	975
	650	979
	710	980
	750	980

510+50	Station	Elevation
50900	0	984.61
	250	985
	320	989

380	987
410	982
420	984
480	983
520	975
557	967.82
585	970
592	973
610	979
720	980

511+00	Station	Elevation
50850	0	984.61
	260	985
	280	983
	320	985
	340	991
	380	989
	390	987
	410	983
	420	981
	490	980
	500	977
	510	975
	520	973
	550	966.84
	580	970.24
	594	976.372
	600	979
	680	977
	720	979

511+50	Station	Elevation
50800	0	984.61
	310	985
	330	990
	340	994
	390	991
	410	982
	450	979
	490	981
	504	974
	510	971
	530	967.84
	570	970.24
	587	975.7367
	600	979.94

	620	980
	670	980

512+00	Station	Elevation
50750	0	984.61
	300	984
	340	984.4
	350	996
	370	996.09
	420	989.3
	440	980
	480	980
	491	974.5
	500	970
	530	968.14
	560	970.44
	570	975.22
	580	980
	600	980.54
	610	980.54
	620	980.54
	650	981.27
	720	981.08
	750	981.9

512+50	Station	Elevation
50700	0	985
	110	984
	190	985
	240	997
	250	993
	270	985
	320	980
	340	980
	352	974
	360	970
	380	966.24
	410	970.64
	430	975
	460	980
	500	982

513+00	Station	Elevation
50650	0	985
	100	984
	150	983.71

	190	985
	220	986
	240	985
	280	983
	320	982
	330	980
	336	974
	340	970
	360	966.8
	380	967
	390	970
	406	974
	410	975
	430	976
	440	977
	450	980
	500	982.61

513+50	Station	Elevation
50600	0	985.03
	20	984
	330	981
	340	977
	344	974.2
	350	970
	380	966.6
	400	970
	410	972
	430	975
	440	976
	450	980
	461	981
	480	982

514+00	Station	Elevation
50550	0	984
	210	985
	280	984.1
	292	976.24
	300	971
	340	966
	350	970
	370	975
	390	978
	420	981
	480	982.7

Proposed conditions cross sections used in the HEC-RAS modeling from Elm Bridge to Lyman Bridge.

500+00

51948	Station	Elevation
	0	993
	698	990
	958	984.8
	981.4	983.73
	1006.5	983.32
	1049.2	984.38
	1099.7	985.83
	1111.5	975.7
	1112.1	975.18
	1112.4	974.93
	1112.5	974.84
	1113.5	973.98
	1124.5	970.5
	1141	970
	1143	969.8
	1158	970
	1171.5	971
	1173.5	971.5
	1181.5	978
	1183.5	978
	1191	983
	1192.5	985
	1194	985
	1196.9	985.33
	1232.9	985.05
	1254.2	984.07
	1264.8	984.38
	1278.2	983.98
	1315	983.04
	2188	985
	2348	986
	2523	985
	2993	982
	3213	985
	3548	990
	3698	995

500+50

51900	Station	Elevation
	0	985.5
	160	983
	172	975.5
	172.5	974.86
	173	974.21

180.5	970
209	967.5
216	967.5
234	969.5
239	970.5
239.8	970.5
247	975
267	983
375	982.5

501+00
51850

Station	Elevation
0	987
160	982
171	975
180	970
204	967.5
205.5	967.5
231	970.5
239	975
264	984
310	982
380	982.5

501+50
51800

Station	Elevation
0	984.5
150	983.5
169	975
180.5	969.5
184	969.3
193	968.5
209.5	968.5
227.5	970.5
235	975
251	981
370	981.05

502+00
51750

Station	Elevation
0	983.5
70	982
110	984.5
160	982
178	975
190	970.5

197	969.5
208.5	968.5
218.5	968.5
243.5	970.5
254	974.5
255	974.83
269	979.5
340	980.71
360	980.71
370	980.71

502+50

51700

Station	Elevation
0	982.76
110	979.11
170	978.06
250	978
256.5	978
265	975
271	970.5
281.25	970
293	969
309	969
318.5	969.5
330.5	970.5
334	973
340	975.15
350.75	979
355.5	979.5
420	980.66
430	980.66
440	980.66

503+00

51650

Station	Elevation
0	982.12
80	980.41
180	978.41
270	979.19
300	977.5
300.5	977.5
305.5	975
311.5	970.5
323	969.5
354	969.5
372	970.5
373.25	971.25

380.5	975
395	979
410	979.97
450	980.66
470	980.66
480	980.66

503+50

51600

Station	Elevation
0	983.29
90	981.33
180	979
300	981
320	978.63
347	976.88
350	977
357	977
363	976
365	975
371	970.5
382	969.5
417	969.5
432.5	970.5
440	974.08
441	974.49
443	975.31
452	979
490	980.56
500	980.56
510	980.56

504+50

51500

Station	Elevation
0	984
20	983
60	980
75	980
100	980
160	982
240	980.85
300	985
370	982
370.5	982
391	975
398	970.5
416	969.5
445	969.5

459	970.5
469.5	975.3
470	975.79
482	981
560	981.41
580	981.54
590	981.54

505+00

51450	Station	Elevation
	0	981
	44	976.6
	60	975
	80	980
	120	982
	210	985
	230	985.63
	290	988
	320	987
	340	985
	410	983.33
	421.5	982
	430	982
	440	976.68
	442	975.62
	443	975.09
	453.5	969.5
	494.5	968.5
	503	968
	515	973.29
	519	975.05
	520	975.49
	532.5	981
	590	982.03
	610	981.09
	620	981.09

505+50

51400	Station	Elevation
	0	981
	50	980
	60	975
	90	980
	130	982
	150	984
	260	986
	300	987

370	986
450	982
458	982
467	978
478	977.5
483	975
490	970.5
501	969.5
515	968.5
524	968.5
540	969.5
546	969.5
559	975.28
560	975.72
573	981.5
613	982
633	982
643	982

506+00
51350

Station	Elevation
0	979
40	978
50	975
70	980
140	985
280	986.5
400	985
460	983
470	982
479	982
492	975.5
493	975
495	974
497	973
500	970.5
508	969.5
525	968.5
536	968.5
557	974.5
558	974.69
559	974.88
560	975.08
575	978
582	980
642	982
702	982
722	981.97

732	981.97

506+50

51300

Station	Elevation
0	977
20	976
30	980
90	983
150	985
230	986.45
270	985
370	985.01
460	982
464.5	982
474	978
481.5	978
494	975
500	970.5
510	969.5
523.5	968.5
541	968.5
558.5	970.5
568	974.95
569	975.42
570	975.89
572	976.83
574.5	978
644.5	980.05
704.5	982
734.5	982.86
744.5	982.86

507+00

51250

Station	Elevation
0	983
90	983
250	985
390	983
450	982
460	981.5
468	981.5
476	981
481.5	978
500	978
505	974.88
506	974.25
507	973.63

512	970.5
533	968.5
549	968.5
562	969.5
570	970.5
579	975
589	978.5
629	979.04
679	981
729	983
739	983

507+50

51200	Station	Elevation
	0	983
	100	984.61
	420	984
	480	981.5
	486	981
	492	978
	508	978
	516	975
	523.5	970
	524	969.5
	540	968.5
	563.5	968.5
	583	969.5
	587	970
	597	970.5
	634	970.5
	635	974.25
	635.25	975.19
	636	978
	638	978
	640.5	978.5
	643	979
	646	980
	706	982
	746	983.35
	756	983.35
	766	983.35

508+00

51150	Station	Elevation
	0	983
	100	984.61
	380	984

420	983
480	982
500	981
510	980
517	980
532	978
540	975.43
546	973.5
550.5	970.5
554	969.5
575.5	967.5
584	967.5
603.5	969.5
616	975.24
618	976.16
622	978
692	980.95
712	982

508+50

51100

Station	Elevation
0	983
100	984.61
250	985
400	984
430	983
500	981
506.5	981
535	974.89
541.5	973.5
556.5	970.5
582	967.5
608	969.5
612	970.5
613.5	971.5
617	975
618	976
620	978
633	979
703	981
773	983

509+00

51050

Station	Elevation
0	984.61
240	985
400	984

420	983
423	983
436.5	978
443	978
451.5	976
452	975.86
453	975.57
455	975
462	973
478	970.5
490	969.5
503.5	967.5
507	966.5
516	965.5
527	969.5
539	975.17
540	975.64
545	978
565	979
615	980
665	981

509+50

51000

Station	Elevation
0	984.61
240	985
290	985.44
330	985
430	984
500	983
504.5	983
521.5	978
527.5	978
535	975.12
540.5	973
556	970.5
578	967.5
582	967.5
585	967.2
610.5	969.5
613.5	970
623	974.43
624	974.9
625	975.36
628.5	977
658.5	979.4
778.5	980

510+00

50950	Station	Elevation
	0	984.61
	200	983
	320	986
	380	984
	450	983
	500	982
	505	982
	513	982
	530	975.39
	531	975
	540	971.5
	564.5	968.5
	582	968.5
	597	969.5
	600	970
	610	974.67
	611	975.14
	615	977
	675	980
	715	980

510+50

50900	Station	Elevation
	0	984.61
	250	985
	320	989
	380	987
	410	982
	420	984
	480	983
	520	981.5
	520.5	981.5
	551.5	975
	559.5	970.5
	562	969.5
	570	968.5
	587	967.5
	617	969.5
	621	970.5
	630	974.8
	631	975.28
	632.5	976
	650.5	979
	760.5	980

511+00

50850	Station	Elevation
	0	984.61
	260	985
	280	983
	320	985
	340	991
	380	989
	390	987
	410	983
	420	981
	428.5	981
	440.5	977
	456	975
	461	973.5
	488	966.5
	517.5	969.5
	521	970.5
	528.5	975
	536	978
	542.5	978
	622.5	977
	662.5	979

511+50

50800	Station	Elevation
	0	984.61
	310	985
	330	990
	340	994
	390	991
	410	982
	450	979
	490	980.5
	497	980.5
	513.5	975
	522.5	970
	547	967.5
	552	967.5
	577	969
	581.5	970.5
	589	975
	597	978
	617	980
	667	980

512+00

50750	Station	Elevation
	0	984.61
	300	984
	340	984.4
	350	996
	370	996.09
	420	989.3
	440	980
	480	980
	486	980
	491	979.5
	498	975.18
	500	973.94
	508	969
	515	968.5
	541	968.5
	553	969.5
	561	970.5
	570	975
	583	980
	603	980.54
	613	980.54
	623	980.54
	653	981.27
	723	981.08
	753	981.9

512+50

50700	Station	Elevation
	0	985
	110	984
	190	985
	240	997
	250	993
	270	985
	320	980
	340	980
	343	980
	348	979.5
	354	975.5
	354.5	975.17
	355	974.83
	363	969.5
	378	968.5
	399.5	968.5
	421	970.5
	428	975

440	976
453.5	980
455	980
495	982

513+00

50650

Station	Elevation
0	985
100	984
150	983.71
190	985
220	986
240	985
280	983
320	982
330	981
334.5	981
340	979.5
347	975.07
349	973.81
350	973.18
359	967.5
391	967.5
395	968.5
402.5	969.5
409	970.5
418	975
437.5	978.5
451.5	978.5
461.5	980
511.5	982.61

513+50

50600

Station	Elevation
0	985.03
20	984
330	981
335.5	981
340.5	979.5
347.5	975.12
348	974.81
348.5	974.5
356.5	969.5
372.5	967.5
376	966.5
383	966.5
396	968.5

400	968.5
404	969.5
405.5	969.5
407	970.5
433	975.05
434	975.22
435	975.39
437	975.74
438.5	976
454	980.5
465	981
484	982

514+00

50550	Station	Elevation
	0	984
	210	985
	280	984
	283	984
	292	978.78
	295	977.04
	298	975.3
	298.5	975.01
	299	974.72
	308	969.5
	331	966.5
	333	966.5
	354	969.5
	366	973
	378	975.18
	379	975.36
	380	975.54
	384	976.27
	388	977
	401.5	981
	461.5	982.7

Manning's n used in the HEC-RAS modeling.

XS in HEC-RAS	Right overbank	Channel	Left overbank
55258-52935	0.052	0.025	0.052
52921-52000	0.052	0.033	0.052
51948-49633	0.052	0.025	0.052
49588-49133	0.0575	0.025	0.0575
49078-47603	0.0575	0.02	0.0575
47566-44718	0.0576	0.02	0.0576
44468-44218	0.058	0.02	0.058
43958	0.0576	0.02	0.0576
39618-0	0.0425	0.02	0.0425

Profile Output Table - Standard Table 3
HEC-RAS Plan: Housatonic small scale existing n=0.033 output

Rivers 1
Hydraulic Reaches = 1
River Stations = 227
Plans 1
Profiles 12

Reach	River St	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Shear Chan (lb/sq ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	0	14492	948.3	954.11	1.17	956.36	0.003481	13.5	1570.85	393.82	0.99
Reach-1	0	12028	948.3	954.01	0.85	955.63	0.002563	11.45	1530.62	389.33	0.85
Reach-1	0	7270	948.3	952.65	0.99	954.84	0.003869	11.87	612.57	307.91	1.01
Reach-1	0	5543	948.3	951.93	0.88	953.76	0.004065	10.85	510.87	293.99	1.01
Reach-1	0	3402	948.3	950.92	0.71	952.25	0.004461	9.23	368.61	274.48	1.01
Reach-1	0	2926	948.3	950.68	0.66	951.87	0.004574	8.77	333.76	269.7	1
Reach-1	0	2775	948.3	950.59	0.64	951.75	0.004632	8.62	321.95	268.07	1
Reach-1	0	2679	948.3	950.54	0.63	951.67	0.004667	8.52	314.42	267.04	1
Reach-1	0	2364	948.3	950.36	0.6	951.4	0.004798	8.18	288.97	263.54	1.01
Reach-1	0	1622	948.3	949.9	0.51	950.71	0.005162	7.21	224.93	180.45	1
Reach-1	0	764	948.3	949.27	0.36	949.76	0.006047	5.62	136.05	172.95	1.01
Reach-1	0	222	948.3	948.73	0.21	948.94	0.007903	3.72	59.62	166.49	1.01
Reach-1	35213	14492	951.76	966.02	0.06	966.07	0.000091	3.52	10428.48	1470.11	0.18
Reach-1	35213	12028	951.76	965.13	0.06	965.18	0.000095	3.41	9125.74	1465.64	0.18
Reach-1	35213	7270	951.76	963.63	0.04	963.67	0.00008	2.83	6941.28	1458.17	0.17
Reach-1	35213	5543	951.76	962.8	0.04	962.84	0.000082	2.69	5729.5	1454.01	0.17
Reach-1	35213	3402	951.76	961.62	0.04	961.66	0.000085	2.47	4015.15	1448.1	0.16
Reach-1	35213	2926	951.76	961.32	0.04	961.36	0.000086	2.41	3579.9	1446.59	0.16
Reach-1	35213	2775	951.76	961.22	0.03	961.26	0.000086	2.39	3435.83	1446.1	0.16
Reach-1	35213	2679	951.76	961.15	0.03	961.19	0.000086	2.38	3340.96	1445.77	0.16
Reach-1	35213	2364	951.76	960.93	0.03	960.98	0.000087	2.33	3023.67	1444.67	0.16
Reach-1	35213	1622	951.76	960.3	0.03	960.35	0.000087	2.17	2136.36	1345.16	0.16
Reach-1	35213	764	951.76	959.1	0.02	959.15	0.000083	1.9	807.84	780.44	0.15
Reach-1	35213	222	951.76	956.42	0.01	956.45	0.000063	1.27	174.58	53.88	0.12
Reach-1	36688	14492	952.7	966.13	0.05	966.18	0.000067	3.08	11740.73	1686.13	0.16
Reach-1	36688	12028	952.7	965.25	0.05	965.3	0.00007	2.98	10251.66	1685.25	0.16
Reach-1	36688	7270	952.7	963.74	0.03	963.77	0.00006	2.49	7701.37	1683.74	0.15
Reach-1	36688	5543	952.7	962.91	0.03	962.94	0.000062	2.37	6305.11	1682.91	0.14
Reach-1	36688	3402	952.7	961.73	0.03	961.76	0.000061	2.13	4328.76	1643.65	0.14
Reach-1	36688	2926	952.7	961.43	0.02	961.46	0.000059	2.03	3842.13	1601.36	0.14
Reach-1	36688	2775	952.7	961.33	0.02	961.36	0.000058	2	3683.61	1587.34	0.14
Reach-1	36688	2679	952.7	961.26	0.02	961.3	0.000057	1.98	3580.15	1578.13	0.13
Reach-1	36688	2364	952.7	961.04	0.02	961.08	0.000055	1.89	3237.83	1547.24	0.13
Reach-1	36688	1622	952.7	960.41	0.02	960.44	0.000048	1.65	2327.25	1329.12	0.12
Reach-1	36688	764	952.7	959.21	0.01	959.23	0.000035	1.25	1068.19	688.32	0.1
Reach-1	36688	222	952.7	956.51	0.01	956.52	0.000041	0.91	244.44	92.54	0.1
Reach-1	37238	14492	952.6	966.07	0.13	966.29	0.00018	5.03	6306.67	1013.51	0.26
Reach-1	37238	12028	952.6	965.19	0.12	965.41	0.000186	4.86	5417.98	1007.35	0.26
Reach-1	37238	7270	952.6	963.7	0.09	963.86	0.000154	3.99	3919.02	996.88	0.23
Reach-1	37238	5543	952.6	962.87	0.08	963.03	0.000151	3.72	3099.99	991.12	0.23
Reach-1	37238	3402	952.6	961.71	0.06	961.84	0.000129	3.1	1965.43	903.86	0.2

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Reach-1	37238	2926	952.6	961.42	0.05	961.53	0.000117	2.87	1712.35	820.96	0.19
Reach-1	37238	2775	952.6	961.32	0.05	961.43	0.000113	2.79	1633.87	793.49	0.19
Reach-1	37238	2679	952.6	961.26	0.05	961.36	0.00011	2.74	1583.69	775.42	0.19
Reach-1	37238	2364	952.6	961.04	0.04	961.14	0.0001	2.55	1424.01	714.88	0.18
Reach-1	37238	1622	952.6	960.42	0.03	960.48	0.000073	2.04	1034.46	539.4	0.15
Reach-1	37238	764	952.6	959.22	0.01	959.25	0.000037	1.26	650.37	207.65	0.1
Reach-1	37238	222	952.6	956.53	0.01	956.54	0.000038	0.82	271.43	114	0.09
Reach-1	37588	14492	952.8	965.87	0.4	966.61	0.00064	8.71	3294.08	578.31	0.48
Reach-1	37588	12028	952.8	964.99	0.38	965.72	0.000673	8.42	2795.53	565.46	0.48
Reach-1	37588	7270	952.8	963.56	0.27	964.1	0.000554	6.85	1998.72	544.29	0.42
Reach-1	37588	5543	952.8	962.74	0.24	963.25	0.000552	6.37	1559.92	532.27	0.42
Reach-1	37588	3402	952.8	961.61	0.18	962.01	0.000469	5.31	979.26	486.74	0.37
Reach-1	37588	2926	952.8	961.32	0.15	961.68	0.000429	4.94	842.3	477.83	0.36
Reach-1	37588	2775	952.8	961.23	0.15	961.57	0.000414	4.81	797.78	474.9	0.35
Reach-1	37588	2679	952.8	961.17	0.14	961.5	0.000404	4.72	768.71	472.98	0.34
Reach-1	37588	2364	952.8	960.97	0.12	961.26	0.000365	4.4	673.35	460.06	0.33
Reach-1	37588	1622	952.8	960.38	0.08	960.57	0.000251	3.44	473.49	148.64	0.27
Reach-1	37588	764	952.8	959.22	0.03	959.29	0.000121	2.08	367.51	88.12	0.18
Reach-1	37588	222	952.8	956.55	0.02	956.58	0.000213	1.58	140.58	79.45	0.21
Reach-1	38568	13000	953.87	966.63	0.31	967.18	0.000499	7.75	3691.74	726.33	0.42
Reach-1	38568	10790	953.87	965.76	0.32	966.34	0.000549	7.66	3062.57	717.61	0.44
Reach-1	38568	6521	953.87	964.09	0.28	964.66	0.000585	6.96	1879.05	700.93	0.44
Reach-1	38568	4972	953.87	963.28	0.25	963.82	0.00059	6.49	1354.49	571.7	0.43
Reach-1	38568	3052	953.87	962.08	0.19	962.5	0.000526	5.41	798.56	359.83	0.4
Reach-1	38568	2625	953.87	961.76	0.16	962.14	0.000485	5.05	690.19	313.23	0.38
Reach-1	38568	2489	953.87	961.65	0.16	962.01	0.000468	4.91	657.03	298.87	0.37
Reach-1	38568	2404	953.87	961.58	0.15	961.93	0.000458	4.83	636.08	289.43	0.37
Reach-1	38568	2120	953.87	961.34	0.13	961.65	0.000417	4.52	569.76	257.29	0.35
Reach-1	38568	1455	953.87	960.64	0.09	960.84	0.000311	3.65	421.98	164.42	0.3
Reach-1	38568	686	953.87	959.35	0.04	959.43	0.00017	2.34	293.14	76.75	0.21
Reach-1	38568	199	953.87	956.75	0.03	956.79	0.00021	1.73	115.15	56.05	0.21
Reach-1	38966	13000	954.3	964.83	1.75	969.59	0.003575	17.51	742.58	78.77	1
Reach-1	38966	10790	954.3	963.74	1.59	967.93	0.003583	16.41	657.48	78.65	1
Reach-1	38966	6521	954.3	963.76	0.58	965.28	0.001301	9.9	658.8	78.65	0.6
Reach-1	38966	4972	954.3	963.25	0.39	964.25	0.000921	8.04	618.24	78.59	0.51
Reach-1	38966	3052	954.3	962.24	0.2	962.74	0.000531	5.66	539.32	78.47	0.38
Reach-1	38966	2625	954.3	961.93	0.16	962.33	0.000455	5.1	514.66	78.44	0.35
Reach-1	38966	2489	954.3	961.82	0.15	962.19	0.000431	4.92	506.01	78.43	0.34
Reach-1	38966	2404	954.3	961.74	0.15	962.1	0.000417	4.81	500.3	78.42	0.34
Reach-1	38966	2120	954.3	961.5	0.12	961.8	0.000366	4.41	481.26	78.39	0.31
Reach-1	38966	1455	954.3	960.78	0.08	960.96	0.000256	3.43	424.45	78.31	0.26
Reach-1	38966	686	954.3	959.43	0.03	959.5	0.000142	2.15	318.86	78.15	0.19
Reach-1	38966	199	954.3	956.85	0.03	956.89	0.000302	1.69	117.87	77.85	0.24
Reach-1	38988 Bridge										
Reach-1	39010	13000	954.3	966.17	1.29	969.82	0.002378	15.32	848.73	78.93	0.82
Reach-1	39010	10790	954.3	964.89	1.18	968.13	0.002409	14.43	747.98	78.78	0.83
Reach-1	39010	6521	954.3	963.86	0.56	965.34	0.001256	9.79	666.37	78.66	0.59
Reach-1	39010	4972	954.3	963.3	0.38	964.29	0.000901	7.99	622.59	78.6	0.5
Reach-1	39010	3052	954.3	962.27	0.2	962.76	0.000525	5.64	541.23	78.48	0.38
Reach-1	39010	2625	954.3	961.95	0.16	962.35	0.00045	5.08	516.27	78.44	0.35

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Reach-1	39010	2489	954.3	961.84	0.15	962.21	0.000427	4.9	507.52	78.43	0.34
Reach-1	39010	2404	954.3	961.77	0.15	962.12	0.000412	4.79	502.29	78.42	0.33
Reach-1	39010	2120	954.3	961.52	0.12	961.82	0.000362	4.39	483.01	78.39	0.31
Reach-1	39010	1455	954.3	960.78	0.08	960.96	0.000256	3.43	424.62	78.31	0.26
Reach-1	39010	686	954.3	959.43	0.03	959.5	0.000142	2.15	318.93	78.15	0.19
Reach-1	39010	199	954.3	956.87	0.03	956.91	0.000291	1.67	119.29	77.85	0.24
Reach-1	39108	13000	953.5	969.14	0.36	970.16	0.000451	8.59	2165.62	322.85	0.41
Reach-1	39108	10790	953.5	967.34	0.38	968.44	0.00056	8.69	1615.64	286.77	0.45
Reach-1	39108	6521	953.5	964.58	0.31	965.49	0.000517	7.63	854.1	165.37	0.42
Reach-1	39108	4972	953.5	963.76	0.22	964.39	0.000399	6.34	784.62	122.72	0.37
Reach-1	39108	3052	953.5	962.5	0.12	962.81	0.000246	4.51	676.86	101.59	0.28
Reach-1	39108	2625	953.5	962.14	0.1	962.39	0.000212	4.06	646.33	95.6	0.26
Reach-1	39108	2489	953.5	962.01	0.09	962.25	0.000201	3.91	635.81	93.54	0.25
Reach-1	39108	2404	953.5	961.94	0.09	962.16	0.000194	3.82	629.46	93.07	0.25
Reach-1	39108	2120	953.5	961.67	0.07	961.86	0.000171	3.5	606.43	91.95	0.23
Reach-1	39108	1455	953.5	960.87	0.05	960.98	0.00012	2.7	538.72	88.63	0.19
Reach-1	39108	686	953.5	959.47	0.02	959.51	0.00006	1.63	419.87	83.94	0.13
Reach-1	39108	199	953.5	956.9	0.01	956.91	0.000044	0.94	210.76	78.8	0.1
Reach-1	39408	13000	954.19	969.97	0.16	970.32	0.000215	5.65	4354.71	684.13	0.29
Reach-1	39408	10790	954.19	968.19	0.19	968.63	0.000305	6.06	3187.51	628.56	0.33
Reach-1	39408	6521	954.19	965.07	0.25	965.68	0.00058	6.53	1360.19	456.48	0.43
Reach-1	39408	4972	954.19	963.95	0.24	964.54	0.000667	6.25	939.24	301.05	0.45
Reach-1	39408	3052	954.19	962.54	0.18	962.95	0.00066	5.18	600.58	177.1	0.43
Reach-1	39408	2625	954.19	962.16	0.17	962.53	0.000655	4.87	539.94	144.06	0.42
Reach-1	39408	2489	954.19	962.03	0.16	962.38	0.000654	4.77	522.08	132.77	0.42
Reach-1	39408	2404	954.19	961.95	0.16	962.3	0.000644	4.7	511.96	128.85	0.42
Reach-1	39408	2120	954.19	961.67	0.14	961.98	0.00059	4.45	476.49	121.77	0.4
Reach-1	39408	1455	954.19	960.86	0.1	961.08	0.000442	3.77	385.63	101.41	0.34
Reach-1	39408	686	954.19	959.46	0.05	959.56	0.000228	2.58	265.81	74.95	0.24
Reach-1	39408	199	954.19	956.9	0.03	956.95	0.000258	1.91	104.35	51.14	0.24
Reach-1	39486	13000	955.1	968.99	0.61	970.79	0.000939	10.81	1299	188.3	0.52
Reach-1	39486	10790	955.1	967.38	0.57	969.03	0.000976	10.3	1054.67	116.21	0.53
Reach-1	39486	6521	955.1	964.87	0.36	965.85	0.000756	7.95	820.55	90	0.46
Reach-1	39486	4972	955.1	963.92	0.27	964.63	0.000618	6.76	735.44	90	0.42
Reach-1	39486	3052	955.1	962.62	0.15	963	0.000402	4.94	618.38	90	0.33
Reach-1	39486	2625	955.1	962.26	0.13	962.57	0.000352	4.48	585.97	90	0.31
Reach-1	39486	2489	955.1	962.14	0.12	962.43	0.000337	4.33	574.76	90	0.3
Reach-1	39486	2404	955.1	962.06	0.11	962.34	0.000326	4.23	567.91	90	0.3
Reach-1	39486	2120	955.1	961.78	0.1	962.02	0.000293	3.91	542.76	90	0.28
Reach-1	39486	1455	955.1	960.96	0.06	961.11	0.00022	3.1	468.85	90	0.24
Reach-1	39486	686	955.1	959.51	0.03	959.58	0.000139	2.03	338.76	90	0.18
Reach-1	39486	199	955.1	956.93	0.04	956.98	0.000526	1.88	105.77	90	0.31
Reach-1	39503 Bridge										
Reach-1	39520	13000	955.1	971.07	0.41	972.28	0.000565	9.03	1786.98	281.6	0.41
Reach-1	39520	10790	955.1	969.89	0.35	970.94	0.000518	8.3	1486.79	228.76	0.39
Reach-1	39520	6521	955.1	964.9	0.36	965.87	0.000749	7.92	823.08	90	0.46
Reach-1	39520	4972	955.1	963.95	0.27	964.65	0.000612	6.74	738	90	0.41
Reach-1	39520	3052	955.1	962.64	0.15	963.02	0.000398	4.92	620.06	90	0.33
Reach-1	39520	2625	955.1	962.26	0.13	962.57	0.000352	4.48	586.21	90	0.31
Reach-1	39520	2489	955.1	962.14	0.12	962.43	0.000336	4.33	574.97	90	0.3

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Reach-1	39520	2404	955.1	962.06	0.11	962.34	0.000326	4.23	568.14	90	0.3
Reach-1	39520	2120	955.1	961.78	0.1	962.02	0.000293	3.9	542.94	90	0.28
Reach-1	39520	1455	955.1	960.96	0.06	961.11	0.00022	3.1	469.02	90	0.24
Reach-1	39520	686	955.1	959.52	0.03	959.58	0.000139	2.02	338.85	90	0.18
Reach-1	39520	199	955.1	956.96	0.04	957.01	0.000477	1.83	108.93	90	0.29
Reach-1	39618	13000	953.1	972.24	0.07	972.4	0.000071	3.76	5609.35	621.78	0.17
Reach-1	39618	10790	953.1	970.9	0.06	971.04	0.000072	3.54	4811.83	559.32	0.17
Reach-1	39618	6521	953.1	965.77	0.09	965.98	0.000168	3.98	2361.32	439.12	0.24
Reach-1	39618	4972	953.1	964.54	0.08	964.74	0.000182	3.74	1828.79	427.6	0.24
Reach-1	39618	3052	953.1	962.92	0.06	963.06	0.000179	3.14	1182.52	344.78	0.23
Reach-1	39618	2625	953.1	962.49	0.06	962.62	0.000176	2.96	1040.07	313.68	0.23
Reach-1	39618	2489	953.1	962.34	0.06	962.47	0.000175	2.89	996.19	303.46	0.22
Reach-1	39618	2404	953.1	962.26	0.05	962.38	0.000173	2.85	970.17	297.24	0.22
Reach-1	39618	2120	953.1	961.94	0.05	962.05	0.000169	2.69	880.42	275.39	0.22
Reach-1	39618	1455	953.1	961.05	0.04	961.14	0.000163	2.31	658.91	222.56	0.21
Reach-1	39618	686	953.1	959.54	0.02	959.58	0.000061	1.64	418.31	83.92	0.13
Reach-1	39618	199	953.1	957.01	0.01	957.03	0.000043	0.93	213.86	78	0.1
Reach-1	43958	13000	953.5	972.64	0.06	972.71	0.000068	3.5	11008.9	1197.67	0.16
Reach-1	43958	10790	953.5	971.3	0.06	971.37	0.000074	3.43	9411.39	1186.73	0.16
Reach-1	43958	6521	953.5	966.67	0.13	966.87	0.000259	4.91	4003	1148.89	0.29
Reach-1	43958	4972	953.5	965.53	0.14	965.77	0.000311	4.92	2742.94	1021.85	0.31
Reach-1	43958	3052	953.5	963.89	0.13	964.13	0.000332	4.51	1483.39	599.43	0.31
Reach-1	43958	2625	953.5	963.44	0.12	963.66	0.000321	4.28	1241.05	469.79	0.3
Reach-1	43958	2489	953.5	963.28	0.11	963.5	0.000318	4.21	1172.75	436.58	0.3
Reach-1	43958	2404	953.5	963.19	0.11	963.4	0.000316	4.17	1131.81	425.56	0.3
Reach-1	43958	2120	953.5	962.85	0.1	963.04	0.000304	3.97	993.16	375.45	0.29
Reach-1	43958	1455	953.5	961.91	0.08	962.08	0.000285	3.52	690.77	306.52	0.27
Reach-1	43958	686	953.5	959.99	0.07	960.13	0.000328	2.98	252.61	156.54	0.28
Reach-1	43958	199	953.5	957.36	0.04	957.44	0.000309	2.28	87.25	35.22	0.26
Reach-1	44218.*	13000	954.81	972.59	0.12	972.76	0.000137	4.97	7333.99	833.87	0.23
Reach-1	44218.*	10790	954.81	971.25	0.12	971.43	0.000149	4.88	6223.9	823.6	0.23
Reach-1	44218.*	6521	954.81	966.53	0.28	967.07	0.000548	7.01	2429.64	785.17	0.42
Reach-1	44218.*	4972	954.81	965.33	0.32	966.03	0.000737	7.37	1494.03	755.18	0.47
Reach-1	44218.*	3052	954.81	963.75	0.26	964.36	0.000737	6.46	671.24	245.03	0.46
Reach-1	44218.*	2625	954.81	963.32	0.24	963.88	0.000707	6.11	568.21	230.96	0.45
Reach-1	44218.*	2489	954.81	963.18	0.23	963.71	0.000694	5.98	535.65	226.74	0.44
Reach-1	44218.*	2404	954.81	963.09	0.23	963.61	0.000684	5.89	515.7	224.11	0.44
Reach-1	44218.*	2120	954.81	962.78	0.2	963.25	0.000646	5.57	451.69	164.88	0.42
Reach-1	44218.*	1455	954.81	961.9	0.15	962.23	0.000534	4.63	322.6	105.38	0.38
Reach-1	44218.*	686	954.81	960.06	0.1	960.25	0.000505	3.51	195.52	61.21	0.35
Reach-1	44218.*	199	954.81	957.43	0.11	957.61	0.001045	3.35	59.36	34.72	0.45
Reach-1	44468	13000	956.07	972.37	0.28	972.93	0.000336	7.68	4024.76	470.58	0.36
Reach-1	44468	10790	956.07	971.04	0.27	971.59	0.000362	7.47	3398.17	469.37	0.37
Reach-1	44468	6521	956.07	966.09	0.62	967.56	0.001323	10.36	1158.39	432.86	0.64
Reach-1	44468	4972	956.07	965.01	0.61	966.53	0.001515	10.07	693.93	423.99	0.67
Reach-1	44468	3052	956.07	963.75	0.39	964.69	0.001142	7.76	398.99	83.19	0.57
Reach-1	44468	2625	956.07	963.37	0.34	964.16	0.001048	7.16	369.4	73.26	0.54
Reach-1	44468	2489	956.07	963.24	0.32	963.99	0.001012	6.95	359.89	72.32	0.53
Reach-1	44468	2404	956.07	963.15	0.31	963.88	0.000989	6.82	353.96	71.73	0.52
Reach-1	44468	2120	956.07	962.85	0.27	963.49	0.000913	6.38	332.88	68.87	0.5
Reach-1	44468	1455	956.07	961.99	0.19	962.42	0.000745	5.26	276.57	63.15	0.44

HEC-RAS Plan: Housatonic small scale existing n=0.033 output

Reach-1	44468	686	956.07	960.16	0.14	960.43	0.000822	4.16	164.95	58.89	0.44
Reach-1	44468	199	956.07	957.75	0.28	958.14	0.004325	5.01	39.73	37.86	0.86
Reach-1	44718	8721	957.33	971.86	0.46	973.29	0.00059	9.75	1030.1	89	0.47
Reach-1	44718	7239	957.33	970.7	0.4	971.89	0.000554	8.9	926.4	89	0.45
Reach-1	44718	4375	957.33	966.89	0.36	967.86	0.000727	7.95	587.23	88.8	0.48
Reach-1	44718	3336	957.33	966.17	0.26	966.86	0.000571	6.65	524.6	86.12	0.42
Reach-1	44718	2047	957.33	964.52	0.17	964.94	0.000479	5.21	397.46	69.79	0.37
Reach-1	44718	1761	957.33	964.02	0.15	964.39	0.000465	4.88	363.27	67.89	0.36
Reach-1	44718	1670	957.33	963.86	0.15	964.21	0.00046	4.77	352.05	67.26	0.36
Reach-1	44718	1612	957.33	963.75	0.14	964.09	0.000456	4.69	345.05	66.86	0.36
Reach-1	44718	1422	957.33	963.38	0.13	963.69	0.000446	4.45	320.52	65.44	0.35
Reach-1	44718	976	957.33	962.36	0.1	962.58	0.000419	3.82	255.7	61.2	0.33
Reach-1	44718	460	957.33	960.46	0.08	960.62	0.000541	3.18	144.72	56.55	0.35
Reach-1	44718	134	957.33	958.7	0.09	958.82	0.00145	2.73	49.04	51.53	0.49
Reach-1	44778	8721	957.51	971.91	0.46	973.33	0.000603	9.63	980.74	82.3	0.47
Reach-1	44778	7239	957.51	970.74	0.39	971.93	0.000574	8.81	884.21	82.3	0.46
Reach-1	44778	4375	957.51	966.94	0.37	967.92	0.000798	7.98	571.36	82.3	0.5
Reach-1	44778	3336	957.51	966.19	0.27	966.89	0.00065	6.74	511.18	78.78	0.45
Reach-1	44778	2047	957.51	964.52	0.19	964.98	0.00057	5.41	383.45	73.29	0.4
Reach-1	44778	1761	957.51	964.02	0.17	964.42	0.00057	5.12	347.06	71.36	0.4
Reach-1	44778	1670	957.51	963.85	0.17	964.24	0.00057	5.02	335.22	70.72	0.4
Reach-1	44778	1612	957.51	963.75	0.17	964.13	0.000568	4.95	327.89	70.32	0.4
Reach-1	44778	1422	957.51	963.38	0.15	963.72	0.000569	4.72	302.15	68.91	0.39
Reach-1	44778	976	957.51	962.36	0.13	962.63	0.000598	4.17	233.85	64.8	0.39
Reach-1	44778	460	957.51	960.46	0.12	960.68	0.00085	3.74	123.05	52.84	0.43
Reach-1	44778	134	957.51	958.77	0.16	958.97	0.003379	3.59	37.29	48.97	0.73
Reach-1	44818	8721	957.37	971.91	0.48	973.37	0.000715	9.74	932.99	79.5	0.49
Reach-1	44818	7239	957.37	970.73	0.42	971.96	0.000675	8.94	839.58	79.5	0.47
Reach-1	44818	4375	957.37	966.92	0.4	967.97	0.000928	8.22	537.28	77.8	0.53
Reach-1	44818	3336	957.37	966.2	0.3	966.95	0.000752	6.95	481.63	75.1	0.47
Reach-1	44818	2047	957.37	964.52	0.21	965.02	0.000658	5.64	362.95	67.55	0.43
Reach-1	44818	1761	957.37	964.01	0.19	964.46	0.000651	5.35	328.93	65.92	0.42
Reach-1	44818	1670	957.37	963.85	0.19	964.28	0.000648	5.25	317.95	65.38	0.42
Reach-1	44818	1612	957.37	963.74	0.18	964.16	0.000643	5.18	311.2	65.05	0.42
Reach-1	44818	1422	957.37	963.38	0.17	963.76	0.000634	4.95	287.45	63.87	0.41
Reach-1	44818	976	957.37	962.36	0.14	962.65	0.000632	4.36	224.04	60.61	0.4
Reach-1	44818	460	957.37	960.47	0.14	960.72	0.001081	3.98	115.52	54.49	0.48
Reach-1	44818	134	957.37	958.91	0.13	959.08	0.002009	3.33	40.19	39.9	0.59
Reach-1	44863	8721	957.3	971.89	0.52	973.43	0.000781	10.02	930.94	100.45	0.5
Reach-1	44863	7239	957.3	970.73	0.44	972.02	0.000729	9.17	825.23	80.95	0.48
Reach-1	44863	4375	957.3	966.95	0.41	968.02	0.000954	8.31	531.05	74.92	0.53
Reach-1	44863	3336	957.3	966.21	0.3	966.98	0.000764	7.01	477.01	71.24	0.47
Reach-1	44863	2047	957.3	964.57	0.2	965.05	0.000631	5.58	366.77	64.44	0.41
Reach-1	44863	1761	957.3	964.06	0.19	964.49	0.000616	5.26	334.48	63.31	0.4
Reach-1	44863	1670	957.3	963.89	0.18	964.31	0.00061	5.15	323.99	62.94	0.4
Reach-1	44863	1612	957.3	963.79	0.17	964.19	0.000604	5.08	317.52	62.71	0.4
Reach-1	44863	1422	957.3	963.42	0.16	963.79	0.000589	4.83	294.67	61.88	0.39
Reach-1	44863	976	957.3	962.41	0.13	962.68	0.000568	4.19	233.01	59.63	0.37
Reach-1	44863	460	957.3	960.56	0.12	960.76	0.000875	3.66	125.83	56.08	0.43
Reach-1	44863	134	957.3	959.03	0.12	959.19	0.002456	3.14	42.69	53.16	0.62

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Reach-1	44918	8721	957.23	972.17	0.44	973.5	0.000626	9.28	979.61	80.8	0.45
Reach-1	44918	7239	957.23	970.96	0.38	972.07	0.000589	8.51	881.53	80.8	0.44
Reach-1	44918	4375	957.23	967.19	0.34	968.09	0.000741	7.61	579.16	77.25	0.47
Reach-1	44918	3336	957.23	966.38	0.25	967.03	0.000606	6.46	517.58	74.78	0.42
Reach-1	44918	2047	957.23	964.67	0.17	965.09	0.000495	5.15	397.57	67.01	0.37
Reach-1	44918	1761	957.23	964.16	0.15	964.53	0.000475	4.84	363.67	65.26	0.36
Reach-1	44918	1670	957.23	963.99	0.15	964.34	0.000468	4.73	352.71	64.77	0.36
Reach-1	44918	1612	957.23	963.89	0.14	964.23	0.000462	4.66	345.93	64.51	0.35
Reach-1	44918	1422	957.23	963.52	0.13	963.82	0.000445	4.42	322.08	63.57	0.35
Reach-1	44918	976	957.23	962.49	0.1	962.71	0.00041	3.78	258.2	60.99	0.32
Reach-1	44918	460	957.23	960.65	0.08	960.8	0.000488	3.06	150.21	56.62	0.33
Reach-1	44918	134	957.23	959.18	0.04	959.24	0.000465	1.92	69.9	52.24	0.29
Reach-1	44963	8721	957.43	972.17	0.45	973.53	0.000689	9.36	945.01	83.57	0.47
Reach-1	44963	7239	957.43	970.95	0.4	972.11	0.000661	8.63	846.18	80.17	0.46
Reach-1	44963	4375	957.43	967.17	0.38	968.15	0.000928	7.96	549.88	76.25	0.52
Reach-1	44963	3336	957.43	966.36	0.29	967.08	0.000766	6.83	488.7	74.32	0.47
Reach-1	44963	2047	957.43	964.65	0.2	965.13	0.000636	5.55	368.59	66.8	0.42
Reach-1	44963	1761	957.43	964.14	0.19	964.57	0.000624	5.26	334.81	65.1	0.41
Reach-1	44963	1670	957.43	963.97	0.18	964.39	0.000619	5.16	323.89	64.55	0.41
Reach-1	44963	1612	957.43	963.87	0.18	964.27	0.000614	5.08	317.16	64.2	0.4
Reach-1	44963	1422	957.43	963.5	0.16	963.86	0.0006	4.84	293.54	62.97	0.4
Reach-1	44963	976	957.43	962.47	0.13	962.75	0.000579	4.23	230.86	59.5	0.38
Reach-1	44963	460	957.43	960.64	0.11	960.84	0.000771	3.58	128.32	53.43	0.41
Reach-1	44963	134	957.43	959.18	0.08	959.28	0.001218	2.58	51.91	51.05	0.45
Reach-1	45013	8721	956.32	972.5	0.36	973.58	0.000511	8.37	1059.97	87.43	0.41
Reach-1	45013	7239	956.32	971.25	0.31	972.16	0.000484	7.69	951.74	85.41	0.39
Reach-1	45013	4375	956.32	967.49	0.27	968.21	0.000595	6.81	642.72	79.37	0.42
Reach-1	45013	3336	956.32	966.6	0.2	967.13	0.000496	5.83	572.16	78.8	0.38
Reach-1	45013	2047	956.32	964.83	0.14	965.17	0.000389	4.67	438.76	71.05	0.33
Reach-1	45013	1761	956.32	964.31	0.12	964.61	0.000378	4.38	401.76	70.3	0.32
Reach-1	45013	1670	956.32	964.14	0.12	964.42	0.000373	4.29	389.65	70.05	0.32
Reach-1	45013	1612	956.32	964.03	0.12	964.31	0.000369	4.22	382.09	69.9	0.32
Reach-1	45013	1422	956.32	963.65	0.11	963.9	0.000359	4	355.51	69.35	0.31
Reach-1	45013	976	956.32	962.6	0.08	962.78	0.000327	3.44	284	65.38	0.29
Reach-1	45013	460	956.32	960.77	0.06	960.88	0.000316	2.66	173.03	58.1	0.27
Reach-1	45013	134	956.32	959.28	0.02	959.31	0.000211	1.5	89.41	53.41	0.2
Reach-1	45073	8721	956.84	972.34	0.46	973.71	0.000696	9.4	943.71	84.3	0.48
Reach-1	45073	7239	956.84	971.1	0.41	972.28	0.00068	8.72	840.27	82.77	0.47
Reach-1	45073	4375	956.84	967.33	0.4	968.36	0.001002	8.15	536.76	78.1	0.55
Reach-1	45073	3336	956.84	966.47	0.32	967.25	0.000879	7.1	470	76.64	0.51
Reach-1	45073	2047	956.84	964.72	0.24	965.27	0.00082	5.98	342.35	69.25	0.47
Reach-1	45073	1761	956.84	964.19	0.23	964.71	0.000831	5.74	306.86	66.88	0.47
Reach-1	45073	1670	956.84	964.02	0.22	964.52	0.000831	5.65	295.48	65.95	0.47
Reach-1	45073	1612	956.84	963.92	0.22	964.4	0.000829	5.59	288.48	65.38	0.47
Reach-1	45073	1422	956.84	963.54	0.21	963.99	0.000826	5.38	264.19	63.35	0.46
Reach-1	45073	976	956.84	962.5	0.18	962.87	0.000842	4.85	201.42	57.78	0.46
Reach-1	45073	460	956.84	960.67	0.17	960.97	0.001272	4.4	104.47	47.91	0.53
Reach-1	45073	134	956.84	959.23	0.1	959.37	0.001366	3.08	43.55	36.27	0.49
Reach-1	45123	8721	957.45	972.47	0.43	973.75	0.000663	9.11	994.24	96.97	0.47
Reach-1	45123	7239	957.45	971.2	0.39	972.32	0.000658	8.49	872.16	95.45	0.46
Reach-1	45123	4375	957.45	967.42	0.39	968.41	0.000992	8	547.77	81.58	0.54

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Reach-1	45123	3336	957.45	966.52	0.31	967.29	0.000906	7.02	475.1	80.35	0.51
Reach-1	45123	2047	957.45	964.76	0.24	965.31	0.000847	5.97	342.61	69.94	0.48
Reach-1	45123	1761	957.45	964.24	0.23	964.75	0.00085	5.74	306.96	66.9	0.47
Reach-1	45123	1670	957.45	964.07	0.22	964.56	0.000849	5.65	295.58	65.9	0.47
Reach-1	45123	1612	957.45	963.96	0.22	964.44	0.000846	5.59	288.59	65.28	0.47
Reach-1	45123	1422	957.45	963.58	0.21	964.03	0.000849	5.38	264.29	63.51	0.46
Reach-1	45123	976	957.45	962.54	0.18	962.91	0.000893	4.86	200.91	58.79	0.46
Reach-1	45123	460	957.45	960.72	0.2	961.06	0.001842	4.66	98.68	53.98	0.61
Reach-1	45123	134	957.45	959.17	0.31	959.57	0.006116	5.03	26.63	32.52	0.98
Reach-1	45173	8721	955.31	972.4	0.47	973.83	0.000673	9.64	961.56	83.3	0.47
Reach-1	45173	7239	955.31	971.17	0.41	972.38	0.000634	8.86	858.85	83.3	0.45
Reach-1	45173	4375	955.31	967.52	0.35	968.45	0.000742	7.76	570.68	73.91	0.47
Reach-1	45173	3336	955.31	966.65	0.26	967.33	0.000611	6.61	507.47	71.98	0.43
Reach-1	45173	2047	955.31	964.93	0.17	965.36	0.000488	5.23	391.56	63.23	0.37
Reach-1	45173	1761	955.31	964.42	0.16	964.79	0.000464	4.9	359.51	61.86	0.36
Reach-1	45173	1670	955.31	964.25	0.15	964.61	0.000455	4.78	349.04	61.41	0.35
Reach-1	45173	1612	955.31	964.14	0.14	964.49	0.000448	4.71	342.51	61.13	0.35
Reach-1	45173	1422	955.31	963.77	0.13	964.07	0.000427	4.45	319.69	60.12	0.34
Reach-1	45173	976	955.31	962.73	0.1	962.95	0.000376	3.77	258.94	57.36	0.31
Reach-1	45173	460	955.31	960.99	0.06	961.11	0.000339	2.82	162.97	52.71	0.28
Reach-1	45173	134	955.31	959.59	0.02	959.62	0.000133	1.41	95.15	43.76	0.17
Reach-1	45223	8721	956.74	972.28	0.54	973.93	0.000726	10.39	929.76	88.3	0.51
Reach-1	45223	7239	956.74	971.07	0.47	972.47	0.000705	9.58	822.15	87.81	0.5
Reach-1	45223	4375	956.74	967.42	0.42	968.56	0.000926	8.54	520.61	75.34	0.53
Reach-1	45223	3336	956.74	966.59	0.32	967.41	0.000781	7.29	459.56	70.24	0.48
Reach-1	45223	2047	956.74	964.89	0.22	965.42	0.000648	5.83	351.06	59.87	0.42
Reach-1	45223	1761	956.74	964.38	0.2	964.85	0.000613	5.48	321.23	57.73	0.41
Reach-1	45223	1670	956.74	964.21	0.19	964.66	0.0006	5.36	311.6	57.02	0.4
Reach-1	45223	1612	956.74	964.11	0.18	964.54	0.00059	5.27	305.62	56.58	0.4
Reach-1	45223	1422	956.74	963.74	0.17	964.12	0.000558	4.99	284.88	55	0.39
Reach-1	45223	976	956.74	962.71	0.13	962.99	0.000484	4.23	230.69	51.57	0.35
Reach-1	45223	460	956.74	960.99	0.08	961.14	0.00041	3.14	146.33	45.86	0.31
Reach-1	45223	134	956.74	959.6	0.02	959.63	0.000173	1.56	85.91	41.02	0.19
Reach-1	45273	8721	956.99	973.72	0.15	974.07	0.000195	5.48	3379.62	553.29	0.27
Reach-1	45273	7239	956.99	972.19	0.16	972.59	0.000244	5.63	2551.23	527.22	0.3
Reach-1	45273	4375	956.99	967.92	0.28	968.64	0.000692	6.84	699.67	220.59	0.46
Reach-1	45273	3336	956.99	966.88	0.25	967.48	0.000712	6.2	538.81	100.56	0.46
Reach-1	45273	2047	956.99	965	0.19	965.46	0.000624	5.39	379.49	73.74	0.42
Reach-1	45273	1761	956.99	964.47	0.18	964.88	0.000632	5.17	340.68	71.39	0.42
Reach-1	45273	1670	956.99	964.29	0.18	964.69	0.000634	5.09	328.11	70.61	0.42
Reach-1	45273	1612	956.99	964.18	0.17	964.57	0.000634	5.03	320.29	70.12	0.42
Reach-1	45273	1422	956.99	963.79	0.17	964.16	0.00064	4.85	293.17	68.4	0.41
Reach-1	45273	976	956.99	962.73	0.14	963.03	0.000657	4.37	223.38	62.41	0.41
Reach-1	45273	460	956.99	960.99	0.11	961.19	0.000703	3.64	126.3	48.94	0.4
Reach-1	45273	134	956.99	959.6	0.04	959.66	0.000409	2.05	65.23	40.04	0.28
Reach-1	45333	8721	956.78	973.34	0.31	974.26	0.000473	7.7	1132.44	89.7	0.38
Reach-1	45333	7239	956.78	971.92	0.28	972.73	0.000468	7.2	1005.42	89.7	0.38
Reach-1	45333	4375	956.78	967.99	0.27	968.69	0.000651	6.7	652.68	89.7	0.44
Reach-1	45333	3336	956.78	966.97	0.22	967.52	0.000609	5.94	561.18	89.7	0.42
Reach-1	45333	2047	956.78	965.11	0.16	965.5	0.000491	4.99	410.23	72.47	0.37
Reach-1	45333	1761	956.78	964.57	0.15	964.92	0.000482	4.74	371.47	69.92	0.36

HEC-RAS Plan: Housatonic small scale existing n=0.033 output

Reach-1	45333	1670	956.78	964.39	0.14	964.72	0.000478	4.65	358.95	69.07	0.36
Reach-1	45333	1612	956.78	964.29	0.14	964.61	0.000471	4.58	352.06	68.6	0.36
Reach-1	45333	1422	956.78	963.9	0.13	964.19	0.00046	4.37	325.58	67.1	0.35
Reach-1	45333	976	956.78	962.85	0.1	963.06	0.000386	3.74	260.76	59.67	0.32
Reach-1	45333	460	956.78	961.1	0.07	961.23	0.000367	2.85	161.29	54.56	0.29
Reach-1	45333	134	956.78	959.65	0.02	959.69	0.000244	1.59	84.17	51.49	0.22
Reach-1	45393	8721	957.68	973.36	0.31	974.29	0.000423	7.83	1192.5	98.7	0.38
Reach-1	45393	7239	957.68	971.94	0.28	972.76	0.000421	7.31	1052.83	98.7	0.38
Reach-1	45393	4375	957.68	968.02	0.27	968.73	0.000587	6.75	666.21	98.7	0.43
Reach-1	45393	3336	957.68	967.01	0.22	967.56	0.000537	5.95	565.89	97.4	0.4
Reach-1	45393	2047	957.68	965.15	0.16	965.53	0.000479	4.95	413.9	74.77	0.37
Reach-1	45393	1761	957.68	964.6	0.15	964.95	0.000475	4.71	373.62	72.26	0.37
Reach-1	45393	1670	957.68	964.42	0.14	964.75	0.000473	4.63	360.59	71.43	0.36
Reach-1	45393	1612	957.68	964.32	0.14	964.64	0.000467	4.56	353.39	70.96	0.36
Reach-1	45393	1422	957.68	963.93	0.13	964.22	0.00046	4.36	325.85	69.16	0.35
Reach-1	45393	976	957.68	962.86	0.11	963.09	0.000443	3.83	254.94	64.3	0.34
Reach-1	45393	460	957.68	961.11	0.08	961.26	0.000512	3.1	148.48	58.12	0.34
Reach-1	45393	134	957.68	959.65	0.04	959.71	0.000548	2.01	66.67	53.36	0.32
Reach-1	45433	8721	957.03	973.24	0.36	974.37	0.000436	8.6	1119.18	89.3	0.41
Reach-1	45433	7239	957.03	971.86	0.31	972.82	0.000427	7.94	995.62	89.3	0.39
Reach-1	45433	4375	957.03	968.01	0.27	968.77	0.000538	6.99	652.14	89.3	0.42
Reach-1	45433	3336	957.03	967.02	0.21	967.59	0.00047	6.03	563.96	89.3	0.38
Reach-1	45433	2047	957.03	965.19	0.15	965.55	0.000411	4.84	422.81	68.77	0.34
Reach-1	45433	1761	957.03	964.64	0.13	964.96	0.000398	4.57	385.39	66.94	0.34
Reach-1	45433	1670	957.03	964.45	0.13	964.76	0.000393	4.47	373.22	66.34	0.33
Reach-1	45433	1612	957.03	964.36	0.13	964.66	0.000385	4.39	366.96	66.02	0.33
Reach-1	45433	1422	957.03	963.97	0.12	964.24	0.00037	4.17	341.31	64.72	0.32
Reach-1	45433	976	957.03	962.91	0.09	963.11	0.000331	3.55	275.09	61.36	0.3
Reach-1	45433	460	957.03	961.17	0.06	961.28	0.000305	2.67	172.42	56.45	0.27
Reach-1	45433	134	957.03	959.7	0.02	959.73	0.000189	1.46	91.93	52.86	0.19
Reach-1	45488	8721	956.96	973.66	0.25	974.43	0.000333	7.05	1298.51	104.3	0.34
Reach-1	45488	7239	956.96	972.2	0.22	972.87	0.000333	6.59	1146.41	104.3	0.34
Reach-1	45488	4375	956.96	968.25	0.21	968.81	0.000452	6.01	734.23	104.3	0.38
Reach-1	45488	3336	956.96	967.19	0.17	967.63	0.000417	5.3	629.3	91.59	0.36
Reach-1	45488	2047	956.96	965.27	0.13	965.58	0.000385	4.44	461.51	83.15	0.33
Reach-1	45488	1761	956.96	964.71	0.12	964.99	0.000388	4.24	415.13	80.53	0.33
Reach-1	45488	1670	956.96	964.52	0.12	964.79	0.000388	4.17	400.1	79.66	0.33
Reach-1	45488	1612	956.96	964.41	0.11	964.67	0.000385	4.12	391.59	79.16	0.33
Reach-1	45488	1422	956.96	964.01	0.11	964.25	0.000383	3.95	360.4	77.31	0.32
Reach-1	45488	976	956.96	962.95	0.09	963.14	0.000377	3.47	280.87	72.39	0.31
Reach-1	45488	460	956.96	961.18	0.07	961.31	0.000466	2.88	159.82	64.63	0.32
Reach-1	45488	134	956.96	959.69	0.04	959.75	0.000597	1.97	67.93	59.08	0.32
Reach-1	45528	8721	957.51	973.5	0.32	974.52	0.000411	8.17	1188.4	100.4	0.39
Reach-1	45528	7239	957.51	972.07	0.29	972.95	0.000413	7.61	1044.39	100.4	0.38
Reach-1	45528	4375	957.51	968.15	0.27	968.89	0.000563	6.87	652.28	98.04	0.42
Reach-1	45528	3336	957.51	967.12	0.22	967.68	0.000511	5.99	556.8	78.92	0.39
Reach-1	45528	2047	957.51	965.24	0.16	965.62	0.000468	4.92	415.88	72.74	0.36
Reach-1	45528	1761	957.51	964.68	0.15	965.02	0.000474	4.69	375.45	71.55	0.36
Reach-1	45528	1670	957.51	964.49	0.14	964.82	0.000476	4.61	362.18	71.16	0.36
Reach-1	45528	1612	957.51	964.39	0.14	964.71	0.000473	4.55	354.65	70.93	0.36
Reach-1	45528	1422	957.51	963.99	0.13	964.29	0.000473	4.35	326.81	70.09	0.36

HEC-RAS Plan: Housatonic small scale existing n=0.033 output

Reach-1	45528	976	957.51	962.94	0.11	963.17	0.000487	3.84	254.04	67.85	0.35
Reach-1	45528	460	957.51	961.18	0.09	961.35	0.000689	3.3	139.53	61.73	0.39
Reach-1	45528	134	957.51	959.69	0.08	959.8	0.001266	2.59	51.74	52.67	0.46
Reach-1	45578	8721	957.74	973.43	0.37	974.58	0.000455	8.84	1203.06	108.5	0.41
Reach-1	45578	7239	957.74	972	0.34	973.01	0.000455	8.24	1048.47	108.05	0.41
Reach-1	45578	4375	957.74	968.11	0.31	968.95	0.000596	7.4	637.49	102.93	0.44
Reach-1	45578	3336	957.74	967.09	0.24	967.73	0.000525	6.41	538.29	89.46	0.4
Reach-1	45578	2047	957.74	965.24	0.17	965.65	0.00047	5.15	397.59	65.52	0.37
Reach-1	45578	1761	957.74	964.69	0.15	965.05	0.000468	4.87	361.64	64.27	0.36
Reach-1	45578	1670	957.74	964.5	0.15	964.85	0.000465	4.77	349.85	63.86	0.36
Reach-1	45578	1612	957.74	964.4	0.15	964.74	0.000459	4.7	343.17	63.62	0.36
Reach-1	45578	1422	957.74	964.01	0.13	964.32	0.000448	4.46	318.49	62.74	0.35
Reach-1	45578	976	957.74	962.96	0.1	963.19	0.000419	3.84	254.19	60.38	0.33
Reach-1	45578	460	957.74	961.24	0.07	961.38	0.000446	3	153.51	56.49	0.32
Reach-1	45578	134	957.74	959.78	0.03	959.83	0.000387	1.82	73.82	52.69	0.27
Reach-1	45608	8721	956.88	973.24	0.48	974.69	0.000579	10	1142.57	113.48	0.46
Reach-1	45608	7239	956.88	971.83	0.43	973.11	0.00058	9.34	984.57	110.79	0.46
Reach-1	45608	4375	956.88	967.95	0.4	969.04	0.000761	8.44	568.96	103.39	0.49
Reach-1	45608	3336	956.88	966.99	0.3	967.8	0.000652	7.26	472.21	84.24	0.45
Reach-1	45608	2047	956.88	965.19	0.2	965.7	0.000552	5.72	358.02	56.73	0.4
Reach-1	45608	1761	956.88	964.64	0.19	965.09	0.000539	5.37	327.64	55.22	0.39
Reach-1	45608	1670	956.88	964.46	0.18	964.89	0.000532	5.26	317.7	54.86	0.38
Reach-1	45608	1612	956.88	964.36	0.17	964.78	0.000523	5.17	312.08	54.68	0.38
Reach-1	45608	1422	956.88	963.98	0.16	964.35	0.0005	4.88	291.25	54	0.37
Reach-1	45608	976	956.88	962.95	0.12	963.21	0.000441	4.12	236.67	52.19	0.34
Reach-1	45608	460	956.88	961.25	0.07	961.39	0.000368	3.03	151.89	47.31	0.3
Reach-1	45608	134	956.88	959.8	0.02	959.84	0.00018	1.56	86.06	43.43	0.19
Reach-1	45668	8721	957.32	974.71	0.06	974.83	0.000074	3.6	5617.65	707.2	0.17
Reach-1	45668	7239	957.32	973.09	0.07	973.23	0.00009	3.65	4486.51	689.46	0.18
Reach-1	45668	4375	957.32	968.87	0.11	969.15	0.000237	4.47	1733.52	615.36	0.28
Reach-1	45668	3336	957.32	967.56	0.12	967.87	0.000305	4.51	948.63	568.75	0.31
Reach-1	45668	2047	957.32	965.5	0.11	965.75	0.000351	4.03	507.78	99.85	0.32
Reach-1	45668	1761	957.32	964.9	0.1	965.14	0.000369	3.92	449.74	95.92	0.32
Reach-1	45668	1670	957.32	964.71	0.1	964.94	0.000375	3.87	431	94.62	0.32
Reach-1	45668	1612	957.32	964.59	0.1	964.82	0.000376	3.84	420.26	93.87	0.32
Reach-1	45668	1422	957.32	964.17	0.1	964.39	0.000387	3.73	381.59	91.1	0.32
Reach-1	45668	976	957.32	963.07	0.09	963.25	0.000432	3.43	284.64	83.75	0.33
Reach-1	45668	460	957.32	961.27	0.08	961.42	0.000593	3.11	148.03	64.21	0.36
Reach-1	45668	134	957.32	959.81	0.03	959.87	0.000334	1.89	70.83	42.06	0.26
Reach-1	45708	8721	957.53	973.83	0.49	975.23	0.000695	9.92	1151.02	107.3	0.46
Reach-1	45708	7239	957.53	972.32	0.45	973.59	0.000694	9.36	988.77	107.3	0.45
Reach-1	45708	4375	957.53	968.27	0.43	969.43	0.000898	8.69	554.41	107.3	0.51
Reach-1	45708	3336	957.53	967.18	0.34	968.07	0.000794	7.6	443.58	67.63	0.47
Reach-1	45708	2047	957.53	965.29	0.23	965.87	0.000668	6.07	337.26	53.19	0.42
Reach-1	45708	1761	957.53	964.73	0.21	965.24	0.000651	5.72	307.68	52.66	0.42
Reach-1	45708	1670	957.53	964.55	0.21	965.04	0.000646	5.61	297.92	52.49	0.41
Reach-1	45708	1612	957.53	964.44	0.2	964.91	0.000637	5.51	292.34	52.39	0.41
Reach-1	45708	1422	957.53	964.05	0.18	964.47	0.000619	5.23	271.74	52.02	0.4
Reach-1	45708	976	957.53	962.99	0.14	963.31	0.000577	4.49	217.46	51.03	0.38
Reach-1	45708	460	957.53	961.27	0.1	961.46	0.000629	3.52	130.79	49.41	0.38
Reach-1	45708	134	957.53	959.82	0.04	959.89	0.00042	2.06	65.11	40.96	0.29

HEC-RAS Plan: Housatonic small scale existing n=0.033 output

Reach-1	45758	8721	956.61	974.06	0.39	975.28	0.000536	8.9	1029.01	80.05	0.41
Reach-1	45758	7239	956.61	972.6	0.35	973.64	0.000516	8.23	913.85	77.13	0.4
Reach-1	45758	4375	956.61	968.73	0.28	969.51	0.000571	7.09	626.05	71.98	0.41
Reach-1	45758	3336	956.61	967.55	0.23	968.14	0.000513	6.2	541.97	70.64	0.38
Reach-1	45758	2047	956.61	965.51	0.17	965.91	0.000486	5.09	402.31	65.82	0.36
Reach-1	45758	1761	956.61	964.92	0.15	965.29	0.00048	4.83	364.25	63.94	0.36
Reach-1	45758	1670	956.61	964.73	0.15	965.08	0.000478	4.75	351.88	63.32	0.35
Reach-1	45758	1612	956.61	964.62	0.15	964.96	0.000472	4.68	344.74	62.96	0.35
Reach-1	45758	1422	956.61	964.2	0.13	964.51	0.000461	4.46	318.99	61.64	0.35
Reach-1	45758	976	956.61	963.11	0.11	963.34	0.000435	3.85	253.24	58.74	0.33
Reach-1	45758	460	956.61	961.35	0.07	961.49	0.000417	2.97	154.67	52.81	0.31
Reach-1	45758	134	956.61	959.86	0.03	959.91	0.000242	1.66	80.52	45.64	0.22
Reach-1	45813	8721	957.03	974.1	0.38	975.31	0.00046	8.88	1079.27	88.29	0.41
Reach-1	45813	7239	957.03	972.63	0.34	973.67	0.000456	8.23	951.67	84.82	0.4
Reach-1	45813	4375	957.03	968.75	0.28	969.54	0.000549	7.14	637.55	78.01	0.42
Reach-1	45813	3336	957.03	967.56	0.23	968.17	0.000509	6.27	545.91	76.4	0.39
Reach-1	45813	2047	957.03	965.53	0.17	965.94	0.000478	5.17	397.36	65.68	0.37
Reach-1	45813	1761	957.03	964.94	0.16	965.31	0.000463	4.9	359.81	62.7	0.36
Reach-1	45813	1670	957.03	964.75	0.15	965.11	0.000457	4.81	347.74	61.72	0.35
Reach-1	45813	1612	957.03	964.63	0.15	964.98	0.00045	4.73	340.82	61.14	0.35
Reach-1	45813	1422	957.03	964.22	0.13	964.54	0.000431	4.5	316.05	59.05	0.34
Reach-1	45813	976	957.03	963.13	0.1	963.36	0.000397	3.86	253.15	56.73	0.32
Reach-1	45813	460	957.03	961.38	0.07	961.51	0.000394	2.94	156.38	53.67	0.3
Reach-1	45813	134	957.03	959.88	0.03	959.93	0.000265	1.69	79.16	47.05	0.23
Reach-1	45826	8721	957.95	975.01	0.16	975.4	0.000197	5.82	3259.84	570.99	0.28
Reach-1	45826	7239	957.95	973.2	0.2	973.73	0.000285	6.37	2005.5	439.24	0.33
Reach-1	45826	4375	957.95	968.81	0.29	969.55	0.000654	7.06	829.51	266.52	0.46
Reach-1	45826	3336	957.95	967.5	0.29	968.21	0.000795	6.83	546.19	210.95	0.49
Reach-1	45826	2047	957.95	965.37	0.3	966.02	0.001139	6.49	315.37	73.68	0.55
Reach-1	45826	1761	957.95	964.76	0.3	965.41	0.001227	6.47	272.24	67.58	0.57
Reach-1	45826	1670	957.95	964.56	0.3	965.2	0.001254	6.45	258.84	65.56	0.57
Reach-1	45826	1612	957.95	964.44	0.3	965.08	0.001259	6.41	251.36	64.41	0.57
Reach-1	45826	1422	957.95	964.02	0.29	964.64	0.001294	6.32	225.06	60.19	0.58
Reach-1	45826	976	957.95	962.93	0.27	963.47	0.001315	5.91	165.23	49.42	0.57
Reach-1	45826	460	957.95	961.2	0.23	961.61	0.001582	5.13	89.62	38.17	0.59
Reach-1	45826	134	957.95	959.82	0.1	959.97	0.00107	3.11	43.06	29.16	0.45
Reach-1	45853	8721	957.98	974.51	0.36	975.63	0.000479	8.53	1062.56	87.12	0.4
Reach-1	45853	7239	957.98	972.89	0.33	973.88	0.000486	8.02	925.7	81.57	0.4
Reach-1	45853	4375	957.98	968.77	0.3	969.59	0.000634	7.25	605.12	74.78	0.44
Reach-1	45853	3336	957.98	967.59	0.25	968.24	0.000601	6.44	517.94	72.95	0.42
Reach-1	45853	2047	957.98	965.61	0.19	966.07	0.000603	5.45	375.76	69.52	0.41
Reach-1	45853	1761	957.98	965.03	0.18	965.46	0.000611	5.23	336.6	67.04	0.41
Reach-1	45853	1670	957.98	964.84	0.18	965.25	0.000614	5.16	323.9	66.21	0.41
Reach-1	45853	1612	957.98	964.73	0.18	965.13	0.000612	5.09	316.48	65.73	0.41
Reach-1	45853	1422	957.98	964.32	0.17	964.69	0.000613	4.9	289.95	63.95	0.41
Reach-1	45853	976	957.98	963.22	0.14	963.52	0.000624	4.39	222.47	59.11	0.4
Reach-1	45853	460	957.98	961.45	0.11	961.66	0.000683	3.6	127.83	49.4	0.39
Reach-1	45853	134	957.98	959.91	0.06	960	0.000803	2.42	55.31	44.4	0.38
Reach-1	45861	8721	957.8	975.01	0.25	975.68	0.000359	7.11	2326.95	487.77	0.32
Reach-1	45861	7239	957.8	973.08	0.29	973.9	0.000461	7.51	1453.09	383.88	0.37

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Reach-1	45861	4375	957.8	968.8	0.3	969.6	0.000625	7.18	609.32	69.05	0.43
Reach-1	45861	3336	957.8	967.63	0.24	968.25	0.000561	6.31	528.56	69	0.4
Reach-1	45861	2047	957.8	965.65	0.18	966.08	0.00053	5.22	392.42	68.6	0.38
Reach-1	45861	1761	957.8	965.08	0.16	965.47	0.000536	4.98	353.58	67.35	0.38
Reach-1	45861	1670	957.8	964.89	0.16	965.26	0.000538	4.9	340.79	66.94	0.38
Reach-1	45861	1612	957.8	964.78	0.16	965.14	0.000536	4.84	333.24	66.69	0.38
Reach-1	45861	1422	957.8	964.37	0.15	964.7	0.00054	4.65	306.07	65.8	0.38
Reach-1	45861	976	957.8	963.26	0.13	963.53	0.000572	4.16	234.76	63.38	0.38
Reach-1	45861	460	957.8	961.45	0.12	961.66	0.000846	3.68	124.99	55.53	0.43
Reach-1	45861	134	957.8	959.89	0.09	960.02	0.001319	2.83	47.4	44	0.48
Reach-1	45890 Bridge										
Reach-1	45915	8721	957.8	975.17	0.24	975.8	0.000341	6.97	2403.66	490.99	0.32
Reach-1	45915	7239	957.8	973.12	0.29	973.94	0.000456	7.47	1469.24	387.67	0.36
Reach-1	45915	4375	957.8	968.85	0.29	969.64	0.000614	7.14	612.78	69.06	0.42
Reach-1	45915	3336	957.8	967.66	0.24	968.28	0.000553	6.28	531.09	69	0.4
Reach-1	45915	2047	957.8	965.69	0.17	966.11	0.00052	5.19	394.76	68.68	0.38
Reach-1	45915	1761	957.8	965.12	0.16	965.5	0.000525	4.95	355.88	67.43	0.38
Reach-1	45915	1670	957.8	964.93	0.16	965.29	0.000527	4.87	343.09	67.01	0.38
Reach-1	45915	1612	957.8	964.81	0.16	965.17	0.000525	4.8	335.52	66.77	0.38
Reach-1	45915	1422	957.8	964.4	0.15	964.73	0.000528	4.61	308.32	65.87	0.38
Reach-1	45915	976	957.8	963.3	0.12	963.56	0.000555	4.12	237.06	63.46	0.38
Reach-1	45915	460	957.8	961.51	0.11	961.71	0.000789	3.59	128	55.93	0.42
Reach-1	45915	134	957.8	959.97	0.07	960.08	0.001054	2.63	50.98	44.59	0.43
Reach-1	45918	8721	956.65	974.87	0.35	975.93	0.000494	8.29	1052.39	67.9	0.37
Reach-1	45918	7239	956.65	973.04	0.32	973.98	0.000491	7.8	927.93	67.9	0.37
Reach-1	45918	4375	956.65	968.95	0.26	969.65	0.000516	6.73	650.39	67.9	0.38
Reach-1	45918	3336	956.65	967.75	0.2	968.29	0.00045	5.86	569.32	67.9	0.36
Reach-1	45918	2047	956.65	965.77	0.14	966.11	0.000389	4.71	434.57	67.9	0.33
Reach-1	45918	1761	956.65	965.2	0.13	965.51	0.000385	4.45	395.77	67.9	0.32
Reach-1	45918	1670	956.65	965.01	0.12	965.3	0.000385	4.36	382.82	67.9	0.32
Reach-1	45918	1612	956.65	964.89	0.12	965.18	0.000382	4.3	375.08	67.9	0.32
Reach-1	45918	1422	956.65	964.48	0.11	964.74	0.000379	4.1	347.08	67.9	0.32
Reach-1	45918	976	956.65	963.37	0.09	963.57	0.000388	3.59	271.76	67.9	0.32
Reach-1	45918	460	956.65	961.58	0.07	961.72	0.000434	2.95	156.16	58.32	0.32
Reach-1	45918	134	956.65	960.04	0.03	960.09	0.000294	1.77	75.69	45.59	0.24
Reach-1	45951	8721	958.14	975.73	0.13	976.03	0.000147	5.28	3637.82	442.92	0.24
Reach-1	45951	7239	958.14	973.49	0.21	974.04	0.000266	6.52	2044.12	433.97	0.32
Reach-1	45951	4375	958.14	968.92	0.29	969.69	0.000576	7.17	772.92	302.92	0.44
Reach-1	45951	3336	958.14	967.68	0.26	968.34	0.000599	6.58	552.32	183.19	0.43
Reach-1	45951	2047	958.14	965.68	0.21	966.18	0.000657	5.64	363.04	68.41	0.43
Reach-1	45951	1761	958.14	965.11	0.2	965.57	0.000665	5.42	324.76	65.55	0.43
Reach-1	45951	1670	958.14	964.92	0.19	965.36	0.000667	5.35	312.39	64.6	0.43
Reach-1	45951	1612	958.14	964.81	0.19	965.24	0.000664	5.28	305.13	64.04	0.43
Reach-1	45951	1422	958.14	964.4	0.18	964.8	0.000663	5.09	279.36	61.99	0.42
Reach-1	45951	976	958.14	963.3	0.15	963.62	0.000663	4.55	214.48	56.52	0.41
Reach-1	45951	460	958.14	961.54	0.12	961.76	0.000764	3.75	122.51	48.39	0.42
Reach-1	45951	134	958.14	960.02	0.07	960.12	0.000885	2.53	53	43.07	0.4
Reach-1	45963	8721	956.47	975.52	0.22	976.13	0.000236	6.99	1992.08	143.1	0.3
Reach-1	45963	7239	956.47	973.39	0.25	974.09	0.000299	7.2	1380.54	143.1	0.33
Reach-1	45963	4375	956.47	969.14	0.22	969.71	0.000367	6.39	891.68	143.1	0.34

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Reach-1	45963	3336	956.47	967.92	0.17	968.37	0.00033	5.6	751.77	143.1	0.32
Reach-1	45963	2047	956.47	965.9	0.12	966.2	0.00029	4.5	537.8	116.64	0.29
Reach-1	45963	1761	956.47	965.32	0.11	965.59	0.00028	4.23	484.01	116.14	0.28
Reach-1	45963	1670	956.47	965.13	0.11	965.39	0.000277	4.14	466.12	115.97	0.28
Reach-1	45963	1612	956.47	965.01	0.1	965.26	0.000273	4.07	455.34	115.87	0.27
Reach-1	45963	1422	956.47	964.6	0.09	964.82	0.000261	3.85	417.18	112.96	0.27
Reach-1	45963	976	956.47	963.49	0.07	963.65	0.000222	3.22	324.25	100.22	0.24
Reach-1	45963	460	956.47	961.7	0.04	961.78	0.000165	2.26	204.72	72.86	0.2
Reach-1	45963	134	956.47	960.11	0.01	960.13	0.00007	1.1	122.19	50.45	0.12
Reach-1	46013	8721	957.35	975.36	0.27	976.21	0.00034	7.52	1282.9	90.1	0.33
Reach-1	46013	7239	957.35	973.34	0.26	974.13	0.000362	7.19	1101.36	90.1	0.34
Reach-1	46013	4375	957.35	969.12	0.23	969.75	0.000431	6.36	721.2	90.1	0.36
Reach-1	46013	3336	957.35	967.92	0.18	968.4	0.00039	5.58	612.36	90.1	0.34
Reach-1	46013	2047	957.35	965.9	0.13	966.22	0.000326	4.5	454.94	66.92	0.3
Reach-1	46013	1761	957.35	965.33	0.11	965.61	0.000305	4.22	417.32	64.14	0.29
Reach-1	46013	1670	957.35	965.14	0.11	965.4	0.000298	4.12	405.09	63.51	0.29
Reach-1	46013	1612	957.35	965.02	0.1	965.28	0.000293	4.05	397.78	63.14	0.28
Reach-1	46013	1422	957.35	964.61	0.09	964.84	0.000276	3.82	371.98	61.8	0.27
Reach-1	46013	976	957.35	963.5	0.07	963.66	0.00024	3.21	304.26	60.16	0.25
Reach-1	46013	460	957.35	961.7	0.04	961.79	0.000203	2.32	198.45	57.89	0.22
Reach-1	46013	134	957.35	960.11	0.01	960.14	0.00012	1.24	107.9	55.88	0.16
Reach-1	46016	8721	958.24	976.06	0.1	976.28	0.000108	4.58	4225.11	508.17	0.21
Reach-1	46016	7239	958.24	973.88	0.12	974.18	0.000161	5.02	2974.75	501.65	0.25
Reach-1	46016	4375	958.24	969.21	0.21	969.76	0.000429	6.06	956.67	324.95	0.38
Reach-1	46016	3336	958.24	967.91	0.2	968.41	0.000475	5.69	650.42	180.45	0.38
Reach-1	46016	2047	958.24	965.86	0.16	966.24	0.000524	4.99	410.28	78.91	0.39
Reach-1	46016	1761	958.24	965.27	0.16	965.63	0.000528	4.82	365.58	74.54	0.38
Reach-1	46016	1670	958.24	965.08	0.15	965.43	0.000528	4.75	351.27	73.09	0.38
Reach-1	46016	1612	958.24	964.96	0.15	965.31	0.000525	4.7	342.82	72.22	0.38
Reach-1	46016	1422	958.24	964.55	0.14	964.87	0.00052	4.54	313.42	69.1	0.38
Reach-1	46016	976	958.24	963.43	0.12	963.69	0.000518	4.06	240.48	62.73	0.37
Reach-1	46016	460	958.24	961.64	0.1	961.82	0.000657	3.42	134.52	54.82	0.38
Reach-1	46016	134	958.24	960.07	0.06	960.16	0.000796	2.4	55.87	45.41	0.38
Reach-1	46043	8721	958.25	975.69	0.23	976.45	0.000252	7.08	1438.27	103.3	0.31
Reach-1	46043	7239	958.25	973.61	0.22	974.31	0.000281	6.8	1223.07	103.3	0.32
Reach-1	46043	4375	958.25	969.19	0.21	969.78	0.000389	6.18	766.81	103.3	0.36
Reach-1	46043	3336	958.25	967.96	0.17	968.43	0.000369	5.47	639.47	103.3	0.34
Reach-1	46043	2047	958.25	965.95	0.13	966.26	0.00034	4.49	456.32	71.95	0.31
Reach-1	46043	1761	958.25	965.37	0.11	965.65	0.000327	4.24	415.71	69.59	0.31
Reach-1	46043	1670	958.25	965.18	0.11	965.45	0.000325	4.15	402.4	69.2	0.3
Reach-1	46043	1612	958.25	965.07	0.11	965.33	0.000322	4.09	394.39	68.96	0.3
Reach-1	46043	1422	958.25	964.65	0.1	964.89	0.000314	3.89	365.95	68.1	0.3
Reach-1	46043	976	958.25	963.53	0.08	963.71	0.000299	3.35	291	65.79	0.28
Reach-1	46043	460	958.25	961.73	0.06	961.84	0.00032	2.61	176.03	62.07	0.27
Reach-1	46043	134	958.25	960.13	0.03	960.18	0.000324	1.67	80.43	57.27	0.25
Reach-1	46093	8721	957.51	975.64	0.26	976.49	0.000286	7.59	1377.57	100.1	0.33
Reach-1	46093	7239	957.51	973.56	0.26	974.35	0.000316	7.28	1169.73	100.1	0.34
Reach-1	46093	4375	957.51	969.17	0.24	969.83	0.000423	6.56	730.14	100.1	0.37
Reach-1	46093	3336	957.51	967.94	0.19	968.46	0.000394	5.78	607.52	100.1	0.35
Reach-1	46093	2047	957.51	965.95	0.14	966.29	0.000361	4.67	438.49	67.24	0.32
Reach-1	46093	1761	957.51	965.38	0.12	965.68	0.000352	4.4	400.34	66.14	0.32

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Reach-1	46093	1670	957.51	965.18	0.12	965.47	0.000348	4.31	387.74	65.77	0.31
Reach-1	46093	1612	957.51	965.07	0.12	965.35	0.000345	4.24	380.15	65.55	0.31
Reach-1	46093	1422	957.51	964.66	0.11	964.91	0.000335	4.03	353.2	64.76	0.3
Reach-1	46093	976	957.51	963.54	0.08	963.72	0.000314	3.46	282.11	62.61	0.29
Reach-1	46093	460	957.51	961.75	0.06	961.86	0.000321	2.66	172.93	59.17	0.27
Reach-1	46093	134	957.51	960.15	0.03	960.19	0.00029	1.64	81.83	54.64	0.24
Reach-1	46138	8721	957.32	975.79	0.23	976.52	0.000239	7.03	1549.56	117.2	0.31
Reach-1	46138	7239	957.32	973.7	0.22	974.38	0.000269	6.79	1303.69	117.2	0.32
Reach-1	46138	4375	957.32	969.26	0.21	969.85	0.000381	6.26	783.23	117.2	0.36
Reach-1	46138	3336	957.32	968	0.18	968.48	0.000365	5.57	636.38	117.2	0.34
Reach-1	46138	2047	957.32	965.98	0.13	966.3	0.000341	4.55	451.59	75.34	0.32
Reach-1	46138	1761	957.32	965.39	0.12	965.68	0.000343	4.31	408.54	71.17	0.32
Reach-1	46138	1670	957.32	965.2	0.12	965.48	0.000342	4.23	395.02	69.92	0.31
Reach-1	46138	1612	957.32	965.09	0.11	965.36	0.000339	4.17	386.93	69.55	0.31
Reach-1	46138	1422	957.32	964.67	0.1	964.92	0.000331	3.97	358.33	68.22	0.31
Reach-1	46138	976	957.32	963.55	0.08	963.73	0.000313	3.44	283.59	64.62	0.29
Reach-1	46138	460	957.32	961.76	0.06	961.87	0.000312	2.66	173.21	58.84	0.27
Reach-1	46138	134	957.32	960.17	0.02	960.21	0.00024	1.58	84.58	51.73	0.22
Reach-1	46188	8721	957.08	975.68	0.28	976.58	0.000303	7.8	1369.53	101.3	0.34
Reach-1	46188	7239	957.08	973.6	0.27	974.44	0.000336	7.5	1158.61	101.3	0.35
Reach-1	46188	4375	957.08	969.2	0.25	969.91	0.000453	6.79	712.72	101.3	0.38
Reach-1	46188	3336	957.08	967.97	0.2	968.52	0.000423	5.99	587.97	101.3	0.36
Reach-1	46188	2047	957.08	965.97	0.14	966.33	0.000374	4.82	424.64	63.64	0.33
Reach-1	46188	1761	957.08	965.4	0.13	965.72	0.000361	4.53	388.44	62.49	0.32
Reach-1	46188	1670	957.08	965.21	0.13	965.51	0.000356	4.43	376.55	62.11	0.32
Reach-1	46188	1612	957.08	965.09	0.12	965.39	0.000352	4.36	369.39	61.88	0.31
Reach-1	46188	1422	957.08	964.68	0.11	964.94	0.000339	4.13	343.97	61.05	0.31
Reach-1	46188	976	957.08	963.55	0.09	963.75	0.000309	3.53	276.57	58.8	0.29
Reach-1	46188	460	957.08	961.77	0.05	961.88	0.000282	2.63	174.98	55.22	0.26
Reach-1	46188	134	957.08	960.18	0.02	960.22	0.000184	1.47	90.95	50.57	0.19
Reach-1	46233	8721	957.91	976.58	0.03	976.67	0.000029	2.48	4230.94	309.1	0.11
Reach-1	46233	7239	957.91	974.43	0.03	974.52	0.000033	2.41	3568.06	309.1	0.12
Reach-1	46233	4375	957.91	969.9	0.03	969.97	0.00005	2.25	2166.45	309.1	0.13
Reach-1	46233	3336	957.91	968.51	0.02	968.58	0.000052	2.05	1738.69	309.1	0.13
Reach-1	46233	2047	957.91	966.32	0.02	966.37	0.000061	1.78	1150.27	214.16	0.13
Reach-1	46233	1761	957.91	965.7	0.02	965.75	0.000064	1.72	1022.1	203.45	0.14
Reach-1	46233	1670	957.91	965.5	0.02	965.54	0.000065	1.7	980.74	200.62	0.14
Reach-1	46233	1612	957.91	965.37	0.02	965.42	0.000065	1.69	955.69	198.89	0.14
Reach-1	46233	1422	957.91	964.93	0.02	964.97	0.000067	1.64	868.73	192.74	0.14
Reach-1	46233	976	957.91	963.73	0.02	963.77	0.00007	1.5	648.74	170.84	0.14
Reach-1	46233	460	957.91	961.87	0.01	961.89	0.000086	1.27	363.43	144.39	0.14
Reach-1	46233	134	957.91	960.21	0.01	960.22	0.000139	0.95	140.73	123.85	0.16
Reach-1	46258	8721	957.81	976.25	0.19	976.81	0.00021	6.46	2009.75	181.5	0.29
Reach-1	46258	7239	957.81	974.1	0.2	974.67	0.000251	6.41	1619.22	181.5	0.31
Reach-1	46258	4375	957.81	969.52	0.23	970.15	0.000433	6.4	789.48	176.84	0.38
Reach-1	46258	3336	957.81	968.2	0.2	968.72	0.00044	5.8	590.18	124.47	0.37
Reach-1	46258	2047	957.81	966.11	0.15	966.47	0.000401	4.83	424.08	68.16	0.34
Reach-1	46258	1761	957.81	965.51	0.13	965.84	0.000393	4.58	384.25	66.03	0.33
Reach-1	46258	1670	957.81	965.32	0.13	965.63	0.000391	4.5	371.3	65.32	0.33
Reach-1	46258	1612	957.81	965.2	0.13	965.5	0.000387	4.43	363.49	64.89	0.33
Reach-1	46258	1422	957.81	964.77	0.12	965.05	0.000378	4.23	336.12	63.36	0.32

HEC-RAS Plan: Housatonic small scale existing n=0.033 output

Reach-1	46258	976	957.81	963.62	0.09	963.83	0.000358	3:68	265.32	59.66	0.31
Reach-1	46258	460	957.81	961.8	0.07	961.93	0.000372	2.86	160.89	55.5	0.3
Reach-1	46258	134	957.81	960.19	0.03	960.24	0.000357	1.8	74.64	51.03	0.26
Reach-1	46328	8721	957.73	976.16	0.23	976.88	0.000273	6.9	1401.69	96.7	0.31
Reach-1	46328	7239	957.73	974.05	0.22	974.72	0.000296	6.64	1197.83	96.7	0.32
Reach-1	46328	4375	957.73	969.63	0.2	970.19	0.00038	6.01	770.61	96.7	0.35
Reach-1	46328	3336	957.73	968.31	0.17	968.76	0.000365	5.37	643.14	96.7	0.33
Reach-1	46328	2047	957.73	966.19	0.13	966.5	0.000365	4.51	454.16	76.13	0.33
Reach-1	46328	1761	957.73	965.58	0.12	965.87	0.000359	4.3	409.3	72.72	0.32
Reach-1	46328	1670	957.73	965.38	0.12	965.66	0.000356	4.23	394.88	71.58	0.32
Reach-1	46328	1612	957.73	965.26	0.11	965.53	0.000352	4.17	386.19	70.89	0.32
Reach-1	46328	1422	957.73	964.83	0.11	965.08	0.000342	3.99	356.04	68.44	0.31
Reach-1	46328	976	957.73	963.66	0.08	963.85	0.000312	3.48	280.11	61.84	0.29
Reach-1	46328	460	957.73	961.85	0.05	961.95	0.000259	2.6	176.73	53.23	0.25
Reach-1	46328	134	957.73	960.22	0.02	960.26	0.000158	1.43	93.8	48.85	0.18
Reach-1	46373	8721	957.18	975.97	0.31	976.98	0.000333	8.26	1290.58	95.6	0.36
Reach-1	46373	7239	957.18	973.88	0.3	974.81	0.000367	7.93	1090.46	95.6	0.37
Reach-1	46373	4375	957.18	969.5	0.27	970.27	0.00048	7.11	671.72	95.6	0.4
Reach-1	46373	3336	957.18	968.22	0.22	968.82	0.000446	6.26	556.18	83.85	0.37
Reach-1	46373	2047	957.18	966.15	0.16	966.54	0.000397	5.05	405.47	59.08	0.34
Reach-1	46373	1761	957.18	965.56	0.14	965.91	0.00038	4.75	371	57.64	0.33
Reach-1	46373	1670	957.18	965.36	0.14	965.69	0.000373	4.64	359.73	57.17	0.33
Reach-1	46373	1612	957.18	965.24	0.13	965.56	0.000368	4.57	352.9	56.87	0.32
Reach-1	46373	1422	957.18	964.81	0.12	965.1	0.000351	4.32	328.91	55.84	0.31
Reach-1	46373	976	957.18	963.66	0.09	963.87	0.000308	3.67	266.21	53.04	0.29
Reach-1	46373	460	957.18	961.86	0.05	961.96	0.000244	2.64	174.39	48.66	0.25
Reach-1	46373	134	957.18	960.24	0.02	960.27	0.000119	1.35	99.02	44.74	0.16
Reach-1	46418	8721	956.82	975.88	0.35	977.04	0.000392	8.71	1121.7	88.36	0.39
Reach-1	46418	7239	956.82	973.79	0.34	974.87	0.000443	8.41	941.45	84.18	0.41
Reach-1	46418	4375	956.82	969.43	0.32	970.33	0.000618	7.63	593.53	75.44	0.45
Reach-1	46418	3336	956.82	968.17	0.27	968.88	0.0006	6.79	499.47	72.9	0.43
Reach-1	46418	2047	956.82	966.1	0.2	966.6	0.000582	5.67	360.8	59.85	0.41
Reach-1	46418	1761	956.82	965.51	0.19	965.96	0.000563	5.39	326.55	57.05	0.4
Reach-1	46418	1670	956.82	965.32	0.18	965.75	0.000556	5.29	315.53	56.12	0.39
Reach-1	46418	1612	956.82	965.2	0.18	965.62	0.000548	5.22	308.91	55.56	0.39
Reach-1	46418	1422	956.82	964.77	0.16	965.15	0.000528	4.99	285.25	53.48	0.38
Reach-1	46418	976	956.82	963.62	0.13	963.91	0.000476	4.31	226.63	49.26	0.35
Reach-1	46418	460	956.82	961.85	0.08	962	0.000384	3.18	144.73	42.86	0.3
Reach-1	46418	134	956.82	960.25	0.02	960.29	0.000183	1.66	80.76	37.1	0.2
Reach-1	46478	8721	957.27	976.61	0.19	977.13	0.000204	6.49	2837.83	415.87	0.29
Reach-1	46478	7239	957.27	974.23	0.25	974.93	0.000307	7.16	1859.64	404.85	0.34
Reach-1	46478	4375	957.27	969.54	0.3	970.38	0.000571	7.38	676.62	135.66	0.43
Reach-1	46478	3336	957.27	968.23	0.26	968.92	0.000576	6.68	521.51	100.45	0.42
Reach-1	46478	2047	957.27	966.14	0.2	966.63	0.000582	5.63	363.62	61.84	0.41
Reach-1	46478	1761	957.27	965.55	0.19	966	0.000576	5.37	327.76	59.52	0.4
Reach-1	46478	1670	957.27	965.35	0.18	965.79	0.000573	5.28	316.16	58.74	0.4
Reach-1	46478	1612	957.27	965.23	0.18	965.66	0.000569	5.21	309.16	58.27	0.4
Reach-1	46478	1422	957.27	964.8	0.17	965.19	0.000563	5.01	284.04	56.55	0.39
Reach-1	46478	976	957.27	963.64	0.14	963.95	0.000538	4.41	221.52	52.02	0.38
Reach-1	46478	460	957.27	961.85	0.09	962.03	0.000511	3.42	134.41	44.94	0.35
Reach-1	46478	134	957.27	960.25	0.03	960.31	0.000295	1.94	69.1	36.23	0.25

HEC-RAS Plan: Housatonic small scale existing n=0.033 output

Reach-1	46533	8721	957.25	976.19	0.36	977.34	0.000436	8.63	1053.19	78.73	0.38
Reach-1	46533	7239	957.25	974	0.34	975.06	0.000469	8.29	892.41	68.22	0.39
Reach-1	46533	4375	957.25	969.58	0.29	970.41	0.00055	7.29	602.21	63.57	0.41
Reach-1	46533	3336	957.25	968.31	0.24	968.94	0.000497	6.4	522.05	62.33	0.39
Reach-1	46533	2047	957.25	966.25	0.16	966.67	0.000431	5.16	396.35	59.46	0.35
Reach-1	46533	1761	957.25	965.67	0.15	966.03	0.000418	4.87	361.71	58.18	0.34
Reach-1	46533	1670	957.25	965.47	0.14	965.82	0.000413	4.77	350.34	57.75	0.34
Reach-1	46533	1612	957.25	965.35	0.14	965.69	0.000408	4.69	343.4	57.49	0.34
Reach-1	46533	1422	957.25	964.91	0.13	965.22	0.000397	4.47	318.4	56.53	0.33
Reach-1	46533	976	957.25	963.75	0.1	963.98	0.000366	3.84	254.24	54	0.31
Reach-1	46533	460	957.25	961.93	0.06	962.06	0.000337	2.88	159.55	50.04	0.28
Reach-1	46533	134	957.25	960.27	0.03	960.31	0.000243	1.67	80.1	45.37	0.22
Reach-1	46623	8721	957.24	976.88	0.18	977.42	0.000187	6.36	2560.47	444.34	0.28
Reach-1	46623	7239	957.24	974.62	0.18	975.15	0.000219	6.23	1851.06	246.61	0.29
Reach-1	46623	4375	957.24	969.83	0.23	970.47	0.000405	6.44	728.8	186	0.37
Reach-1	46623	3336	957.24	968.48	0.19	969	0.000396	5.75	591.82	82.28	0.36
Reach-1	46623	2047	957.24	966.37	0.14	966.71	0.000342	4.71	436.59	67.47	0.32
Reach-1	46623	1761	957.24	965.77	0.12	966.08	0.000336	4.45	396.97	65.37	0.31
Reach-1	46623	1670	957.24	965.57	0.12	965.87	0.000333	4.36	384.07	64.67	0.31
Reach-1	46623	1612	957.24	965.45	0.12	965.74	0.00033	4.29	376.19	64.24	0.31
Reach-1	46623	1422	957.24	965.01	0.11	965.27	0.000325	4.09	348.03	62.67	0.3
Reach-1	46623	976	957.24	963.82	0.09	964.01	0.000306	3.54	275.9	58.74	0.29
Reach-1	46623	460	957.24	961.98	0.05	962.09	0.000274	2.66	173.21	52.91	0.26
Reach-1	46623	134	957.24	960.29	0.02	960.33	0.000179	1.51	88.75	46.73	0.19
Reach-1	46663	8721	958.32	976.77	0.22	977.48	0.000228	6.98	1583.58	132.6	0.3
Reach-1	46663	7239	958.32	974.53	0.22	975.21	0.00026	6.78	1293.58	118.7	0.31
Reach-1	46663	4375	958.32	969.89	0.21	970.49	0.00037	6.24	768.69	109.56	0.35
Reach-1	46663	3336	958.32	968.54	0.18	969.01	0.000359	5.57	628.62	96.11	0.34
Reach-1	46663	2047	958.32	966.4	0.13	966.73	0.00035	4.6	445.44	74.18	0.32
Reach-1	46663	1761	958.32	965.8	0.12	966.09	0.000341	4.36	404.06	66.95	0.31
Reach-1	46663	1670	958.32	965.6	0.12	965.88	0.000338	4.27	390.75	66.25	0.31
Reach-1	46663	1612	958.32	965.47	0.11	965.75	0.000335	4.21	382.61	65.82	0.31
Reach-1	46663	1422	958.32	965.03	0.11	965.28	0.000327	4.02	353.59	64.26	0.3
Reach-1	46663	976	958.32	963.83	0.08	964.02	0.000308	3.49	279.34	60.19	0.29
Reach-1	46663	460	958.32	961.99	0.06	962.1	0.000309	2.68	171.65	56.7	0.27
Reach-1	46663	134	958.32	960.3	0.03	960.35	0.00029	1.69	79.48	51.16	0.24
Reach-1	46703	8721	958.88	976.82	0.21	977.5	0.000227	6.74	1941.31	464.97	0.3
Reach-1	46703	7239	958.88	974.52	0.22	975.22	0.000282	6.77	1231.86	195.63	0.32
Reach-1	46703	4375	958.88	969.9	0.22	970.51	0.000424	6.29	711.73	90.92	0.37
Reach-1	46703	3336	958.88	968.54	0.19	969.04	0.00043	5.67	591.79	84.7	0.36
Reach-1	46703	2047	958.88	966.39	0.15	966.75	0.000415	4.81	425.57	69.98	0.34
Reach-1	46703	1761	958.88	965.79	0.13	966.12	0.000393	4.57	384.93	65.55	0.33
Reach-1	46703	1670	958.88	965.59	0.13	965.91	0.000392	4.49	371.9	65.07	0.33
Reach-1	46703	1612	958.88	965.48	0.13	965.78	0.000388	4.42	364.6	64.81	0.33
Reach-1	46703	1422	958.88	965.03	0.12	965.31	0.000386	4.23	335.88	63.74	0.33
Reach-1	46703	976	958.88	963.84	0.1	964.05	0.000389	3.73	261.38	60.88	0.32
Reach-1	46703	460	958.88	961.99	0.07	962.13	0.000456	3.01	152.85	56.47	0.32
Reach-1	46703	134	958.88	960.3	0.05	960.38	0.000733	2.2	60.99	52.69	0.36
Reach-1	46748	8721	958.87	976.88	0.19	977.5	0.000204	6.4	1514.85	120.9	0.28
Reach-1	46748	7239	958.87	974.65	0.19	975.25	0.000235	6.22	1245.29	120.9	0.29

HEC-RAS Plan: Housatonic small scale existing n=0.033 output

Reach-1	46748	4375	958.87	970.04	0.18	970.54	0.000334	5.67	778.05	88.83	0.33
Reach-1	46748	3336	958.87	968.66	0.15	969.06	0.000331	5.08	658.23	85.26	0.32
Reach-1	46748	2047	958.87	966.5	0.11	966.78	0.000308	4.25	481.58	75.46	0.3
Reach-1	46748	1761	958.87	965.89	0.1	966.14	0.000291	4.03	437.01	71.01	0.29
Reach-1	46748	1670	958.87	965.68	0.1	965.93	0.000284	3.95	422.83	69.56	0.28
Reach-1	46748	1612	958.87	965.57	0.1	965.8	0.000281	3.89	414.87	69.35	0.28
Reach-1	46748	1422	958.87	965.12	0.09	965.33	0.000277	3.71	383.76	68.51	0.28
Reach-1	46748	976	958.87	963.91	0.07	964.07	0.000272	3.23	302.4	66.28	0.27
Reach-1	46748	460	958.87	962.05	0.05	962.15	0.000301	2.53	181.76	63.62	0.26
Reach-1	46748	134	958.87	960.36	0.03	960.4	0.000421	1.77	75.84	60.29	0.28
Reach-1	46798	8721	958.78	976.78	0.24	977.56	0.000254	7.16	1373.02	109.6	0.32
Reach-1	46798	7239	958.78	974.56	0.24	975.3	0.000296	6.99	1129.07	109.6	0.33
Reach-1	46798	4375	958.78	969.96	0.23	970.6	0.000439	6.45	691.91	85.4	0.38
Reach-1	46798	3336	958.78	968.6	0.2	969.12	0.000442	5.81	578.87	80.82	0.37
Reach-1	46798	2047	958.78	966.44	0.16	966.82	0.00046	4.95	413.72	70.87	0.36
Reach-1	46798	1761	958.78	965.84	0.15	966.19	0.000446	4.73	372.04	66.52	0.35
Reach-1	46798	1670	958.78	965.64	0.14	965.97	0.000439	4.65	358.81	65.08	0.35
Reach-1	46798	1612	958.78	965.52	0.14	965.85	0.000432	4.59	351.48	64.3	0.35
Reach-1	46798	1422	958.78	965.07	0.13	965.38	0.000435	4.4	322.84	63.37	0.34
Reach-1	46798	976	958.78	963.87	0.11	964.11	0.000458	3.93	248.28	60.87	0.34
Reach-1	46798	460	958.78	962.02	0.09	962.19	0.000625	3.31	139.03	57.02	0.37
Reach-1	46798	134	958.78	960.34	0.08	960.46	0.001269	2.74	48.84	45.92	0.47
Reach-1	46858	8721	957.65	977.39	0.09	977.63	0.000102	4.34	3930.87	621.3	0.2
Reach-1	46858	7239	957.65	975.1	0.1	975.37	0.000138	4.5	2716.19	440.73	0.22
Reach-1	46858	4375	957.65	970.25	0.15	970.65	0.000345	5.13	1059.1	285.83	0.33
Reach-1	46858	3336	957.65	968.78	0.16	969.16	0.000432	4.98	703.37	183.39	0.35
Reach-1	46858	2047	957.65	966.54	0.13	966.85	0.000338	4.52	453.37	68.63	0.31
Reach-1	46858	1761	957.65	965.93	0.12	966.22	0.000335	4.27	412.03	67.73	0.31
Reach-1	46858	1670	957.65	965.73	0.11	966	0.000334	4.19	398.37	67.43	0.3
Reach-1	46858	1612	957.65	965.61	0.11	965.88	0.00033	4.13	390.61	67.26	0.3
Reach-1	46858	1422	957.65	965.16	0.1	965.4	0.000329	3.95	360.39	66.59	0.3
Reach-1	46858	976	957.65	963.96	0.09	964.14	0.000335	3.47	281.11	64.8	0.29
Reach-1	46858	460	957.65	962.1	0.07	962.23	0.00041	2.81	163.7	61.83	0.3
Reach-1	46858	134	957.65	960.45	0.05	960.52	0.000677	2.08	64.44	56.87	0.34
Reach-1	46903	8721	959.01	976.76	0.36	977.91	0.0004	8.83	1199.54	87	0.39
Reach-1	46903	7239	959.01	974.54	0.36	975.63	0.000457	8.56	1006.14	87	0.4
Reach-1	46903	4375	959.01	969.88	0.35	970.85	0.000676	7.96	608.77	82.51	0.46
Reach-1	46903	3336	959.01	968.52	0.3	969.31	0.000679	7.18	497.27	80.78	0.45
Reach-1	46903	2047	959.01	966.39	0.23	966.95	0.000685	6.04	339.1	55.58	0.43
Reach-1	46903	1761	959.01	965.79	0.22	966.31	0.000687	5.75	306.47	54.6	0.43
Reach-1	46903	1670	959.01	965.6	0.21	966.09	0.000687	5.65	295.72	54.27	0.43
Reach-1	46903	1612	959.01	965.48	0.21	965.96	0.000681	5.56	289.69	54.09	0.42
Reach-1	46903	1422	959.01	965.04	0.2	965.49	0.000686	5.35	265.97	53.36	0.42
Reach-1	46903	976	959.01	963.86	0.17	964.22	0.000726	4.78	204.03	51.41	0.42
Reach-1	46903	460	959.01	962.04	0.14	962.29	0.00102	4.07	113.07	48.4	0.47
Reach-1	46903	134	959.01	960.42	0.16	960.62	0.003243	3.64	36.77	45.73	0.72
Reach-1	46948	8721	958.76	977.13	0.28	977.97	0.000296	7.87	1646.17	136	0.34
Reach-1	46948	7239	958.76	974.83	0.29	975.68	0.000355	7.8	1334.02	136	0.37
Reach-1	46948	4375	958.76	969.93	0.34	970.87	0.000637	7.88	673.25	132.55	0.46
Reach-1	46948	3336	958.76	968.54	0.31	969.34	0.000668	7.24	489.38	105.67	0.45
Reach-1	46948	2047	958.76	966.41	0.24	966.99	0.000702	6.11	336.56	61.39	0.44

HEC-RAS Plan: Housatonic small scale existing n=0.033 output

Reach-1	46948	1761	958.76	965.81	0.23	966.34	0.000724	5.85	301.28	57.23	0.44
Reach-1	46948	1670	958.76	965.61	0.22	966.13	0.000732	5.76	290.08	55.87	0.45
Reach-1	46948	1612	958.76	965.5	0.22	966	0.000728	5.68	283.84	55.59	0.44
Reach-1	46948	1422	958.76	965.06	0.21	965.53	0.00074	5.48	259.46	54.49	0.44
Reach-1	46948	976	958.76	963.88	0.18	964.26	0.000802	4.96	196.72	51.56	0.45
Reach-1	46948	460	958.76	962.07	0.15	962.35	0.000989	4.22	109.02	43.56	0.47
Reach-1	46948	134	958.76	960.59	0.08	960.72	0.001135	2.81	47.64	39.62	0.45
Reach-1	46988	8721	957.74	977.23	0.27	977.99	0.000275	7.81	1959.52	170.2	0.33
Reach-1	46988	7239	957.74	974.9	0.29	975.7	0.000337	7.85	1563.42	170.2	0.36
Reach-1	46988	4375	957.74	969.91	0.37	970.92	0.000643	8.25	724.6	163.87	0.46
Reach-1	46988	3336	957.74	968.52	0.33	969.39	0.000665	7.58	509.3	127.98	0.46
Reach-1	46988	2047	957.74	966.42	0.25	967.03	0.000668	6.29	329.6	62.5	0.44
Reach-1	46988	1761	957.74	965.83	0.23	966.38	0.000681	5.96	296.15	52.41	0.44
Reach-1	46988	1670	957.74	965.63	0.22	966.16	0.000683	5.85	285.79	51.92	0.43
Reach-1	46988	1612	957.74	965.52	0.22	966.04	0.000679	5.76	279.95	51.63	0.43
Reach-1	46988	1422	957.74	965.08	0.21	965.55	0.000689	5.53	257.25	50.52	0.43
Reach-1	46988	976	957.74	963.92	0.17	964.29	0.000679	4.87	200.61	47.64	0.42
Reach-1	46988	460	957.74	962.16	0.12	962.38	0.000701	3.82	120.48	43.23	0.4
Reach-1	46988	134	957.74	960.67	0.04	960.75	0.000417	2.18	61.5	35.1	0.29
Reach-1	47033	8721	957.26	977.8	0.09	978.04	0.000097	4.4	4022.92	658.64	0.2
Reach-1	47033	7239	957.26	975.48	0.1	975.76	0.000131	4.6	2728.64	458.41	0.22
Reach-1	47033	4375	957.26	970.64	0.14	971	0.00028	4.95	1144.32	259.91	0.3
Reach-1	47033	3336	957.26	969.12	0.14	969.47	0.000335	4.79	773.5	220.81	0.32
Reach-1	47033	2047	957.26	966.78	0.13	967.09	0.000474	4.44	460.84	98.24	0.36
Reach-1	47033	1761	957.26	966.13	0.13	966.43	0.000491	4.4	399.99	87.74	0.36
Reach-1	47033	1670	957.26	965.92	0.13	966.21	0.000485	4.38	381.39	83.52	0.36
Reach-1	47033	1612	957.26	965.79	0.13	966.08	0.000477	4.34	371.07	81.07	0.36
Reach-1	47033	1422	957.26	965.31	0.12	965.59	0.000447	4.25	334.62	71.79	0.35
Reach-1	47033	976	957.26	964.11	0.1	964.33	0.000353	3.75	260.13	56.3	0.31
Reach-1	47033	460	957.26	962.29	0.06	962.41	0.000306	2.81	163.8	49.85	0.27
Reach-1	47033	134	957.26	960.74	0.02	960.77	0.000157	1.48	90.53	44.33	0.18
Reach-1	47078	8721	958.43	977.7	0.14	978.1	0.000143	5.44	2329.86	184.7	0.24
Reach-1	47078	7239	958.43	975.4	0.14	975.8	0.000173	5.39	1905.62	184.7	0.26
Reach-1	47078	4375	958.43	970.6	0.16	971.04	0.000312	5.43	1019.75	184.7	0.32
Reach-1	47078	3336	958.43	969.09	0.16	969.5	0.000363	5.16	740.47	184.7	0.34
Reach-1	47078	2047	958.43	966.78	0.15	967.12	0.000475	4.71	434.73	83.89	0.36
Reach-1	47078	1761	958.43	966.13	0.14	966.46	0.000483	4.6	382.9	77.55	0.36
Reach-1	47078	1670	958.43	965.92	0.14	966.24	0.000485	4.56	366.41	75.42	0.36
Reach-1	47078	1612	958.43	965.79	0.14	966.11	0.000482	4.51	357.08	74.19	0.36
Reach-1	47078	1422	958.43	965.32	0.13	965.62	0.00048	4.4	322.94	69.49	0.36
Reach-1	47078	976	958.43	964.11	0.11	964.35	0.000436	3.97	245.94	57.52	0.34
Reach-1	47078	460	958.43	962.29	0.08	962.44	0.000432	3.09	148.65	50.94	0.32
Reach-1	47078	134	958.43	960.73	0.03	960.79	0.000342	1.84	72.7	46.36	0.26
Reach-1	47118	8721	958.08	977.64	0.17	978.13	0.000165	6.07	2197.38	169.6	0.26
Reach-1	47118	7239	958.08	975.34	0.17	975.82	0.000194	5.98	1807	169.6	0.28
Reach-1	47118	4375	958.08	970.57	0.18	971.06	0.000315	5.84	997.43	169.6	0.33
Reach-1	47118	3336	958.08	969.06	0.17	969.51	0.000343	5.45	743	169.6	0.33
Reach-1	47118	2047	958.08	966.78	0.14	967.13	0.000398	4.75	430.65	73.54	0.34
Reach-1	47118	1761	958.08	966.15	0.13	966.47	0.000405	4.56	385.91	69.35	0.34
Reach-1	47118	1670	958.08	965.94	0.13	966.25	0.000408	4.5	371.25	68.55	0.34
Reach-1	47118	1612	958.08	965.81	0.13	966.12	0.000406	4.44	362.82	68.08	0.34

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Reach-1	47118	1422	958.08	965.35	0.12	965.64	0.000409	4.28	331.93	66.34	0.34
Reach-1	47118	976	958.08	964.14	0.11	964.37	0.000422	3.84	254.22	61.74	0.33
Reach-1	47118	460	958.08	962.3	0.08	962.45	0.000489	3.13	146.94	54.76	0.34
Reach-1	47118	134	958.08	960.74	0.04	960.8	0.000494	2.03	66.11	48.23	0.31
Reach-1	47168	8721	957.95	977.51	0.23	978.2	0.000227	7.1	1828.4	141.9	0.3
Reach-1	47168	7239	957.95	975.22	0.23	975.89	0.000265	6.97	1502.7	141.9	0.32
Reach-1	47168	4375	957.95	970.47	0.24	971.13	0.000414	6.69	828.49	141.9	0.38
Reach-1	47168	3336	957.95	969	0.21	969.57	0.000432	6.14	624.41	126.23	0.37
Reach-1	47168	2047	957.95	966.75	0.17	967.18	0.00047	5.23	405.59	78.8	0.37
Reach-1	47168	1761	957.95	966.13	0.16	966.52	0.000476	5.02	356.66	76.78	0.37
Reach-1	47168	1670	957.95	965.91	0.16	966.29	0.000478	4.94	340.54	76.11	0.37
Reach-1	47168	1612	957.95	965.79	0.15	966.16	0.000473	4.87	331.61	69.6	0.36
Reach-1	47168	1422	957.95	965.34	0.14	965.68	0.000463	4.68	304.15	57.46	0.36
Reach-1	47168	976	957.95	964.14	0.12	964.4	0.000457	4.12	237.18	54.25	0.35
Reach-1	47168	460	957.95	962.31	0.08	962.47	0.000477	3.23	142.43	49.35	0.34
Reach-1	47168	134	957.95	960.76	0.04	960.82	0.00037	1.93	69.29	43.56	0.27
Reach-1	47213	8721	958.67	977.71	0.18	978.22	0.000188	6.22	2741.4	503.85	0.27
Reach-1	47213	7239	958.67	975.36	0.19	975.91	0.000242	6.34	1837.77	297.15	0.3
Reach-1	47213	4375	958.67	970.48	0.24	971.15	0.000475	6.62	746.02	160.31	0.39
Reach-1	47213	3336	958.67	969.01	0.22	969.6	0.000522	6.14	553.29	97.7	0.4
Reach-1	47213	2047	958.67	966.77	0.18	967.2	0.00051	5.31	385.7	64.71	0.38
Reach-1	47213	1761	958.67	966.14	0.17	966.54	0.000504	5.09	346.12	61.47	0.38
Reach-1	47213	1670	958.67	965.93	0.16	966.32	0.000502	5.01	333.29	60.38	0.38
Reach-1	47213	1612	958.67	965.81	0.16	966.19	0.000496	4.95	325.96	59.75	0.37
Reach-1	47213	1422	958.67	965.34	0.15	965.69	0.000492	4.76	298.66	57.7	0.37
Reach-1	47213	976	958.67	964.15	0.12	964.42	0.000482	4.2	232.18	53.69	0.36
Reach-1	47213	460	958.67	962.32	0.09	962.49	0.000485	3.29	139.69	47.55	0.34
Reach-1	47213	134	958.67	960.78	0.03	960.83	0.000333	1.9	70.55	42.04	0.26
Reach-1	47253	8721	958.4	977.65	0.2	978.26	0.000216	6.61	1864.69	150.8	0.29
Reach-1	47253	7239	958.4	975.33	0.21	975.94	0.000264	6.57	1514.05	150.8	0.32
Reach-1	47253	4375	958.4	970.5	0.25	971.17	0.000492	6.66	785.38	150.8	0.4
Reach-1	47253	3336	958.4	969.02	0.23	969.63	0.00054	6.26	570.54	127.11	0.41
Reach-1	47253	2047	958.4	966.77	0.19	967.24	0.000568	5.48	373.33	64.71	0.4
Reach-1	47253	1761	958.4	966.14	0.18	966.58	0.000561	5.27	333.99	60.77	0.4
Reach-1	47253	1670	958.4	965.93	0.18	966.35	0.000557	5.2	321.34	59.44	0.39
Reach-1	47253	1612	958.4	965.81	0.17	966.22	0.00055	5.13	314.13	58.68	0.39
Reach-1	47253	1422	958.4	965.34	0.16	965.72	0.000546	4.95	287.22	56.37	0.39
Reach-1	47253	976	958.4	964.16	0.13	964.45	0.000513	4.36	223.62	50.82	0.37
Reach-1	47253	460	958.4	962.33	0.09	962.51	0.000501	3.38	135.94	45.25	0.34
Reach-1	47253	134	958.4	960.8	0.03	960.85	0.000323	1.91	70.23	40.45	0.26
Reach-1	47323	8721	958.38	977.66	0.2	978.28	0.000222	6.62	1813.59	148.2	0.3
Reach-1	47323	7239	958.38	975.34	0.21	975.96	0.000274	6.6	1469.32	148.2	0.32
Reach-1	47323	4375	958.38	970.51	0.26	971.21	0.000531	6.76	753.88	148.2	0.41
Reach-1	47323	3336	958.38	969.04	0.25	969.67	0.000619	6.4	538.76	129.67	0.43
Reach-1	47323	2047	958.38	966.78	0.21	967.29	0.000621	5.68	360.67	63.56	0.42
Reach-1	47323	1761	958.38	966.16	0.2	966.62	0.000614	5.47	322.11	59.49	0.41
Reach-1	47323	1670	958.38	965.95	0.19	966.4	0.00061	5.39	309.73	58.12	0.41
Reach-1	47323	1612	958.38	965.83	0.19	966.27	0.000603	5.33	302.69	57.32	0.41
Reach-1	47323	1422	958.38	965.36	0.18	965.77	0.000591	5.14	276.53	54.36	0.4
Reach-1	47323	976	958.38	964.17	0.15	964.49	0.000568	4.54	214.88	49.75	0.39
Reach-1	47323	460	958.38	962.35	0.1	962.55	0.000572	3.56	129.3	44.18	0.37

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Reach-1	47323	134	958.38	960.82	0.04	960.88	0.000395	2.05	65.25	39.28	0.28
Reach-1	47383	8721	959.17	977.67	0.21	978.3	0.000219	6.78	2113.66	266.91	0.3
Reach-1	47383	7239	959.17	975.31	0.23	976	0.000281	6.91	1536.41	222.1	0.33
Reach-1	47383	4375	959.17	970.52	0.26	971.25	0.000495	6.91	692.99	129.69	0.41
Reach-1	47383	3336	959.17	969.09	0.23	969.71	0.000517	6.3	538.18	82.91	0.4
Reach-1	47383	2047	959.17	966.87	0.19	967.32	0.000557	5.42	377.37	66	0.4
Reach-1	47383	1761	959.17	966.24	0.18	966.66	0.000576	5.24	336.39	63.81	0.4
Reach-1	47383	1670	959.17	966.02	0.18	966.44	0.000584	5.17	322.87	63.08	0.4
Reach-1	47383	1612	959.17	965.9	0.18	966.31	0.000585	5.12	315.04	62.65	0.4
Reach-1	47383	1422	959.17	965.42	0.17	965.81	0.000608	4.98	285.49	61.02	0.41
Reach-1	47383	976	959.17	964.2	0.15	964.52	0.000679	4.57	213.51	56.85	0.42
Reach-1	47383	460	959.17	962.36	0.14	962.61	0.001001	4.01	114.78	50.57	0.47
Reach-1	47383	134	959.17	960.79	0.13	960.97	0.00234	3.38	39.61	43.23	0.62
Reach-1	47428	8721	960	977.52	0.26	978.38	0.000279	7.55	1331	105.9	0.33
Reach-1	47428	7239	960	975.22	0.26	976.06	0.000331	7.4	1087.51	105.9	0.35
Reach-1	47428	4375	960	970.53	0.27	971.27	0.00051	6.93	646.71	84.74	0.41
Reach-1	47428	3336	960	969.12	0.23	969.73	0.000528	6.29	533.64	75.3	0.4
Reach-1	47428	2047	960	966.89	0.19	967.35	0.000594	5.46	374.88	68.01	0.41
Reach-1	47428	1761	960	966.26	0.19	966.69	0.000629	5.3	332.46	66.22	0.42
Reach-1	47428	1670	960	966.04	0.19	966.47	0.000644	5.25	318.36	65.62	0.42
Reach-1	47428	1612	960	965.92	0.18	966.34	0.000649	5.2	310.18	65.26	0.42
Reach-1	47428	1422	960	965.44	0.18	965.84	0.000694	5.09	279.2	63.9	0.43
Reach-1	47428	976	960	964.22	0.18	964.57	0.000862	4.8	203.27	60.44	0.46
Reach-1	47428	460	960	962.34	0.22	962.71	0.002051	4.83	95.19	54.62	0.65
Reach-1	47428	134	960	961.09	0.27	961.4	0.007171	4.48	29.88	49.58	1.02
Reach-1	47468	8721	959.62	977.65	0.24	978.4	0.000252	7.27	1864.06	263.84	0.32
Reach-1	47468	7239	959.62	975.26	0.26	976.07	0.000325	7.4	1306.59	200.31	0.35
Reach-1	47468	4375	959.62	970.53	0.28	971.31	0.000523	7.1	647.26	93.75	0.42
Reach-1	47468	3336	959.62	969.13	0.24	969.77	0.000525	6.43	531.81	74.5	0.41
Reach-1	47468	2047	959.62	966.91	0.19	967.38	0.000557	5.5	374.51	67.1	0.4
Reach-1	47468	1761	959.62	966.28	0.19	966.71	0.000591	5.31	332.72	64.99	0.41
Reach-1	47468	1670	959.62	966.06	0.18	966.49	0.000607	5.25	318.86	64.28	0.41
Reach-1	47468	1612	959.62	965.94	0.18	966.35	0.000612	5.19	310.8	63.86	0.41
Reach-1	47468	1422	959.62	965.46	0.18	965.86	0.000654	5.06	281.06	62.29	0.42
Reach-1	47468	976	959.62	964.27	0.16	964.61	0.000762	4.68	208.7	58.81	0.44
Reach-1	47468	460	959.62	962.51	0.16	962.78	0.001224	4.19	109.86	52.93	0.51
Reach-1	47468	134	959.62	961.41	0.07	961.5	0.000934	2.47	54.33	47.7	0.41
Reach-1	47523	8721	959.77	977.75	0.21	978.42	0.000221	6.7	1516.14	120.1	0.3
Reach-1	47523	7239	959.77	975.44	0.21	976.1	0.000263	6.59	1188.88	120.1	0.31
Reach-1	47523	4375	959.77	970.77	0.21	971.36	0.000399	6.14	732.27	97.48	0.36
Reach-1	47523	3336	959.77	969.33	0.18	969.81	0.000406	5.58	606.08	83.78	0.36
Reach-1	47523	2047	959.77	967.05	0.15	967.42	0.000456	4.84	423.38	76.78	0.36
Reach-1	47523	1761	959.77	966.41	0.15	966.75	0.000496	4.7	374.66	74.8	0.37
Reach-1	47523	1670	959.77	966.19	0.15	966.53	0.000514	4.66	358.46	74.13	0.37
Reach-1	47523	1612	959.77	966.06	0.15	966.39	0.000521	4.62	348.95	73.77	0.37
Reach-1	47523	1422	959.77	965.58	0.14	965.9	0.000563	4.53	313.93	72.64	0.38
Reach-1	47523	976	959.77	964.37	0.14	964.66	0.000726	4.29	227.35	69.78	0.42
Reach-1	47523	460	959.77	962.57	0.18	962.87	0.001854	4.35	105.85	65.54	0.6
Reach-1	47523	134	959.77	961.42	0.18	961.63	0.004184	3.75	35.72	51.41	0.79
Reach-1	47563	8721	960.13	977.74	0.21	978.44	0.000221	6.79	1501.36	127	0.3

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Reach-1	47563	7239	960.13	975.43	0.22	976.12	0.000268	6.73	1131.71	127	0.32
Reach-1	47563	4375	960.13	970.77	0.22	971.38	0.000414	6.29	712.78	91.08	0.37
Reach-1	47563	3336	960.13	969.32	0.19	969.84	0.00044	5.75	586.7	86.12	0.37
Reach-1	47563	2047	960.13	967.04	0.17	967.45	0.000566	5.13	399.11	78.27	0.4
Reach-1	47563	1761	960.13	966.4	0.17	966.79	0.000616	5.04	349.56	75.16	0.41
Reach-1	47563	1670	960.13	966.18	0.17	966.57	0.000636	5.01	333.27	74.09	0.42
Reach-1	47563	1612	960.13	966.05	0.17	966.43	0.000645	4.98	323.77	73.46	0.42
Reach-1	47563	1422	960.13	965.57	0.17	965.95	0.000699	4.92	289.16	71.11	0.43
Reach-1	47563	976	960.13	964.36	0.17	964.71	0.000892	4.72	206.64	65.17	0.47
Reach-1	47563	460	960.13	962.64	0.19	962.95	0.001729	4.52	101.67	56.71	0.6
Reach-1	47563	134	960.13	961.63	0.1	961.75	0.001702	2.86	46.85	51.75	0.53
Reach-1	47566	8721	960.2	977.62	0.27	978.49	0.000302	7.57	1285.63	119.14	0.34
Reach-1	47566	7239	960.2	975.32	0.28	976.17	0.000368	7.48	1035.64	105.49	0.37
Reach-1	47566	4375	960.2	970.62	0.31	971.44	0.000648	7.29	615.39	87.33	0.45
Reach-1	47566	3336	960.2	969.18	0.28	969.9	0.000734	6.79	494.28	80.92	0.47
Reach-1	47566	2047	960.2	966.89	0.28	967.52	0.000983	6.34	322.83	68.08	0.51
Reach-1	47566	1761	960.2	966.24	0.28	966.86	0.001078	6.29	279.99	64.03	0.53
Reach-1	47566	1670	960.2	966.03	0.28	966.64	0.001116	6.28	266.1	62.66	0.54
Reach-1	47566	1612	960.2	965.9	0.28	966.5	0.001131	6.24	258.13	61.86	0.54
Reach-1	47566	1422	960.2	965.42	0.28	966.02	0.001225	6.2	229.18	58.86	0.55
Reach-1	47566	976	960.2	964.22	0.28	964.77	0.001501	5.99	162.94	51.35	0.59
Reach-1	47566	460	960.2	962.49	0.34	963.04	0.003462	5.91	77.83	48.53	0.82
Reach-1	47566	134	960.2	961.54	0.21	961.8	0.004582	4.09	32.78	44.53	0.84
Reach-1	47603	8721	960.17	977.21	0.55	978.69	0.001125	9.77	896.09	98.4	0.53
Reach-1	47603	7239	960.17	974.95	0.48	976.36	0.000823	9.52	760.69	54	0.45
Reach-1	47603	4375	960.17	970.46	0.42	971.57	0.000924	8.44	518.19	54	0.48
Reach-1	47603	3336	960.17	969.1	0.34	969.98	0.000848	7.5	444.88	54	0.46
Reach-1	47603	2047	960.17	966.94	0.26	967.55	0.000807	6.24	328.27	54	0.45
Reach-1	47603	1761	960.17	966.35	0.24	966.9	0.000819	5.94	296.45	54	0.45
Reach-1	47603	1670	960.17	966.15	0.23	966.68	0.000827	5.85	285.5	54	0.45
Reach-1	47603	1612	960.17	966.03	0.23	966.55	0.000828	5.78	279.03	54	0.45
Reach-1	47603	1422	960.17	965.59	0.22	966.07	0.000854	5.58	254.92	54	0.45
Reach-1	47603	976	960.17	964.45	0.19	964.84	0.000961	5.05	193.38	54	0.47
Reach-1	47603	460	960.17	962.85	0.17	963.13	0.001425	4.3	107.04	54	0.54
Reach-1	47603	134	960.17	961.79	0.08	961.9	0.001325	2.65	50.54	51.37	0.47
Reach-1	47630 Bridge										
Reach-1	47658	8721	960	979.22	0.34	980.18	0.000613	7.91	1264.47	214.21	0.4
Reach-1	47658	7239	960	977.39	0.33	978.34	0.000577	7.81	935.56	87.7	0.38
Reach-1	47658	4375	960	972.86	0.23	973.51	0.000427	6.48	674.79	54	0.32
Reach-1	47658	3336	960	969.29	0.29	970.03	0.00067	6.92	481.85	54	0.41
Reach-1	47658	2047	960	967.11	0.2	967.6	0.000589	5.62	364.18	54	0.38
Reach-1	47658	1761	960	966.52	0.18	966.95	0.000578	5.3	332.28	54	0.38
Reach-1	47658	1670	960	966.32	0.18	966.73	0.000576	5.2	321.36	54	0.38
Reach-1	47658	1612	960	966.19	0.17	966.6	0.000572	5.12	314.84	54	0.37
Reach-1	47658	1422	960	965.75	0.16	966.12	0.000569	4.89	290.82	54	0.37
Reach-1	47658	976	960	964.62	0.13	964.9	0.000561	4.25	229.68	54	0.36
Reach-1	47658	460	960	963.05	0.08	963.21	0.000538	3.17	145.06	54	0.34
Reach-1	47658	134	960	961.91	0.03	961.95	0.000273	1.61	83.42	54	0.23
Reach-1	47718	8721	960.33	979.64	0.18	980.23	0.000177	6.27	1616.39	120.2	0.27
Reach-1	47718	7239	960.33	977.88	0.16	978.4	0.00018	5.87	1404.49	120.2	0.27

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Reach-1	47718	4375	960.33	973.12	0.15	973.55	0.000246	5.3	878.53	101.89	0.29
Reach-1	47718	3336	960.33	969.44	0.25	970.08	0.000657	6.41	527.77	88.63	0.45
Reach-1	47718	2047	960.33	967.08	0.28	967.68	0.001108	6.23	328.36	78.81	0.54
Reach-1	47718	1761	960.33	966.44	0.29	967.06	0.001285	6.29	279.9	74.04	0.57
Reach-1	47718	1670	960.33	966.22	0.3	966.85	0.001364	6.33	263.96	72.4	0.58
Reach-1	47718	1612	960.33	966.1	0.3	966.72	0.001407	6.33	254.67	71.43	0.59
Reach-1	47718	1422	960.33	965.62	0.32	966.26	0.001633	6.43	221.25	67.8	0.63
Reach-1	47718	976	960.33	964.36	0.42	965.11	0.003001	6.94	140.59	61.04	0.81
Reach-1	47718	460	960.33	963.01	0.47	963.75	0.00536	6.86	67.02	46.31	1.01
Reach-1	47718	134	960.33	961.99	0.32	962.4	0.006775	5.09	26.31	34.34	1.03
Reach-1	47773	8721	961.13	979.7	0.16	980.24	0.000161	6.04	1680.31	121.5	0.26
Reach-1	47773	7239	961.13	977.93	0.15	978.41	0.000163	5.65	1465.63	121.2	0.26
Reach-1	47773	4375	961.13	973.17	0.14	973.57	0.000225	5.12	916.78	107.34	0.28
Reach-1	47773	3336	961.13	969.53	0.23	970.12	0.000599	6.19	549.31	94.55	0.43
Reach-1	47773	2047	961.13	967.19	0.26	967.74	0.001016	5.99	341.72	83.26	0.52
Reach-1	47773	1761	961.13	966.55	0.27	967.12	0.001191	6.06	290.52	78.39	0.55
Reach-1	47773	1670	961.13	966.34	0.28	966.92	0.001267	6.1	273.69	76.62	0.57
Reach-1	47773	1612	961.13	966.21	0.28	966.79	0.001309	6.11	263.81	75.57	0.58
Reach-1	47773	1422	961.13	965.76	0.29	966.35	0.00149	6.17	230.65	71.91	0.61
Reach-1	47773	976	961.13	964.66	0.32	965.26	0.002123	6.22	156.81	63.02	0.7
Reach-1	47773	460	961.13	963.58	0.23	963.96	0.002163	4.93	93.34	54.22	0.66
Reach-1	47773	134	961.13	962.46	0.15	962.65	0.002898	3.56	37.61	44.49	0.68
Reach-1	47818	8721	960.92	979.69	0.17	980.26	0.000169	6.14	1634.83	125.72	0.27
Reach-1	47818	7239	960.92	977.92	0.15	978.42	0.000173	5.75	1415.46	122.62	0.27
Reach-1	47818	4375	960.92	973.16	0.15	973.59	0.000242	5.24	879.43	102.35	0.29
Reach-1	47818	3336	960.92	969.53	0.25	970.16	0.000665	6.38	529.49	90.22	0.45
Reach-1	47818	2047	960.92	967.21	0.27	967.8	0.001057	6.19	330.93	79.9	0.53
Reach-1	47818	1761	960.92	966.59	0.29	967.19	0.001253	6.24	282.32	75.87	0.57
Reach-1	47818	1670	960.92	966.37	0.29	966.98	0.001315	6.27	266.4	73.65	0.58
Reach-1	47818	1612	960.92	966.25	0.29	966.86	0.001346	6.27	257.12	72.33	0.59
Reach-1	47818	1422	960.92	965.8	0.3	966.42	0.001471	6.29	226.16	67.72	0.61
Reach-1	47818	976	960.92	964.8	0.29	965.36	0.001718	5.98	163.11	59.23	0.64
Reach-1	47818	460	960.92	963.75	0.18	964.05	0.001464	4.42	104.09	53.11	0.56
Reach-1	47818	134	960.92	962.63	0.09	962.75	0.001311	2.77	48.32	45.97	0.48
Reach-1	47868	8721	961.14	979.45	0.28	980.37	0.000276	7.89	1362.07	107.2	0.34
Reach-1	47868	7239	961.14	977.71	0.25	978.53	0.000279	7.38	1175.72	107.2	0.33
Reach-1	47868	4375	961.14	973	0.23	973.68	0.00037	6.63	721.78	86.64	0.36
Reach-1	47868	3336	961.14	969.34	0.38	970.3	0.000935	7.9	432.07	71.25	0.54
Reach-1	47868	2047	961.14	967.12	0.36	967.92	0.001267	7.21	284.28	61.94	0.59
Reach-1	47868	1761	961.14	966.53	0.36	967.31	0.00141	7.08	248.74	59.48	0.61
Reach-1	47868	1670	961.14	966.33	0.36	967.1	0.001476	7.05	236.88	58.65	0.62
Reach-1	47868	1612	961.14	966.21	0.36	966.97	0.001504	7.01	229.87	58.23	0.62
Reach-1	47868	1422	961.14	965.79	0.36	966.53	0.001628	6.91	205.86	56.78	0.64
Reach-1	47868	976	961.14	964.84	0.33	965.47	0.001867	6.36	153.42	53.46	0.66
Reach-1	47868	460	961.14	963.81	0.19	964.13	0.001556	4.6	99.97	49.86	0.57
Reach-1	47868	134	961.14	962.69	0.09	962.82	0.0015	2.88	46.45	45.97	0.51
Reach-1	47923	8721	961.19	979.7	0.21	980.41	0.000209	6.9	1526.52	112.4	0.29
Reach-1	47923	7239	961.19	977.94	0.19	978.56	0.00021	6.43	1329.29	109.73	0.29
Reach-1	47923	4375	961.19	973.21	0.17	973.71	0.000276	5.75	843.36	98.02	0.31
Reach-1	47923	3336	961.19	969.68	0.27	970.38	0.000649	6.71	517.63	86.7	0.45
Reach-1	47923	2047	961.19	967.43	0.25	968.01	0.000875	6.12	334.66	69.27	0.49

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Reach-1	47923	1761	961.19	966.85	0.25	967.4	0.000929	5.97	295.13	66.46	0.5
Reach-1	47923	1670	961.19	966.65	0.25	967.2	0.000951	5.92	282.18	65.51	0.5
Reach-1	47923	1612	961.19	966.53	0.24	967.07	0.000961	5.87	274.41	64.94	0.5
Reach-1	47923	1422	961.19	966.12	0.24	966.63	0.001001	5.73	248.18	62.96	0.51
Reach-1	47923	976	961.19	965.16	0.2	965.57	0.001018	5.13	190.09	57.75	0.5
Reach-1	47923	460	961.19	964	0.11	964.21	0.0008	3.66	125.75	53.52	0.42
Reach-1	47923	134	961.19	962.8	0.05	962.87	0.00057	2.09	64.11	49.65	0.32
Reach-1	47988	8721	961.41	979.65	0.25	980.46	0.000238	7.49	1508.58	110.32	0.32
Reach-1	47988	7239	961.41	977.9	0.22	978.6	0.000238	6.98	1317.83	107.8	0.31
Reach-1	47988	4375	961.41	973.18	0.2	973.75	0.000306	6.22	831.6	96.57	0.33
Reach-1	47988	3336	961.41	969.66	0.3	970.45	0.000689	7.19	510.55	86.21	0.47
Reach-1	47988	2047	961.41	967.44	0.27	968.08	0.000892	6.43	326.32	79.66	0.5
Reach-1	47988	1761	961.41	966.87	0.27	967.47	0.000987	6.25	282.7	67.08	0.52
Reach-1	47988	1670	961.41	966.67	0.27	967.27	0.001022	6.19	270.25	63.04	0.52
Reach-1	47988	1612	961.41	966.56	0.27	967.14	0.001038	6.14	262.84	62.65	0.52
Reach-1	47988	1422	961.41	966.15	0.26	966.71	0.001107	5.98	237.64	61.29	0.53
Reach-1	47988	976	961.41	965.19	0.23	965.65	0.00121	5.4	180.61	58.1	0.54
Reach-1	47988	460	961.41	964.03	0.14	964.28	0.001077	3.99	115.4	54.22	0.48
Reach-1	47988	134	961.41	962.83	0.07	962.93	0.001108	2.54	52.7	50.21	0.44
Reach-1	48023	8721	961.96	979.63	0.26	980.47	0.000259	7.57	1414.92	111.17	0.33
Reach-1	48023	7239	961.96	977.88	0.23	978.62	0.000262	7.07	1225.81	105.04	0.32
Reach-1	48023	4375	961.96	973.16	0.21	973.77	0.000353	6.37	764.89	90.17	0.35
Reach-1	48023	3336	961.96	969.65	0.34	970.51	0.000853	7.5	467.49	79.23	0.51
Reach-1	48023	2047	961.96	967.41	0.33	968.15	0.001189	6.91	298	70.72	0.57
Reach-1	48023	1761	961.96	966.83	0.33	967.55	0.001346	6.79	259.3	63.33	0.59
Reach-1	48023	1670	961.96	966.64	0.33	967.35	0.001406	6.76	246.97	62.69	0.6
Reach-1	48023	1612	961.96	966.52	0.33	967.22	0.001438	6.73	239.53	62.38	0.61
Reach-1	48023	1422	961.96	966.11	0.33	966.79	0.00158	6.64	214.16	61.28	0.63
Reach-1	48023	976	961.96	965.14	0.32	965.75	0.001983	6.24	156.32	58.72	0.67
Reach-1	48023	460	961.96	963.98	0.25	964.39	0.002565	5.13	89.71	55.62	0.71
Reach-1	48023	134	961.96	962.85	0.27	963.16	0.007085	4.47	29.99	49.49	1.01
Reach-1	48078	8721	961.64	979.53	0.31	980.54	0.000328	8.31	1309.71	110.51	0.36
Reach-1	48078	7239	961.64	977.79	0.29	978.69	0.000334	7.79	1122.93	104.08	0.36
Reach-1	48078	4375	961.64	973.07	0.27	973.84	0.00046	7.09	673.18	86.66	0.39
Reach-1	48078	3336	961.64	969.54	0.43	970.63	0.001135	8.39	402.95	67.14	0.57
Reach-1	48078	2047	961.64	967.37	0.4	968.27	0.001459	7.61	269.05	57.61	0.62
Reach-1	48078	1761	961.64	966.8	0.4	967.66	0.001599	7.45	236.52	56.49	0.64
Reach-1	48078	1670	961.64	966.62	0.39	967.47	0.001644	7.38	226.43	56.13	0.65
Reach-1	48078	1612	961.64	966.51	0.39	967.34	0.001672	7.33	220.05	55.91	0.65
Reach-1	48078	1422	961.64	966.12	0.39	966.92	0.001792	7.17	198.31	55.14	0.67
Reach-1	48078	976	961.64	965.21	0.35	965.88	0.002049	6.54	149.13	53.35	0.69
Reach-1	48078	460	961.64	964.12	0.23	964.51	0.002077	4.99	92.21	50.97	0.65
Reach-1	48078	134	961.64	963.2	0.09	963.33	0.001362	2.83	47.31	44.86	0.49
Reach-1	48128	8721	961.12	979.5	0.34	980.58	0.000351	8.6	1286.42	112.23	0.37
Reach-1	48128	7239	961.12	977.76	0.31	978.72	0.000359	8.08	1096.52	106.04	0.37
Reach-1	48128	4375	961.12	973.04	0.29	973.89	0.000501	7.4	639.1	84.64	0.41
Reach-1	48128	3336	961.12	969.54	0.47	970.72	0.001219	8.71	384.67	61.59	0.59
Reach-1	48128	2047	961.12	967.41	0.42	968.36	0.001488	7.81	262.11	54.7	0.63
Reach-1	48128	1761	961.12	966.86	0.4	967.75	0.001569	7.58	232.32	53.08	0.64
Reach-1	48128	1670	961.12	966.69	0.4	967.56	0.001588	7.48	223.19	52.57	0.64
Reach-1	48128	1612	961.12	966.58	0.39	967.43	0.001598	7.41	217.43	52.25	0.64

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Reach-1	48128	1422	961.12	966.2	0.38	967	0.00164	7.18	198.05	51.14	0.64
Reach-1	48128	976	961.12	965.37	0.3	965.97	0.001567	6.24	156.37	48.69	0.61
Reach-1	48128	460	961.12	964.3	0.16	964.59	0.001118	4.34	106.11	44.97	0.5
Reach-1	48128	134	961.12	963.3	0.04	963.37	0.000386	2.06	65.16	38.32	0.28
Reach-1	48178	8721	960.97	979.82	0.25	980.62	0.000257	7.37	1456.46	131.57	0.32
Reach-1	48178	7239	960.97	978.03	0.23	978.76	0.000269	6.97	1224.44	128.42	0.32
Reach-1	48178	4375	960.97	973.29	0.22	973.93	0.000389	6.43	708.73	89.87	0.36
Reach-1	48178	3336	960.97	969.93	0.35	970.8	0.000893	7.51	444.66	69.12	0.52
Reach-1	48178	2047	960.97	967.74	0.3	968.45	0.001015	6.74	303.51	60.12	0.53
Reach-1	48178	1761	960.97	967.19	0.29	967.84	0.001042	6.51	270.64	57.82	0.53
Reach-1	48178	1670	960.97	967.01	0.28	967.65	0.001045	6.41	260.49	57.09	0.53
Reach-1	48178	1612	960.97	966.9	0.28	967.52	0.001046	6.34	254.09	56.63	0.53
Reach-1	48178	1422	960.97	966.51	0.27	967.09	0.001049	6.11	232.68	55.05	0.52
Reach-1	48178	976	960.97	965.62	0.21	966.05	0.000959	5.27	185.14	51.36	0.49
Reach-1	48178	460	960.97	964.44	0.11	964.64	0.000641	3.61	127.49	46.51	0.38
Reach-1	48178	134	960.97	963.34	0.03	963.38	0.00024	1.71	78.52	42.64	0.22
Reach-1	48228	8721	960.95	979.71	0.3	980.69	0.000307	8.19	1394.1	117.82	0.35
Reach-1	48228	7239	960.95	977.95	0.28	978.82	0.000313	7.7	1188.7	114.81	0.35
Reach-1	48228	4375	960.95	973.23	0.26	973.98	0.00042	6.98	689.35	89.98	0.38
Reach-1	48228	3336	960.95	969.92	0.37	970.87	0.000868	7.83	433.64	64.44	0.51
Reach-1	48228	2047	960.95	967.79	0.3	968.5	0.000972	6.75	304.38	58.96	0.52
Reach-1	48228	1761	960.95	967.25	0.29	967.9	0.00102	6.48	272.39	58.01	0.52
Reach-1	48228	1670	960.95	967.07	0.28	967.7	0.001034	6.38	262.25	57.71	0.52
Reach-1	48228	1612	960.95	966.96	0.28	967.58	0.001043	6.31	255.79	57.51	0.52
Reach-1	48228	1422	960.95	966.58	0.27	967.15	0.001081	6.08	233.82	56.84	0.53
Reach-1	48228	976	960.95	965.66	0.22	966.1	0.001065	5.33	183.09	53.83	0.51
Reach-1	48228	460	960.95	964.46	0.12	964.69	0.000813	3.79	121.27	49.21	0.43
Reach-1	48228	134	960.95	963.36	0.03	963.41	0.00035	1.9	70.64	43.4	0.26
Reach-1	48273	8721	961.36	979.79	0.28	980.71	0.000293	7.88	1383.78	121.18	0.35
Reach-1	48273	7239	961.36	978.01	0.26	978.84	0.000307	7.45	1170.94	117.78	0.35
Reach-1	48273	4375	961.36	973.26	0.26	974	0.000455	6.95	660.33	86.21	0.39
Reach-1	48273	3336	961.36	969.9	0.42	970.94	0.001115	8.18	409.44	67.87	0.58
Reach-1	48273	2047	961.36	967.72	0.4	968.61	0.001464	7.58	270.21	59.66	0.63
Reach-1	48273	1761	961.36	967.16	0.39	968.02	0.001579	7.41	237.6	57.57	0.64
Reach-1	48273	1670	961.36	966.99	0.39	967.82	0.001615	7.34	227.48	56.91	0.65
Reach-1	48273	1612	961.36	966.87	0.39	967.7	0.001637	7.29	221.06	56.48	0.65
Reach-1	48273	1422	961.36	966.49	0.38	967.28	0.001725	7.13	199.55	55.03	0.66
Reach-1	48273	976	961.36	965.58	0.33	966.23	0.001816	6.44	151.59	50.83	0.66
Reach-1	48273	460	961.36	964.42	0.2	964.77	0.001457	4.76	96.74	43.53	0.56
Reach-1	48273	134	961.36	963.36	0.07	963.46	0.000824	2.56	52.4	39.57	0.39
Reach-1	48328	8721	962.04	979.62	0.36	980.8	0.000379	8.96	1228.78	104.43	0.39
Reach-1	48328	7239	962.04	977.87	0.34	978.93	0.000392	8.44	1048.52	100.89	0.39
Reach-1	48328	4375	962.04	973.15	0.33	974.08	0.000567	7.8	608.86	76.91	0.44
Reach-1	48328	3336	962.04	969.78	0.53	971.09	0.001399	9.22	369.62	64.94	0.64
Reach-1	48328	2047	962.04	967.65	0.52	968.78	0.002056	8.54	239.77	56.65	0.73
Reach-1	48328	1761	962.04	967.08	0.53	968.19	0.002328	8.46	208.19	55.06	0.77
Reach-1	48328	1670	962.04	966.9	0.53	968	0.002423	8.42	198.4	54.56	0.78
Reach-1	48328	1612	962.04	966.79	0.53	967.88	0.002486	8.39	192.19	54.24	0.79
Reach-1	48328	1422	962.04	965.47	1.1	967.53	0.006889	11.54	123.22	46.88	1.25
Reach-1	48328	976	962.04	964.73	1.07	966.57	0.008621	10.9	89.51	44.17	1.35
Reach-1	48328	460	962.04	963.82	0.84	965.07	0.01069	8.97	51.27	40.17	1.4

HEC-RAS Plan: Housatonic small scale existing n=0.033 output

Reach-1	48328	134	962.04	963	0.57	963.67	0.014581	6.58	20.37	32.29	1.46
Reach-1	48378	8721	962.5	979.77	0.33	980.83	0.000372	8.42	1235.26	108.36	0.38
Reach-1	48378	7239	962.5	977.99	0.31	978.96	0.000395	7.99	1044.81	105.22	0.38
Reach-1	48378	4375	962.5	973.23	0.32	974.12	0.000629	7.58	600.52	78.63	0.45
Reach-1	48378	3336	962.5	969.81	0.58	971.19	0.001817	9.44	354.99	66.54	0.71
Reach-1	48378	2047	962.5	967.55	0.71	969.01	0.003378	9.7	210.96	59.67	0.91
Reach-1	48378	1761	962.5	966.94	0.8	968.51	0.004313	10.05	175.3	56.87	1.01
Reach-1	48378	1670	962.5	966.82	0.78	968.34	0.004346	9.9	168.71	56.34	1.01
Reach-1	48378	1612	962.5	966.75	0.77	968.24	0.004373	9.81	164.39	55.99	1.01
Reach-1	48378	1422	962.5	966.49	0.73	967.88	0.004462	9.47	150.11	54.81	1.01
Reach-1	48378	976	962.5	965.75	0.65	966.94	0.004515	8.75	111.59	46.52	1
Reach-1	48378	460	962.5	964.73	0.49	965.49	0.005273	7.02	65.57	43.3	1
Reach-1	48378	134	962.5	963.84	0.29	964.19	0.006711	4.74	28.29	40.88	1
Reach-1	48423	8721	962.07	979.68	0.38	980.9	0.000423	9.03	1160.56	102.3	0.4
Reach-1	48423	7239	962.07	977.91	0.35	979.02	0.000444	8.54	982.86	98.73	0.4
Reach-1	48423	4375	962.07	973.19	0.35	974.18	0.000673	7.98	571.22	72.64	0.46
Reach-1	48423	3336	962.07	969.85	0.59	971.28	0.001696	9.58	350.76	61.49	0.69
Reach-1	48423	2047	962.07	968.08	0.5	969.16	0.001988	8.37	244.7	57.87	0.72
Reach-1	48423	1761	962.07	967.75	0.44	968.69	0.00184	7.79	225.92	56.21	0.69
Reach-1	48423	1670	962.07	967.62	0.42	968.53	0.001807	7.63	218.93	55.57	0.68
Reach-1	48423	1612	962.07	967.53	0.42	968.41	0.001799	7.54	213.78	55.09	0.67
Reach-1	48423	1422	962.07	967.27	0.38	968.06	0.001697	7.12	199.6	53.76	0.65
Reach-1	48423	976	962.07	966.54	0.28	967.11	0.001373	6.02	162.04	48.12	0.58
Reach-1	48423	460	962.07	965.35	0.15	965.63	0.000942	4.21	109.26	42.26	0.46
Reach-1	48423	134	962.07	964.2	0.04	964.27	0.000448	2.14	62.5	38.66	0.3
Reach-1	48483	8721	961.7	979.79	0.36	980.93	0.000399	8.77	1191.11	101.61	0.39
Reach-1	48483	7239	961.7	978.01	0.33	979.05	0.000419	8.29	1014.1	98.16	0.39
Reach-1	48483	4375	961.7	973.29	0.34	974.22	0.000645	7.79	587.81	77.77	0.45
Reach-1	48483	3336	961.7	970.07	0.54	971.39	0.001557	9.21	364.83	63.78	0.66
Reach-1	48483	2047	961.7	968.29	0.46	969.29	0.001799	8.02	255.09	59.46	0.68
Reach-1	48483	1761	961.7	967.92	0.41	968.81	0.001721	7.55	233.14	57.78	0.66
Reach-1	48483	1670	961.7	967.79	0.4	968.64	0.001703	7.41	225.5	57.18	0.66
Reach-1	48483	1612	961.7	967.69	0.39	968.52	0.001703	7.33	220.02	56.75	0.66
Reach-1	48483	1422	961.7	967.41	0.36	968.16	0.001641	6.96	204.28	55.49	0.64
Reach-1	48483	976	961.7	966.63	0.28	967.19	0.00151	6	162.57	52.26	0.6
Reach-1	48483	460	961.7	965.4	0.16	965.7	0.001123	4.39	104.72	43.44	0.5
Reach-1	48483	134	961.7	964.21	0.06	964.3	0.000686	2.41	55.51	39.61	0.36
Reach-1	48528	8721	960.68	979.83	0.34	980.95	0.000333	8.67	1216.35	95.89	0.37
Reach-1	48528	7239	960.68	978.1	0.3	979.08	0.000335	8.08	1053.31	92.23	0.37
Reach-1	48528	4375	960.68	973.47	0.27	974.26	0.000432	7.19	654.69	77.45	0.39
Reach-1	48528	3336	960.68	970.58	0.34	971.48	0.000743	7.62	448.24	66.07	0.49
Reach-1	48528	2047	960.68	968.81	0.24	969.39	0.000677	6.1	336.64	59.91	0.44
Reach-1	48528	1761	960.68	968.4	0.21	968.89	0.000638	5.65	312.33	58.48	0.43
Reach-1	48528	1670	960.68	968.25	0.2	968.72	0.000625	5.5	303.97	57.98	0.42
Reach-1	48528	1612	960.68	968.15	0.19	968.61	0.000617	5.41	298.2	57.63	0.42
Reach-1	48528	1422	960.68	967.84	0.17	968.24	0.000578	5.07	280.42	56.55	0.4
Reach-1	48528	976	960.68	966.99	0.12	967.26	0.000465	4.18	233.5	53.18	0.35
Reach-1	48528	460	960.68	965.62	0.06	965.74	0.000281	2.79	164.64	47.34	0.26
Reach-1	48528	134	960.68	964.29	0.01	964.32	0.000087	1.27	105.7	41.78	0.14
Reach-1	48568	8721	961.51	980.07	0.28	980.98	0.00028	7.87	1400.01	127.46	0.34

HEC-RAS Plan: Housatonic small scale existing n=0.033 output

Reach-1	48568	7239	961.51	978.27	0.26	979.11	0.000293	7.45	1174.69	123.6	0.34
Reach-1	48568	4375	961.51	973.59	0.24	974.29	0.000402	6.75	705.43	87.05	0.38
Reach-1	48568	3336	961.51	970.69	0.32	971.52	0.00075	7.33	471.02	74.59	0.49
Reach-1	48568	2047	961.51	968.84	0.24	969.42	0.000737	6.09	340.64	66.66	0.46
Reach-1	48568	1761	961.51	968.42	0.21	968.92	0.000699	5.69	312.83	64.84	0.44
Reach-1	48568	1670	961.51	968.27	0.21	968.75	0.000689	5.55	303.34	64.21	0.44
Reach-1	48568	1612	961.51	968.17	0.2	968.64	0.000684	5.47	296.82	63.78	0.44
Reach-1	48568	1422	961.51	967.85	0.18	968.27	0.000656	5.17	276.73	62.41	0.42
Reach-1	48568	976	961.51	966.99	0.14	967.28	0.000585	4.35	224.29	58.69	0.39
Reach-1	48568	460	961.51	965.61	0.08	965.76	0.00043	3.1	148.53	51.04	0.32
Reach-1	48568	134	961.51	964.29	0.02	964.33	0.000177	1.55	86.3	43.11	0.19
Reach-1	48633	8721	961.68	980.32	0.21	981.01	0.000237	6.8	1529.74	135.89	0.3
Reach-1	48633	7239	961.68	978.52	0.2	979.15	0.000251	6.45	1288.54	130.78	0.3
Reach-1	48633	4375	961.68	973.77	0.2	974.33	0.000377	6	761.13	93.29	0.35
Reach-1	48633	3336	961.68	970.89	0.28	971.58	0.000729	6.67	507.1	83.88	0.46
Reach-1	48633	2047	961.68	968.94	0.24	969.48	0.000877	5.86	349.41	77.49	0.48
Reach-1	48633	1761	961.68	968.49	0.22	968.98	0.000896	5.6	314.69	75.31	0.48
Reach-1	48633	1670	961.68	968.33	0.22	968.8	0.000896	5.51	302.91	74.15	0.48
Reach-1	48633	1612	961.68	968.22	0.22	968.69	0.000899	5.46	294.97	73.35	0.48
Reach-1	48633	1422	961.68	967.88	0.2	968.31	0.000891	5.26	270.39	70.85	0.47
Reach-1	48633	976	961.68	967	0.17	967.33	0.000846	4.63	210.67	64.35	0.45
Reach-1	48633	460	961.68	965.61	0.11	965.81	0.000785	3.58	128.37	54.83	0.41
Reach-1	48633	134	961.68	964.29	0.05	964.36	0.000503	2.13	62.9	42.56	0.31
Reach-1	48668	8721	963.33	980.23	0.27	981.07	0.000298	7.54	1373.01	116.89	0.34
Reach-1	48668	7239	963.33	978.43	0.25	979.2	0.000319	7.17	1166.87	112.38	0.35
Reach-1	48668	4375	963.33	973.67	0.27	974.39	0.000533	6.89	673.91	91.58	0.42
Reach-1	48668	3336	963.33	970.71	0.42	971.71	0.001213	8.06	422.93	79.1	0.59
Reach-1	48668	2047	963.33	968.76	0.4	969.62	0.001689	7.44	275.99	71.8	0.66
Reach-1	48668	1761	963.33	968.31	0.39	969.12	0.001847	7.22	244.09	70.11	0.68
Reach-1	48668	1670	963.33	968.15	0.39	968.95	0.001929	7.17	232.97	69.51	0.69
Reach-1	48668	1612	963.33	968.04	0.39	968.84	0.002002	7.15	225.36	69.1	0.7
Reach-1	48668	1422	963.33	967.69	0.39	968.46	0.002111	7.05	201.82	65.77	0.71
Reach-1	48668	976	963.33	966.81	0.36	967.49	0.002304	6.6	147.81	56.82	0.72
Reach-1	48668	460	963.33	965.36	0.4	965.99	0.004396	6.38	72.07	47.8	0.92
Reach-1	48668	134	963.33	964.38	0.29	964.73	0.006907	4.73	28.33	41.71	1.01
Reach-1	48733	8721	962.15	980.56	0.17	981.12	0.000178	6.15	1796.54	152.26	0.27
Reach-1	48733	7239	962.15	978.74	0.16	979.24	0.000189	5.85	1523.65	146.59	0.28
Reach-1	48733	4375	962.15	973.98	0.17	974.45	0.000297	5.55	873.8	122.09	0.32
Reach-1	48733	3336	962.15	971.23	0.23	971.81	0.000581	6.12	566.3	101.71	0.43
Reach-1	48733	2047	962.15	969.27	0.2	969.73	0.000714	5.42	381.05	87.63	0.45
Reach-1	48733	1761	962.15	968.81	0.19	969.23	0.000732	5.18	341.68	84.51	0.45
Reach-1	48733	1670	962.15	968.66	0.19	969.06	0.000741	5.1	328.58	83.44	0.45
Reach-1	48733	1612	962.15	968.55	0.18	968.95	0.000748	5.05	319.92	82.73	0.45
Reach-1	48733	1422	962.15	968.21	0.17	968.58	0.000771	4.87	292.1	80.4	0.45
Reach-1	48733	976	962.15	967.31	0.15	967.61	0.000817	4.39	222.07	73.61	0.45
Reach-1	48733	460	962.15	965.94	0.11	966.14	0.000871	3.55	129.73	62.39	0.43
Reach-1	48733	134	962.15	964.76	0.04	964.83	0.000412	2.03	65.9	41.7	0.29
Reach-1	48768	8721	962.58	980.55	0.17	981.13	0.000175	6.24	1751.99	168.12	0.27
Reach-1	48768	7239	962.58	978.73	0.16	979.25	0.000183	5.91	1463.53	148.48	0.27
Reach-1	48768	4375	962.58	974.01	0.15	974.46	0.000258	5.4	873.04	108.64	0.3
Reach-1	48768	3336	962.58	971.33	0.19	971.84	0.000441	5.71	600.46	94.68	0.38

HEC-RAS Plan: Housatonic small scale existing n=0.033 output

Reach-1	48768	2047	962.58	969.4	0.15	969.76	0.000475	4.81	427.25	84.62	0.37
Reach-1	48768	1761	962.58	968.94	0.14	969.26	0.00047	4.53	389.13	82.24	0.36
Reach-1	48768	1670	962.58	968.79	0.13	969.09	0.000468	4.44	376.4	81.42	0.36
Reach-1	48768	1612	962.58	968.68	0.13	968.98	0.000468	4.38	368	80.89	0.36
Reach-1	48768	1422	962.58	968.34	0.12	968.61	0.000463	4.17	340.75	79.11	0.35
Reach-1	48768	976	962.58	967.44	0.1	967.64	0.000436	3.6	270.84	75.03	0.33
Reach-1	48768	460	962.58	966.06	0.06	966.17	0.000391	2.68	171.72	68.92	0.3
Reach-1	48768	134	962.58	964.81	0.02	964.84	0.000255	1.5	89.09	62.09	0.22
Reach-1	48828	8721	962.38	980.33	0.28	981.24	0.000296	7.75	1330.67	138.87	0.35
Reach-1	48828	7239	962.38	978.53	0.26	979.36	0.000314	7.34	1102.58	114.41	0.35
Reach-1	48828	4375	962.38	973.84	0.26	974.56	0.000472	6.82	666.35	83.18	0.4
Reach-1	48828	3336	962.38	971.12	0.35	971.98	0.000917	7.48	449.94	75.41	0.52
Reach-1	48828	2047	962.38	969.23	0.3	969.89	0.00109	6.54	312.96	69.31	0.54
Reach-1	48828	1761	962.38	968.79	0.28	969.39	0.001098	6.23	282.74	67.59	0.54
Reach-1	48828	1670	962.38	968.64	0.27	969.22	0.001102	6.13	272.58	67.03	0.54
Reach-1	48828	1612	962.38	968.54	0.27	969.11	0.001106	6.06	265.84	66.65	0.54
Reach-1	48828	1422	962.38	968.21	0.25	968.73	0.001114	5.83	244.08	65.42	0.53
Reach-1	48828	976	962.38	967.33	0.21	967.74	0.001162	5.19	187.91	62.13	0.53
Reach-1	48828	460	962.38	965.98	0.17	966.26	0.001454	4.27	107.74	57.12	0.55
Reach-1	48828	134	962.38	964.75	0.14	964.92	0.002859	3.33	40.21	51.85	0.67
Reach-1	48868	8721	963.04	980.38	0.27	981.26	0.00029	7.62	1369.89	140.41	0.34
Reach-1	48868	7239	963.04	978.57	0.25	979.37	0.000311	7.25	1134.31	119.48	0.35
Reach-1	48868	4375	963.04	973.86	0.26	974.58	0.000494	6.86	666.4	87.96	0.41
Reach-1	48868	3336	963.04	971.13	0.37	972.04	0.001017	7.65	439.72	78.02	0.55
Reach-1	48868	2047	963.04	969.24	0.32	969.96	0.001183	6.81	300.52	66.95	0.57
Reach-1	48868	1761	963.04	968.8	0.3	969.45	0.001172	6.48	271.75	64.76	0.56
Reach-1	48868	1670	963.04	968.65	0.29	969.28	0.00117	6.37	262.13	64.07	0.56
Reach-1	48868	1612	963.04	968.55	0.29	969.17	0.001171	6.3	255.78	63.61	0.55
Reach-1	48868	1422	963.04	968.22	0.27	968.79	0.001163	6.04	235.31	62.11	0.55
Reach-1	48868	976	963.04	967.36	0.22	967.8	0.001149	5.33	183.17	58.11	0.53
Reach-1	48868	460	963.04	966.05	0.15	966.31	0.001161	4.15	110.9	52.07	0.5
Reach-1	48868	134	963.04	964.9	0.07	964.99	0.000917	2.47	54.21	46.78	0.4
Reach-1	48928	8721	962.05	980.08	0.42	981.42	0.000443	9.59	1196.57	120.45	0.43
Reach-1	48928	7239	962.05	978.31	0.39	979.51	0.000464	9.05	1001.2	100.52	0.43
Reach-1	48928	4375	962.05	973.64	0.39	974.73	0.000708	8.5	581.52	80.33	0.49
Reach-1	48928	3336	962.05	970.88	0.54	972.24	0.001389	9.4	375.76	69.05	0.65
Reach-1	48928	2047	962.05	969.13	0.43	970.12	0.00153	7.98	261.5	61.28	0.65
Reach-1	48928	1761	962.05	968.72	0.4	969.6	0.00154	7.53	236.7	59.46	0.64
Reach-1	48928	1670	962.05	968.58	0.39	969.43	0.00155	7.39	228.33	58.83	0.64
Reach-1	48928	1612	962.05	968.48	0.38	969.31	0.001561	7.3	222.77	58.41	0.64
Reach-1	48928	1422	962.05	968.17	0.36	968.93	0.001586	6.98	204.86	57.04	0.64
Reach-1	48928	976	962.05	967.34	0.29	967.92	0.00152	6.12	159.54	50.82	0.61
Reach-1	48928	460	962.05	966.08	0.17	966.4	0.001124	4.51	102.03	40.69	0.5
Reach-1	48928	134	962.05	964.95	0.05	965.03	0.000465	2.25	59.65	35.23	0.3
Reach-1	48978	8721	962.65	980.23	0.38	981.45	0.00042	9.1	1202.53	113.77	0.41
Reach-1	48978	7239	962.65	978.42	0.36	979.55	0.000454	8.69	1004.25	104.86	0.42
Reach-1	48978	4375	962.65	973.68	0.39	974.76	0.000762	8.4	562.55	81.61	0.51
Reach-1	48978	3336	962.65	970.93	0.58	972.34	0.001648	9.54	356.46	68.09	0.7
Reach-1	48978	2047	962.65	969.13	0.51	970.24	0.002035	8.46	241.98	59.26	0.73
Reach-1	48978	1761	962.65	968.71	0.48	969.73	0.002078	8.09	217.64	57.21	0.73
Reach-1	48978	1670	962.65	968.57	0.47	969.56	0.002085	7.97	209.5	56.51	0.73

HEC-RAS Plan: Housatonic small scale existing n=0.033 output

Reach-1	48978	1612	962.65	968.47	0.46	969.44	0.002094	7.9	204.12	56.04	0.73
Reach-1	48978	1422	962.65	968.17	0.44	969.06	0.0021	7.6	186.99	54.52	0.72
Reach-1	48978	976	962.65	967.32	0.38	968.05	0.002185	6.85	142.57	50.36	0.72
Reach-1	48978	460	962.65	966.04	0.29	966.53	0.002504	5.59	82.35	44.1	0.72
Reach-1	48978	134	962.65	964.91	0.14	965.11	0.002013	3.6	37.26	32.94	0.6
Reach-1	49028	8721	962.95	980.41	0.33	981.48	0.000371	8.44	1203.77	107.08	0.39
Reach-1	49028	7239	962.95	978.6	0.32	979.58	0.000401	8.05	1016.57	100.08	0.39
Reach-1	49028	4375	962.95	973.88	0.34	974.82	0.000682	7.77	587.66	81.79	0.48
Reach-1	49028	3336	962.95	971.27	0.49	972.45	0.001417	8.71	387.19	71.67	0.64
Reach-1	49028	2047	962.95	969.41	0.43	970.36	0.001711	7.82	261.81	63.26	0.67
Reach-1	49028	1761	962.95	968.97	0.41	969.85	0.001774	7.51	234.5	61.26	0.68
Reach-1	49028	1670	962.95	968.82	0.4	969.68	0.001792	7.41	225.36	60.57	0.68
Reach-1	49028	1612	962.95	968.72	0.4	969.56	0.001813	7.36	219.17	60.1	0.68
Reach-1	49028	1422	962.95	968.38	0.39	969.17	0.001881	7.15	198.76	58.53	0.68
Reach-1	49028	976	962.95	967.49	0.35	968.16	0.002109	6.57	148.59	54.47	0.7
Reach-1	49028	460	962.95	966.17	0.31	966.68	0.003002	5.69	80.89	48.39	0.78
Reach-1	49028	134	962.95	964.99	0.19	965.26	0.003064	4.15	32.32	31.65	0.72
Reach-1	49078	8721	963.05	980.13	0.47	981.63	0.000524	10.08	1075.68	101.09	0.46
Reach-1	49078	7239	963.05	978.35	0.45	979.73	0.000565	9.61	902.02	93.6	0.47
Reach-1	49078	4375	963.05	973.65	0.48	974.97	0.000948	9.28	509.11	73.89	0.56
Reach-1	49078	3336	963.05	971	0.69	972.68	0.001975	10.42	327.8	62.74	0.76
Reach-1	49078	2047	963.05	969.29	0.58	970.57	0.002278	9.06	226.83	55.57	0.78
Reach-1	49078	1761	963.05	968.89	0.54	970.04	0.002305	8.62	204.63	53.87	0.77
Reach-1	49078	1670	963.05	968.75	0.53	969.86	0.002324	8.48	197.15	53.28	0.77
Reach-1	49078	1612	963.05	968.65	0.52	969.75	0.002348	8.4	192.04	52.88	0.77
Reach-1	49078	1422	963.05	968.33	0.5	969.35	0.002429	8.12	175.17	51.52	0.78
Reach-1	49078	976	963.05	967.5	0.43	968.32	0.00254	7.3	133.79	48.03	0.77
Reach-1	49078	460	963.05	966.3	0.31	966.82	0.002732	5.79	79.45	43.01	0.75
Reach-1	49078	134	963.05	965.17	0.16	965.4	0.002499	3.84	34.89	32.91	0.66
Reach-1	49133	8721	963.15	980.07	0.82	981.71	0.000939	10.56	993.1	95.02	0.49
Reach-1	49133	7239	963.15	978.28	0.79	979.81	0.00103	10.13	829.66	87.83	0.5
Reach-1	49133	4375	963.15	973.57	0.9	975.11	0.001873	10.03	460.41	68.87	0.63
Reach-1	49133	3336	963.15	970.85	1.41	972.97	0.004443	11.7	287.93	57.93	0.9
Reach-1	49133	2047	963.15	969.19	1.23	970.86	0.00523	10.39	197.18	51.24	0.93
Reach-1	49133	1761	963.15	968.81	1.14	970.33	0.005263	9.88	178.26	49.71	0.92
Reach-1	49133	1670	963.15	968.68	1.11	970.15	0.005259	9.72	171.83	49.11	0.92
Reach-1	49133	1612	963.15	968.59	1.1	970.03	0.005278	9.63	167.43	48.69	0.91
Reach-1	49133	1422	963.15	968.29	1.04	969.63	0.005327	9.3	152.96	47.28	0.91
Reach-1	49133	976	963.15	967.52	0.88	968.58	0.005354	8.28	117.85	43.68	0.89
Reach-1	49133	460	963.15	966.43	0.57	967.05	0.004874	6.28	73.29	38.68	0.8
Reach-1	49133	134	963.15	965.34	0.27	965.58	0.003931	3.93	34.09	31.15	0.66
Reach-1	49188	8721	963.05	980.18	0.78	981.77	0.000899	10.34	993.9	92.67	0.48
Reach-1	49188	7239	963.05	978.41	0.75	979.88	0.000975	9.88	835.64	86.01	0.49
Reach-1	49188	4375	963.05	973.84	0.8	975.23	0.001618	9.5	481.95	68.83	0.58
Reach-1	49188	3336	963.05	971.73	0.94	973.21	0.002539	9.79	344.93	60.88	0.69
Reach-1	49188	2047	963.05	970.06	0.73	971.11	0.002695	8.22	248.88	54.63	0.68
Reach-1	49188	1761	963.05	969.63	0.67	970.58	0.002644	7.8	225.73	53.01	0.67
Reach-1	49188	1670	963.05	969.49	0.65	970.4	0.002629	7.66	218.02	52.46	0.66
Reach-1	49188	1612	963.05	969.39	0.64	970.28	0.002621	7.57	213.01	52.1	0.66
Reach-1	49188	1422	963.05	969.06	0.6	969.88	0.002593	7.25	196.13	50.87	0.65
Reach-1	49188	976	963.05	968.19	0.49	968.82	0.00253	6.37	153.11	47.58	0.63

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Reach-1	49188	460	963.05	966.88	0.33	967.25	0.002423	4.89	94.11	42.67	0.58
Reach-1	49188	134	963.05	965.59	0.16	965.74	0.001993	3.09	43.38	34.16	0.48
Reach-1	49233	8721	965.25	980.21	0.8	981.81	0.000941	10.37	977.15	91.61	0.49
Reach-1	49233	7239	965.25	978.44	0.77	979.93	0.001039	9.95	820.34	85.3	0.5
Reach-1	49233	4375	965.25	973.85	0.87	975.34	0.00189	9.82	466.77	69	0.63
Reach-1	49233	3336	965.25	969.71	3.15	973.91	0.014488	16.45	203.57	58.17	1.53
Reach-1	49233	2047	965.25	968.6	2.73	971.87	0.017338	14.5	141.14	54.59	1.59
Reach-1	49233	1761	965.25	968.32	2.61	971.35	0.018193	13.96	126.14	53.69	1.61
Reach-1	49233	1670	965.25	968.23	2.56	971.18	0.018472	13.76	121.33	53.4	1.61
Reach-1	49233	1612	965.25	968.17	2.54	971.06	0.018699	13.64	118.15	53.21	1.61
Reach-1	49233	1422	965.25	967.97	2.45	970.69	0.019573	13.23	107.48	52.56	1.63
Reach-1	49233	976	965.25	967.46	2.2	969.71	0.022409	12.03	81.14	50.91	1.68
Reach-1	49233	460	965.25	966.78	1.7	968.25	0.028218	9.74	47.23	48.71	1.74
Reach-1	49233	134	965.25	966.17	1.02	966.88	0.032796	6.75	19.84	39.82	1.69
Reach-1	49293	8721	966.65	979.92	1.1	982.04	0.001439	11.97	863.98	90.8	0.6
Reach-1	49293	7239	966.65	978.11	1.12	980.18	0.001706	11.76	706.11	84.1	0.63
Reach-1	49293	4375	966.65	973.19	1.8	976	0.005076	13.5	337.38	65.82	0.98
Reach-1	49293	3336	966.65	972.21	1.63	974.6	0.005516	12.44	274.17	62.15	0.99
Reach-1	49293	2047	966.65	970.85	1.32	972.6	0.006209	10.61	193.43	57.12	1
Reach-1	49293	1761	966.65	970.51	1.24	972.1	0.006444	10.11	174.35	55.87	1
Reach-1	49293	1670	966.65	970.39	1.22	971.94	0.006614	9.97	167.49	55.41	1.01
Reach-1	49293	1612	966.65	970.32	1.2	971.83	0.006666	9.86	163.57	55.15	1.01
Reach-1	49293	1422	966.65	970.07	1.14	971.47	0.006809	9.49	149.8	54.21	1.01
Reach-1	49293	976	966.65	969.41	0.99	970.53	0.007284	8.51	114.74	51.75	1.01
Reach-1	49293	460	966.65	968.47	0.73	969.18	0.008431	6.79	67.78	48.27	1.01
Reach-1	49293	134	966.65	967.64	0.44	967.97	0.010888	4.61	29.07	45.19	1.01
Reach-1	49333	8721	966.74	980.71	0.74	982.15	0.000982	9.76	989.55	100.86	0.49
Reach-1	49333	7239	966.74	978.91	0.74	980.3	0.001161	9.56	814.46	93.51	0.52
Reach-1	49333	4375	966.74	974.9	0.84	976.27	0.0021	9.39	473.05	77.18	0.64
Reach-1	49333	3336	966.74	973.63	0.8	974.86	0.002473	8.87	377.99	72.61	0.67
Reach-1	49333	2047	966.74	971.84	0.75	972.85	0.003226	8.09	253.03	66.25	0.73
Reach-1	49333	1761	966.74	971.39	0.73	972.35	0.003475	7.87	223.65	64.67	0.75
Reach-1	49333	1670	966.74	971.25	0.72	972.19	0.003535	7.77	214.8	64.19	0.75
Reach-1	49333	1612	966.74	971.16	0.71	972.08	0.003587	7.72	208.89	63.86	0.75
Reach-1	49333	1422	966.74	970.85	0.69	971.72	0.003772	7.51	189.39	62.77	0.76
Reach-1	49333	976	966.74	970.03	0.66	970.79	0.004604	7	139.36	59.89	0.81
Reach-1	49333	460	966.74	968.93	0.6	969.51	0.007151	6.1	75.41	56	0.93
Reach-1	49333	134	966.74	968.09	0.37	968.38	0.008897	4.3	31.14	46.22	0.92
Reach-1	49378	8721	965.54	980.49	0.93	982.31	0.001219	11.03	914.26	96.3	0.55
Reach-1	49378	7239	965.54	978.71	0.94	980.47	0.001429	10.8	749.07	88.72	0.58
Reach-1	49378	4375	965.54	974.77	1.02	976.46	0.002443	10.46	432.83	72	0.7
Reach-1	49378	3336	965.54	973.59	0.93	975.04	0.002664	9.65	350.97	67	0.71
Reach-1	49378	2047	965.54	971.93	0.78	973.01	0.003122	8.35	245.14	59.91	0.73
Reach-1	49378	1761	965.54	971.51	0.73	972.5	0.00317	7.98	220.57	58.15	0.72
Reach-1	49378	1670	965.54	971.39	0.7	972.34	0.003129	7.81	213.69	57.64	0.72
Reach-1	49378	1612	965.54	971.31	0.69	972.23	0.003106	7.71	209.14	57.3	0.71
Reach-1	49378	1422	965.54	971.05	0.63	971.88	0.00301	7.32	194.17	56.18	0.69
Reach-1	49378	976	965.54	970.37	0.48	970.97	0.00266	6.21	157.17	53.31	0.64
Reach-1	49378	460	965.54	969.39	0.25	969.68	0.0019	4.3	106.87	49.14	0.51
Reach-1	49378	134	965.54	968.41	0.08	968.49	0.000851	2.19	61.09	42.56	0.32

HEC-RAS Plan: Housatonic small scale existing n=0.033 output

Reach-1	49433	8721	965.24	980.27	0.74	982.5	0.001075	12.06	779.87	83.87	0.62
Reach-1	49433	7239	965.24	978.5	0.76	980.67	0.001295	11.86	637.58	76.78	0.66
Reach-1	49433	4375	965.24	974.52	0.92	976.77	0.002609	12.03	363.71	61.01	0.87
Reach-1	49433	3336	965.24	973.37	0.85	975.35	0.00278	11.28	295.79	57.35	0.88
Reach-1	49433	2047	965.24	971.83	0.68	973.29	0.002821	9.71	210.9	52.42	0.85
Reach-1	49433	1761	965.24	971.45	0.63	972.76	0.00279	9.21	191.28	51.21	0.84
Reach-1	49433	1670	965.24	971.34	0.6	972.6	0.002735	8.99	185.82	50.87	0.83
Reach-1	49433	1612	965.24	971.27	0.59	972.49	0.002704	8.85	182.18	50.64	0.82
Reach-1	49433	1422	965.24	971.03	0.53	972.11	0.002585	8.36	170.06	49.87	0.8
Reach-1	49433	976	965.24	970.4	0.39	971.16	0.002228	7.01	139.21	47.86	0.72
Reach-1	49433	460	965.24	969.43	0.21	969.8	0.001631	4.88	94.32	44.72	0.59
Reach-1	49433	134	965.24	968.44	0.06	968.53	0.00059	2.44	54.96	34.39	0.34
Reach-1	49488	8721	966.14	980.15	1.32	982.66	0.001784	13.08	802.81	86.13	0.66
Reach-1	49488	7239	966.14	978.39	1.35	980.85	0.002138	12.88	655.98	80.31	0.71
Reach-1	49488	4375	966.14	974.53	1.57	977.02	0.003971	12.82	370.44	67.58	0.89
Reach-1	49488	3336	966.14	973.44	1.43	975.59	0.004366	11.87	298.62	63.98	0.91
Reach-1	49488	2047	966.14	971.92	1.2	973.55	0.005108	10.27	205.67	58.99	0.93
Reach-1	49488	1761	966.14	971.53	1.15	973.04	0.005492	9.89	182.41	57.68	0.94
Reach-1	49488	1670	966.14	971.41	1.13	972.87	0.005558	9.72	175.66	57.29	0.95
Reach-1	49488	1612	966.14	971.33	1.11	972.76	0.005612	9.61	171.23	57.04	0.95
Reach-1	49488	1422	966.14	971.05	1.08	972.39	0.00596	9.31	155.19	56.1	0.96
Reach-1	49488	976	966.14	970.4	0.9	971.45	0.006215	8.22	119.67	52.67	0.94
Reach-1	49488	460	966.14	969.39	0.64	970.04	0.006333	6.49	70.9	43.65	0.9
Reach-1	49488	134	966.14	968.4	0.26	968.64	0.003697	3.9	34.4	30.4	0.65
Reach-1	49538	8721	967.04	980.04	1.48	982.84	0.002025	13.82	755.95	81.03	0.71
Reach-1	49538	7239	967.04	974.52	4.72	981.96	0.01211	22.19	357.75	64.53	1.56
Reach-1	49538	4375	967.04	972.9	3.53	977.99	0.012199	18.26	255.81	61.51	1.49
Reach-1	49538	3336	967.04	972.24	2.95	976.31	0.011867	16.28	215.96	60.29	1.43
Reach-1	49538	2047	967.04	971.29	2.13	973.98	0.011228	13.2	159.94	56.96	1.33
Reach-1	49538	1761	967.04	971.04	1.92	973.41	0.011043	12.38	145.99	56.09	1.3
Reach-1	49538	1670	967.04	970.95	1.86	973.23	0.011048	12.12	141.11	55.79	1.3
Reach-1	49538	1612	967.04	970.92	1.79	973.09	0.010738	11.85	139.22	55.67	1.28
Reach-1	49538	1422	967.04	970.72	1.67	972.7	0.010856	11.31	128.1	54.97	1.27
Reach-1	49538	976	967.04	970.92	0.66	971.71	0.00396	7.19	138.95	55.65	0.77
Reach-1	49538	460	967.04	969.83	0.5	970.34	0.005086	5.75	80.3	51.84	0.8
Reach-1	49538	134	967.04	968.62	0.5	969.02	0.010215	5.11	26.2	33.21	1.01
Reach-1	49588	8721	967.04	976.33	4.77	984.36	0.010519	22.86	402.75	62.74	1.47
Reach-1	49588	7239	967.04	975.5	4.35	982.56	0.010776	21.4	351.72	60.08	1.46
Reach-1	49588	4375	967.04	973.71	3.32	978.59	0.011212	17.75	249.14	54.37	1.41
Reach-1	49588	3336	967.04	972.98	2.81	976.9	0.011138	15.9	210.41	52.04	1.37
Reach-1	49588	2047	967.04	971.97	1.99	974.53	0.01008	12.84	159.47	48.82	1.25
Reach-1	49588	1761	967.04	971.7	1.78	973.94	0.009657	12.03	146.38	47.96	1.21
Reach-1	49588	1670	967.04	971.63	1.68	973.74	0.00928	11.66	143.21	47.75	1.19
Reach-1	49588	1612	967.04	971.92	1.28	973.55	0.006561	10.27	156.92	48.65	1.01
Reach-1	49588	1422	967.04	971.35	1.52	973.21	0.009043	10.95	129.91	46.85	1.16
Reach-1	49588	976	967.04	970.78	1.19	972.15	0.008453	9.4	103.86	45.04	1.09
Reach-1	49588	460	967.04	970	0.66	970.68	0.006518	6.61	69.63	42.55	0.91
Reach-1	49588	134	967.04	969.12	0.26	969.35	0.004058	3.86	34.71	33.45	0.67
Reach-1	49633	8721	967.04	977.45	4.25	984.84	0.008218	22.06	429.24	59.5	1.33
Reach-1	49633	7239	967.04	976.5	3.9	983.04	0.008473	20.71	373.63	57.21	1.32
Reach-1	49633	4375	967.04	974.43	3.04	979.07	0.009052	17.34	260.57	52.27	1.3

HEC-RAS Plan: Housatonic small scale existing n=0.033 output

Reach-1	49633	3336	967.04	973.59	2.61	977.37	0.009156	15.64	217.49	49.95	1.27
Reach-1	49633	2047	967.04	972.43	1.9	974.95	0.008783	12.76	161.38	46.55	1.19
Reach-1	49633	1761	967.04	972.14	1.7	974.35	0.008428	11.92	148.33	45.72	1.15
Reach-1	49633	1670	967.04	972.07	1.6	974.14	0.008111	11.55	145.11	45.52	1.13
Reach-1	49633	1612	967.04	972.02	1.56	974.01	0.007983	11.34	142.58	45.35	1.11
Reach-1	49633	1422	967.04	971.96	1.26	973.57	0.006566	10.18	140.05	45.19	1.01
Reach-1	49633	976	967.04	971.23	1.08	972.5	0.00707	9.06	107.77	43.02	1.01
Reach-1	49633	460	967.04	970.27	0.65	970.96	0.005825	6.67	68.96	37.96	0.87
Reach-1	49633	134	967.04	969.29	0.26	969.52	0.003729	3.89	34.42	30.64	0.65
Reach-1	49673	8721	966.84	980.15	2.77	985.29	0.004237	18.52	529.3	58.99	0.97
Reach-1	49673	7239	966.84	978.83	2.59	983.48	0.004486	17.54	453.42	55.74	0.98
Reach-1	49673	4375	966.84	975.99	2.12	979.45	0.005131	15.03	305.04	48.76	0.99
Reach-1	49673	3336	966.84	974.82	1.89	977.74	0.005443	13.75	249.77	45.89	0.99
Reach-1	49673	2047	966.84	973.09	1.55	975.27	0.006025	11.86	174.24	41.64	1
Reach-1	49673	1761	966.84	972.64	1.47	974.65	0.006303	11.38	155.5	40.52	1
Reach-1	49673	1670	966.84	972.49	1.44	974.44	0.006368	11.2	149.73	40.17	1.01
Reach-1	49673	1612	966.84	972.41	1.41	974.3	0.006352	11.04	146.46	39.97	1
Reach-1	49673	1422	966.84	972.15	1.29	973.85	0.006196	10.46	136.19	39.33	0.98
Reach-1	49673	976	966.84	971.67	0.86	972.74	0.004682	8.32	117.3	38.13	0.84
Reach-1	49673	460	966.84	970.63	0.46	971.16	0.003434	5.81	79.21	35.59	0.69
Reach-1	49673	134	966.84	969.46	0.19	969.64	0.002326	3.4	39.46	30.15	0.52
Reach-1	49733	8721	968.28	983.98	0.9	985.75	0.001246	10.69	815.57	73.52	0.53
Reach-1	49733	7239	968.28	982.29	0.86	983.92	0.001379	10.23	707.6	70.12	0.54
Reach-1	49733	4375	968.28	978.47	0.82	979.84	0.001912	9.4	465.32	62.64	0.6
Reach-1	49733	3336	968.28	976.82	0.82	978.11	0.002322	9.11	366.33	59.59	0.64
Reach-1	49733	2047	968.28	974.44	0.87	975.65	0.003517	8.81	232.37	53.55	0.74
Reach-1	49733	1761	968.28	973.84	0.89	975.04	0.004038	8.76	200.97	51.85	0.78
Reach-1	49733	1670	968.28	973.64	0.91	974.83	0.004276	8.78	190.3	51.26	0.8
Reach-1	49733	1612	968.28	973.49	0.92	974.7	0.004488	8.81	182.91	50.85	0.82
Reach-1	49733	1422	968.28	972.94	1.04	974.24	0.005758	9.17	155.02	49.26	0.91
Reach-1	49733	976	968.28	972.03	1.04	973.22	0.00746	8.76	111.45	46.67	1
Reach-1	49733	460	968.28	971.02	0.77	971.78	0.008671	7	65.72	43.79	1.01
Reach-1	49733	134	968.28	970.14	0.46	970.48	0.011087	4.74	28.27	41.28	1.01
Reach-1	49763 Bridge										
Reach-1	49798	8721	969.13	984.72	0.83	986.45	0.001013	10.55	826.74	91.82	0.5
Reach-1	49798	7239	969.13	982.81	0.81	984.42	0.001147	10.17	712.1	84.97	0.52
Reach-1	49798	4375	969.13	978.73	0.79	980.09	0.001711	9.37	466.96	70.34	0.59
Reach-1	49798	3336	969.13	977.04	0.82	978.33	0.002245	9.12	365.79	64.3	0.65
Reach-1	49798	2047	969.13	974.65	0.91	975.91	0.003729	9.02	226.88	55.72	0.79
Reach-1	49798	1761	969.13	974.1	0.93	975.34	0.004212	8.95	196.79	53.75	0.82
Reach-1	49798	1670	969.13	973.94	0.92	975.16	0.004298	8.85	188.62	53.2	0.83
Reach-1	49798	1612	969.13	973.82	0.93	975.04	0.00444	8.85	182.21	52.77	0.84
Reach-1	49798	1422	969.13	973.47	0.91	974.64	0.004733	8.67	164.04	51.52	0.86
Reach-1	49798	976	969.13	972.73	0.77	973.65	0.004899	7.72	126.48	48.84	0.84
Reach-1	49798	460	969.13	971.63	0.56	972.21	0.005411	6.11	75.3	44.92	0.83
Reach-1	49798	134	969.13	970.69	0.29	970.92	0.00551	3.9	34.32	41.05	0.75
Reach-1	49800	8721	968	984.91	0.73	986.47	0.000797	10.03	869.54	96.36	0.46
Reach-1	49800	7239	968	983.04	0.68	984.44	0.000854	9.51	761.54	90.14	0.46
Reach-1	49800	4375	968	979.08	0.58	980.13	0.00103	8.22	532.29	76.92	0.48
Reach-1	49800	3336	968	977.49	0.52	978.38	0.001125	7.57	440.5	71.63	0.48

HEC-RAS Plan: Housatonic small scale existing n=0.033 output

Reach-1	49800	2047	968	975.32	0.43	975.97	0.001295	6.5	315.02	64.39	0.49
Reach-1	49800	1761	968	974.82	0.4	975.41	0.001319	6.15	286.23	62.73	0.49
Reach-1	49800	1670	968	974.67	0.38	975.23	0.001318	6.02	277.31	62.22	0.48
Reach-1	49800	1612	968	974.56	0.38	975.11	0.001325	5.95	271.08	61.86	0.48
Reach-1	49800	1422	968	974.21	0.35	974.71	0.001331	5.66	251.12	60.71	0.48
Reach-1	49800	976	968	973.34	0.28	973.71	0.001283	4.85	201.12	57.81	0.45
Reach-1	49800	460	968	972.07	0.16	972.26	0.0011	3.53	130.45	53.57	0.4
Reach-1	49800	134	968	970.89	0.06	970.94	0.000654	1.93	69.39	48.09	0.28
Reach-1	49850	8721	967	985.74	0.4	986.57	0.000423	7.46	1312.18	108.15	0.33
Reach-1	49850	7239	967	983.76	0.38	984.54	0.000465	7.15	1105.65	101.03	0.34
Reach-1	49850	4375	967	979.59	0.34	980.21	0.000588	6.32	715.62	85.99	0.36
Reach-1	49850	3336	967	977.94	0.31	978.47	0.000649	5.85	578.21	80.02	0.37
Reach-1	49850	2047	967	975.65	0.26	976.05	0.000757	5.05	404.99	71.78	0.37
Reach-1	49850	1761	967	975.13	0.24	975.48	0.000747	4.79	367.62	69.88	0.37
Reach-1	49850	1670	967	974.96	0.23	975.3	0.000738	4.69	356.11	69.28	0.36
Reach-1	49850	1612	967	974.85	0.22	975.18	0.000734	4.63	348.29	68.88	0.36
Reach-1	49850	1422	967	974.48	0.21	974.78	0.000711	4.4	323.27	67.55	0.35
Reach-1	49850	976	967	973.55	0.15	973.77	0.000624	3.72	262.29	64.22	0.32
Reach-1	49850	460	967	972.2	0.08	972.31	0.000442	2.57	178.84	59.34	0.26
Reach-1	49850	134	967	970.94	0.02	970.96	0.000184	1.26	106.63	54.15	0.16
Reach-1	49900	8721	966.5	985.9	0.33	986.61	0.000342	6.87	1452.54	119.36	0.3
Reach-1	49900	7239	966.5	983.92	0.32	984.57	0.000372	6.57	1224.35	111.05	0.31
Reach-1	49900	4375	966.5	979.74	0.27	980.24	0.00045	5.74	796.42	93.49	0.32
Reach-1	49900	3336	966.5	978.07	0.24	978.5	0.000483	5.27	646.78	86.52	0.32
Reach-1	49900	2047	966.5	975.78	0.19	976.09	0.000529	4.46	459.41	76.9	0.32
Reach-1	49900	1761	966.5	975.25	0.18	975.52	0.000521	4.2	418.91	74.66	0.31
Reach-1	49900	1670	966.5	975.08	0.17	975.34	0.000514	4.11	406.38	73.95	0.31
Reach-1	49900	1612	966.5	974.96	0.17	975.22	0.000511	4.05	397.91	73.47	0.31
Reach-1	49900	1422	966.5	974.59	0.15	974.82	0.000489	3.84	370.69	71.9	0.3
Reach-1	49900	976	966.5	973.64	0.11	973.8	0.00041	3.21	304.42	67.92	0.27
Reach-1	49900	460	966.5	972.25	0.05	972.33	0.000258	2.15	214.31	62.11	0.2
Reach-1	49900	134	966.5	970.95	0.01	970.97	0.000085	0.98	137.11	56.51	0.11
Reach-1	49950	8721	967	985.77	0.45	986.69	0.000467	7.91	1301.75	112.72	0.35
Reach-1	49950	7239	967	983.8	0.43	984.66	0.000516	7.6	1087.33	104.33	0.36
Reach-1	49950	4375	967	979.63	0.38	980.33	0.000654	6.75	689.75	86.65	0.38
Reach-1	49950	3336	967	977.98	0.35	978.59	0.000719	6.25	552.72	79.65	0.39
Reach-1	49950	2047	967	975.72	0.29	976.17	0.000826	5.37	383.13	70.03	0.39
Reach-1	49950	1761	967	975.19	0.27	975.59	0.000842	5.09	346.83	67.8	0.39
Reach-1	49950	1670	967	975.02	0.26	975.41	0.000839	4.98	335.64	67.09	0.39
Reach-1	49950	1612	967	974.91	0.25	975.29	0.000838	4.92	328.05	66.61	0.39
Reach-1	49950	1422	967	974.54	0.23	974.88	0.000826	4.68	303.75	65.04	0.38
Reach-1	49950	976	967	973.61	0.18	973.85	0.000735	3.99	244.77	61.07	0.35
Reach-1	49950	460	967	972.24	0.1	972.36	0.000525	2.78	165.18	55.26	0.28
Reach-1	49950	134	967	970.96	0.03	970.99	0.000217	1.37	97.89	49.47	0.17
Reach-1	50000	8721	967.5	985.87	0.42	986.72	0.00045	7.69	1395.13	129.27	0.34
Reach-1	50000	7239	967.5	983.87	0.42	984.69	0.00051	7.47	1147.84	118.33	0.36
Reach-1	50000	4375	967.5	979.66	0.39	980.36	0.000696	6.8	698.46	95.29	0.39
Reach-1	50000	3336	967.5	978	0.37	978.63	0.000797	6.38	548.15	86.22	0.41
Reach-1	50000	2047	967.5	975.73	0.32	976.22	0.000996	5.63	366.34	73.77	0.43
Reach-1	50000	1761	967.5	975.2	0.31	975.65	0.001044	5.38	328.19	70.88	0.43
Reach-1	50000	1670	967.5	975.04	0.3	975.47	0.001055	5.28	316.48	69.97	0.43

HEC-RAS Plan: Housatonic small scale existing n=0.033 output

Reach-1	50000	1612	967.5	974.92	0.29	975.35	0.001068	5.23	308.55	69.35	0.43
Reach-1	50000	1422	967.5	974.55	0.28	974.95	0.001088	5.02	283.22	67.32	0.43
Reach-1	50000	976	967.5	973.61	0.22	973.91	0.001028	4.39	222.34	62.17	0.41
Reach-1	50000	460	967.5	972.24	0.14	972.4	0.000853	3.24	141.85	54.62	0.35
Reach-1	50000	134	967.5	970.96	0.04	971.01	0.00041	1.72	77.92	45.04	0.23
Reach-1	50050	8721	967	986.03	0.35	986.76	0.000367	6.97	1550.16	197.59	0.31
Reach-1	50050	7239	967	984.05	0.34	984.73	0.000406	6.7	1221.99	121.37	0.32
Reach-1	50050	4375	967	979.86	0.3	980.41	0.000524	5.97	768.87	97.23	0.34
Reach-1	50050	3336	967	978.2	0.28	978.68	0.000584	5.55	614.81	88.64	0.35
Reach-1	50050	2047	967	975.92	0.23	976.28	0.000691	4.81	425.86	76.81	0.36
Reach-1	50050	1761	967	975.38	0.22	975.71	0.000686	4.57	385.5	74.04	0.35
Reach-1	50050	1670	967	975.21	0.21	975.53	0.000679	4.48	373.03	73.16	0.35
Reach-1	50050	1612	967	975.1	0.2	975.4	0.000675	4.42	364.63	72.57	0.35
Reach-1	50050	1422	967	974.72	0.19	975	0.000653	4.21	337.7	70.62	0.34
Reach-1	50050	976	967	973.76	0.14	973.96	0.00057	3.59	272.1	65.63	0.31
Reach-1	50050	460	967	972.34	0.08	972.43	0.000395	2.5	183.86	58.25	0.25
Reach-1	50050	134	967	971	0.02	971.02	0.000153	1.21	110.54	51.31	0.15
Reach-1	50100	8721	966	986.28	0.24	986.79	0.000241	5.87	1836.66	195.35	0.25
Reach-1	50100	7239	966	984.28	0.23	984.76	0.000266	5.66	1466.81	155.31	0.26
Reach-1	50100	4375	966	980.07	0.2	980.44	0.000317	4.92	932.16	108.3	0.27
Reach-1	50100	3336	966	978.4	0.18	978.72	0.000336	4.5	758.98	99.58	0.27
Reach-1	50100	2047	966	976.1	0.14	976.32	0.000356	3.78	543.12	87.89	0.26
Reach-1	50100	1761	966	975.55	0.12	975.75	0.000349	3.55	495.98	85.12	0.26
Reach-1	50100	1670	966	975.38	0.12	975.57	0.000344	3.47	481.27	84.24	0.25
Reach-1	50100	1612	966	975.26	0.12	975.44	0.000341	3.42	471.41	83.64	0.25
Reach-1	50100	1422	966	974.88	0.11	975.04	0.000327	3.24	439.56	81.69	0.25
Reach-1	50100	976	966	973.87	0.08	973.99	0.000273	2.71	360.14	76.59	0.22
Reach-1	50100	460	966	972.4	0.04	972.45	0.000171	1.82	252.67	69.1	0.17
Reach-1	50100	134	966	971.02	0.01	971.03	0.000055	0.83	162.31	62.11	0.09
Reach-1	50150	8721	966	986.16	0.34	986.87	0.000335	6.94	1588.38	201.59	0.3
Reach-1	50150	7239	966	984.16	0.33	984.84	0.000372	6.72	1220.58	140.55	0.31
Reach-1	50150	4375	966	980	0.27	980.5	0.000418	5.72	801.63	88.74	0.31
Reach-1	50150	3336	966	978.35	0.23	978.77	0.00043	5.18	660.28	82.84	0.3
Reach-1	50150	2047	966	976.08	0.17	976.36	0.00043	4.27	481.16	74.69	0.29
Reach-1	50150	1761	966	975.54	0.16	975.78	0.00042	3.99	441.47	72.76	0.28
Reach-1	50150	1670	966	975.37	0.15	975.6	0.000414	3.9	429.02	72.14	0.28
Reach-1	50150	1612	966	975.25	0.15	975.48	0.000411	3.83	420.65	71.72	0.28
Reach-1	50150	1422	966	974.87	0.13	975.07	0.000394	3.61	393.54	70.36	0.27
Reach-1	50150	976	966	973.87	0.1	974.01	0.000325	3	325.21	66.79	0.24
Reach-1	50150	460	966	972.4	0.05	972.46	0.0002	1.99	230.9	61.52	0.18
Reach-1	50150	134	966	971.03	0.01	971.04	0.000063	0.89	149.91	56.61	0.1
Reach-1	50200	8721	966	986.1	0.38	986.92	0.000381	7.39	1502.12	244.51	0.32
Reach-1	50200	7239	966	984.13	0.36	984.88	0.000406	7.02	1172.77	113.56	0.32
Reach-1	50200	4375	966	979.98	0.29	980.54	0.000461	6.02	763.91	84.85	0.32
Reach-1	50200	3336	966	978.34	0.26	978.8	0.000471	5.45	629.61	78.99	0.32
Reach-1	50200	2047	966	976.07	0.19	976.38	0.000466	4.48	459.34	70.87	0.3
Reach-1	50200	1761	966	975.54	0.17	975.81	0.000453	4.18	421.97	68.96	0.29
Reach-1	50200	1670	966	975.36	0.16	975.62	0.000447	4.07	410.25	68.35	0.29
Reach-1	50200	1612	966	975.25	0.16	975.5	0.000444	4.01	402.37	67.94	0.29
Reach-1	50200	1422	966	974.87	0.14	975.09	0.000425	3.77	376.84	66.58	0.28
Reach-1	50200	976	966	973.88	0.1	974.03	0.000345	3.12	312.46	63.03	0.25

HEC-RAS Plan: Housatonic small scale existing n=0.033 output

Reach-1	50200	460	966	972.4	0.05	972.47	0.000206	2.06	223.5	57.77	0.18
Reach-1	50200	134	966	971.04	0.01	971.05	0.000061	0.91	147.97	52.89	0.1
Reach-1	50250	8721	965	986.15	0.4	986.94	0.000396	7.57	1750.93	244.35	0.32
Reach-1	50250	7239	965	984.06	0.43	984.94	0.000488	7.7	1244.22	241.2	0.35
Reach-1	50250	4375	965	979.92	0.36	980.6	0.000554	6.63	706.72	81.74	0.35
Reach-1	50250	3336	965	978.3	0.31	978.85	0.000557	5.98	580.01	74.42	0.34
Reach-1	50250	2047	965	976.06	0.22	976.43	0.000527	4.85	424.73	64.33	0.32
Reach-1	50250	1761	965	975.53	0.2	975.85	0.000505	4.51	391.23	61.94	0.31
Reach-1	50250	1670	965	975.36	0.19	975.66	0.000495	4.39	380.79	61.18	0.3
Reach-1	50250	1612	965	975.25	0.18	975.54	0.00049	4.32	373.78	60.66	0.3
Reach-1	50250	1422	965	974.87	0.16	975.13	0.000465	4.05	351.18	59.08	0.29
Reach-1	50250	976	965	973.88	0.11	974.05	0.000365	3.32	294.39	55.61	0.25
Reach-1	50250	460	965	972.4	0.05	972.48	0.000197	2.13	216.15	50.44	0.18
Reach-1	50250	134	965	971.05	0.01	971.06	0.000048	0.89	150.85	45.67	0.09
Reach-1	50300	8721	965.22	986.18	0.38	986.96	0.00038	7.32	1565.1	203.91	0.32
Reach-1	50300	7239	965.22	984.2	0.37	984.97	0.000428	7.14	1183.44	152.96	0.33
Reach-1	50300	4375	965.22	980.05	0.31	980.63	0.000492	6.14	744.71	82.68	0.33
Reach-1	50300	3336	965.22	978.41	0.27	978.89	0.000508	5.57	612.94	77.35	0.33
Reach-1	50300	2047	965.22	976.13	0.2	976.46	0.000517	4.61	445.09	69.96	0.32
Reach-1	50300	1761	965.22	975.59	0.18	975.88	0.000509	4.32	407.68	68.2	0.31
Reach-1	50300	1670	965.22	975.41	0.18	975.69	0.000503	4.22	395.92	67.64	0.31
Reach-1	50300	1612	965.22	975.3	0.17	975.56	0.000499	4.16	388.01	67.26	0.3
Reach-1	50300	1422	965.22	974.91	0.16	975.15	0.000478	3.92	362.35	65.86	0.29
Reach-1	50300	976	965.22	973.9	0.11	974.06	0.000387	3.27	298.1	60.89	0.26
Reach-1	50300	460	965.22	972.41	0.05	972.48	0.000221	2.16	212.79	53.57	0.19
Reach-1	50300	134	965.22	971.05	0.01	971.07	0.000056	0.93	144.81	46.93	0.09
Reach-1	50350	8721	966.76	986.49	0.26	987.01	0.000257	6.06	2054.06	256.04	0.26
Reach-1	50350	7239	966.76	984.47	0.27	985.01	0.000306	6.07	1538.81	252.84	0.28
Reach-1	50350	4375	966.76	980.22	0.24	980.67	0.000384	5.4	851.4	100.55	0.3
Reach-1	50350	3336	966.76	978.54	0.21	978.92	0.000408	4.94	694.07	90.58	0.3
Reach-1	50350	2047	966.76	976.21	0.17	976.48	0.000444	4.18	492.39	82.22	0.29
Reach-1	50350	1761	966.76	975.66	0.16	975.9	0.000448	3.94	447.46	80.24	0.29
Reach-1	50350	1670	966.76	975.48	0.15	975.71	0.000447	3.86	433.31	79.61	0.29
Reach-1	50350	1612	966.76	975.36	0.15	975.59	0.000448	3.81	423.82	79.18	0.29
Reach-1	50350	1422	966.76	974.97	0.14	975.17	0.000445	3.62	392.93	77.7	0.28
Reach-1	50350	976	966.76	973.93	0.1	974.08	0.00039	3.09	315.48	71.69	0.26
Reach-1	50350	460	966.76	972.42	0.05	972.49	0.000265	2.15	213.64	62.91	0.21
Reach-1	50350	134	966.76	971.06	0.01	971.08	0.000089	1	133.78	55.06	0.11
Reach-1	50400	8721	966	986.48	0.27	987.03	0.000267	6.25	1975.96	237.41	0.27
Reach-1	50400	7239	966	984.46	0.28	985.03	0.000311	6.21	1506.57	229.62	0.28
Reach-1	50400	4375	966	980.24	0.24	980.69	0.000366	5.42	856.92	98.78	0.29
Reach-1	50400	3336	966	978.57	0.21	978.94	0.000374	4.91	701.82	88.23	0.28
Reach-1	50400	2047	966	976.25	0.15	976.5	0.000372	4.04	509.93	77.92	0.27
Reach-1	50400	1761	966	975.71	0.14	975.93	0.000361	3.77	468.35	75.73	0.26
Reach-1	50400	1670	966	975.53	0.13	975.74	0.000357	3.67	454.93	75	0.26
Reach-1	50400	1612	966	975.41	0.13	975.61	0.000355	3.62	445.95	74.52	0.26
Reach-1	50400	1422	966	975.01	0.12	975.2	0.000344	3.41	416.76	72.92	0.25
Reach-1	50400	976	966	973.96	0.09	974.09	0.000292	2.86	341.78	69.52	0.23
Reach-1	50400	460	966	972.44	0.04	972.5	0.000189	1.92	239.61	64.62	0.18
Reach-1	50400	134	966	971.07	0.01	971.08	0.000062	0.87	154.26	60.23	0.1

HEC-RAS Plan: Housatonic small scale existing n=0.033 output

Reach-1	50450	8721	966.48	986.47	0.29	987.05	0.000295	6.43	1847.23	305.64	0.28
Reach-1	50450	7239	966.48	984.46	0.29	985.05	0.00034	6.32	1423.71	166.96	0.29
Reach-1	50450	4375	966.48	980.24	0.26	980.73	0.000431	5.64	826.58	99.1	0.31
Reach-1	50450	3336	966.48	978.56	0.24	978.98	0.000465	5.2	666.64	91.39	0.31
Reach-1	50450	2047	966.48	976.24	0.19	976.54	0.000515	4.42	466.77	80.72	0.31
Reach-1	50450	1761	966.48	975.7	0.17	975.97	0.000517	4.17	423.76	78.23	0.31
Reach-1	50450	1670	966.48	975.52	0.17	975.78	0.000515	4.08	409.91	77.42	0.31
Reach-1	50450	1612	966.48	975.4	0.17	975.65	0.000515	4.03	400.65	76.87	0.31
Reach-1	50450	1422	966.48	975	0.15	975.23	0.000511	3.84	370.6	75.05	0.3
Reach-1	50450	976	966.48	973.95	0.12	974.12	0.000481	3.32	294.14	70.21	0.29
Reach-1	50450	460	966.48	972.44	0.07	972.53	0.000373	2.38	193.37	63.28	0.24
Reach-1	50450	134	966.48	971.07	0.02	971.09	0.00016	1.2	112.04	55.04	0.15
Reach-1	50500	8721	966.2	986.55	0.26	987.07	0.000259	6.15	2130.64	394.04	0.26
Reach-1	50500	7239	966.2	984.51	0.27	985.06	0.000306	6.14	1535.63	221.4	0.28
Reach-1	50500	4375	966.2	980.31	0.24	980.75	0.000368	5.39	884.89	107.41	0.29
Reach-1	50500	3336	966.2	978.63	0.21	979	0.000388	4.93	714.39	97.16	0.29
Reach-1	50500	2047	966.2	976.3	0.16	976.57	0.000408	4.13	501.95	84.66	0.28
Reach-1	50500	1761	966.2	975.76	0.15	975.99	0.000403	3.88	456.92	81.11	0.28
Reach-1	50500	1670	966.2	975.58	0.14	975.8	0.0004	3.79	442.52	79.94	0.28
Reach-1	50500	1612	966.2	975.46	0.14	975.68	0.0004	3.74	432.95	79.15	0.27
Reach-1	50500	1422	966.2	975.06	0.13	975.26	0.000395	3.54	402.01	76.56	0.27
Reach-1	50500	976	966.2	974	0.1	974.14	0.000351	3.01	324.09	70.63	0.25
Reach-1	50500	460	966.2	972.48	0.05	972.54	0.000227	2.06	222.81	62.18	0.19
Reach-1	50500	134	966.2	971.08	0.01	971.1	0.000073	0.95	141.44	54.45	0.1
Reach-1	50550	8721	966	986.77	0.33	987.11	0.000327	5.19	2740.55	480	0.22
Reach-1	50550	7239	966	984.66	0.4	985.09	0.000453	5.59	1743.6	382.66	0.26
Reach-1	50550	4375	966	980.37	0.39	980.78	0.000626	5.22	928.55	128.02	0.29
Reach-1	50550	3336	966	978.68	0.36	979.04	0.000684	4.84	728.31	108.5	0.29
Reach-1	50550	2047	966	976.33	0.29	976.59	0.000757	4.13	500.57	86.99	0.29
Reach-1	50550	1761	966	975.78	0.26	976.02	0.000747	3.89	454.36	82.53	0.28
Reach-1	50550	1670	966	975.6	0.25	975.83	0.000741	3.81	439.7	81.06	0.28
Reach-1	50550	1612	966	975.48	0.25	975.7	0.000739	3.76	430	80.07	0.28
Reach-1	50550	1422	966	975.09	0.23	975.28	0.000726	3.57	398.77	76.81	0.27
Reach-1	50550	976	966	974.02	0.17	974.17	0.000638	3.05	320.51	70.71	0.25
Reach-1	50550	460	966	972.5	0.09	972.57	0.000422	2.1	219.12	62.28	0.2
Reach-1	50550	134	966	971.09	0.02	971.11	0.000142	0.98	136.99	54.51	0.11
Reach-1	50600	8721	966.6	986.91	0.23	987.13	0.000228	4.39	3361.02	480	0.19
Reach-1	50600	7239	966.6	984.82	0.29	985.12	0.000324	4.79	2359.35	475.91	0.22
Reach-1	50600	4375	966.6	980.48	0.32	980.82	0.000506	4.74	1003.77	123.93	0.26
Reach-1	50600	3336	966.6	978.78	0.29	979.07	0.000546	4.37	806.92	111.41	0.26
Reach-1	50600	2047	966.6	976.41	0.24	976.63	0.000612	3.75	556.93	100.2	0.26
Reach-1	50600	1761	966.6	975.86	0.22	976.06	0.000618	3.54	502.22	96.99	0.26
Reach-1	50600	1670	966.6	975.68	0.21	975.87	0.000619	3.47	484.79	94.92	0.26
Reach-1	50600	1612	966.6	975.56	0.21	975.74	0.000621	3.42	473.3	93.52	0.26
Reach-1	50600	1422	966.6	975.15	0.19	975.32	0.000624	3.26	436.48	88.91	0.26
Reach-1	50600	976	966.6	974.08	0.15	974.2	0.000575	2.82	345.78	79.66	0.24
Reach-1	50600	460	966.6	972.52	0.08	972.58	0.000384	1.99	231.61	67.06	0.19
Reach-1	50600	134	966.6	971.1	0.02	971.12	0.000127	0.93	144.02	57.09	0.1
Reach-1	50650	8721	966.8	986.86	0.31	987.17	0.000292	5.12	2952.34	500	0.21
Reach-1	50650	7239	966.8	984.77	0.37	985.17	0.000393	5.46	1948.6	415.74	0.24
Reach-1	50650	4375	966.8	980.48	0.36	980.85	0.00052	5.08	1008.79	131.49	0.26

HEC-RAS Plan: Housatonic small scale existing n=0.033 output

Reach-1	50650	3336	966.8	978.79	0.32	979.11	0.000538	4.65	806.8	114.75	0.26
Reach-1	50650	2047	966.8	976.43	0.24	976.67	0.000548	3.9	549.44	100.75	0.25
Reach-1	50650	1761	966.8	975.88	0.22	976.09	0.00053	3.65	495.87	93.53	0.25
Reach-1	50650	1670	966.8	975.7	0.21	975.9	0.000522	3.56	479.35	89.75	0.24
Reach-1	50650	1612	966.8	975.58	0.2	975.77	0.000518	3.5	468.65	87.21	0.24
Reach-1	50650	1422	966.8	975.18	0.18	975.35	0.000498	3.29	435.39	78.79	0.23
Reach-1	50650	976	966.8	974.12	0.14	974.23	0.000442	2.73	357.12	70.58	0.21
Reach-1	50650	460	966.8	972.54	0.07	972.59	0.000268	1.82	252.18	62.7	0.16
Reach-1	50650	134	966.8	971.11	0.01	971.12	0.000074	0.8	167.72	55.56	0.08
Reach-1	50700	8721	966.24	986.87	0.31	987.18	0.000296	5.04	2781.96	432.5	0.22
Reach-1	50700	7239	966.24	984.81	0.35	985.19	0.000389	5.3	1906.18	381.67	0.24
Reach-1	50700	4375	966.24	980.49	0.37	980.88	0.000565	5.09	974.78	154.62	0.27
Reach-1	50700	3336	966.24	978.8	0.33	979.14	0.000599	4.67	765.24	110.44	0.27
Reach-1	50700	2047	966.24	976.45	0.26	976.69	0.000647	3.96	527.24	91.59	0.27
Reach-1	50700	1761	966.24	975.9	0.24	976.12	0.00064	3.72	478.51	87.23	0.27
Reach-1	50700	1670	966.24	975.72	0.23	975.93	0.000637	3.64	463.04	85.79	0.26
Reach-1	50700	1612	966.24	975.6	0.22	975.8	0.000636	3.59	452.8	84.83	0.26
Reach-1	50700	1422	966.24	975.21	0.21	975.39	0.000629	3.4	419.69	81.65	0.26
Reach-1	50700	976	966.24	974.14	0.16	974.27	0.000571	2.9	336.5	74.32	0.24
Reach-1	50700	460	966.24	972.55	0.08	972.62	0.000385	2.03	226.93	63.88	0.19
Reach-1	50700	134	966.24	971.12	0.02	971.14	0.000124	0.94	142.33	54.46	0.1
Reach-1	50750	8721	968.14	986.98	0.24	987.21	0.000235	4.48	3627.48	637.25	0.19
Reach-1	50750	7239	968.14	984.89	0.32	985.21	0.00035	5.01	2299.24	630.94	0.23
Reach-1	50750	4375	968.14	980.5	0.38	980.91	0.0006	5.19	919.54	159.56	0.28
Reach-1	50750	3336	968.14	978.82	0.34	979.16	0.000629	4.73	729.67	95.17	0.28
Reach-1	50750	2047	968.14	976.47	0.27	976.72	0.000675	3.99	517.62	85.57	0.28
Reach-1	50750	1761	968.14	975.92	0.24	976.14	0.000673	3.76	471.17	83.32	0.27
Reach-1	50750	1670	968.14	975.75	0.23	975.96	0.00067	3.67	456.44	82.59	0.27
Reach-1	50750	1612	968.14	975.63	0.23	975.83	0.000669	3.62	446.64	82.11	0.27
Reach-1	50750	1422	968.14	975.23	0.21	975.42	0.000664	3.43	414.54	80.49	0.26
Reach-1	50750	976	968.14	974.16	0.17	974.3	0.000627	2.95	330.64	76.11	0.25
Reach-1	50750	460	968.14	972.56	0.1	972.64	0.000519	2.15	214.35	69.57	0.22
Reach-1	50750	134	968.14	971.13	0.03	971.15	0.000276	1.13	118.95	63.72	0.15
Reach-1	50800	8721	967.84	986.99	0.24	987.22	0.000234	4.45	3388.66	589.05	0.19
Reach-1	50800	7239	967.84	984.93	0.29	985.23	0.000324	4.8	2191.62	523.44	0.22
Reach-1	50800	4375	967.84	980.58	0.34	980.94	0.000543	4.92	1023.86	231.79	0.27
Reach-1	50800	3336	967.84	978.88	0.32	979.2	0.000594	4.57	760.08	102.47	0.27
Reach-1	50800	2047	967.84	976.51	0.25	976.75	0.000658	3.89	532.08	90.43	0.27
Reach-1	50800	1761	967.84	975.96	0.23	976.17	0.000662	3.67	482.79	87.61	0.27
Reach-1	50800	1670	967.84	975.78	0.23	975.98	0.000661	3.59	467.3	86.71	0.27
Reach-1	50800	1612	967.84	975.66	0.22	975.86	0.00066	3.55	457.01	86.1	0.27
Reach-1	50800	1422	967.84	975.27	0.2	975.44	0.000645	3.37	423.38	84.09	0.26
Reach-1	50800	976	967.84	974.19	0.16	974.32	0.000614	2.91	335.88	78.61	0.25
Reach-1	50800	460	967.84	972.59	0.1	972.66	0.00051	2.13	216.21	70.43	0.21
Reach-1	50800	134	967.84	971.14	0.03	971.16	0.000265	1.12	119.86	63.08	0.14
Reach-1	50850	8721	966.84	987.08	0.18	987.23	0.00018	3.86	4073.78	657.33	0.17
Reach-1	50850	7239	966.84	985.05	0.22	985.25	0.000252	4.19	2755.88	640.41	0.19
Reach-1	50850	4375	966.84	980.68	0.3	980.97	0.000481	4.56	1280.53	277.39	0.25
Reach-1	50850	3336	966.84	978.93	0.31	979.23	0.000609	4.53	864	221.85	0.27
Reach-1	50850	2047	966.84	976.54	0.27	976.79	0.000743	4.01	515.53	92.11	0.29
Reach-1	50850	1761	966.84	975.99	0.25	976.21	0.000747	3.8	465.54	88.06	0.28

HEC-RAS Plan: Housatonic small scale existing n=0.033 output

Reach-1	50850	1670	966.84	975.81	0.25	976.03	0.000743	3.72	450	86.77	0.28
Reach-1	50850	1612	966.84	975.69	0.24	975.9	0.000743	3.67	439.72	85.9	0.28
Reach-1	50850	1422	966.84	975.3	0.22	975.49	0.000735	3.5	406.31	83.02	0.28
Reach-1	50850	976	966.84	974.22	0.18	974.37	0.000676	3.04	321.47	75.21	0.26
Reach-1	50850	460	966.84	972.61	0.1	972.68	0.000497	2.2	209.49	63.5	0.21
Reach-1	50850	134	966.84	971.15	0.03	971.17	0.000186	1.08	124.65	53.09	0.12
Reach-1	50900	8721	967.82	987.03	0.27	987.27	0.000264	4.7	3465.22	626.64	0.2
Reach-1	50900	7239	967.82	984.98	0.34	985.3	0.000385	5.2	2227.82	563.51	0.24
Reach-1	50900	4375	967.82	980.6	0.44	981.04	0.000706	5.54	1013.08	228	0.31
Reach-1	50900	3336	967.82	978.88	0.42	979.3	0.000819	5.27	697.24	109.08	0.32
Reach-1	50900	2047	967.82	976.53	0.36	976.86	0.000967	4.61	462.72	90.25	0.33
Reach-1	50900	1761	967.82	975.98	0.34	976.28	0.00099	4.38	414.25	85.85	0.33
Reach-1	50900	1670	967.82	975.81	0.33	976.09	0.000995	4.29	399.23	84.44	0.33
Reach-1	50900	1612	967.82	975.69	0.32	975.96	0.001	4.24	389.32	83.5	0.33
Reach-1	50900	1422	967.82	975.3	0.3	975.56	0.001005	4.04	357.98	80.44	0.32
Reach-1	50900	976	967.82	974.24	0.25	974.43	0.000995	3.55	276.67	71.77	0.31
Reach-1	50900	460	967.82	972.62	0.16	972.73	0.000878	2.69	171.25	58.85	0.28
Reach-1	50900	134	967.82	971.16	0.05	971.2	0.000424	1.43	93.48	47.94	0.18
Reach-1	50950	8721	967.6	987.13	0.19	987.29	0.000184	3.91	4338.96	750	0.17
Reach-1	50950	7239	967.6	985.1	0.25	985.33	0.00028	4.43	2843.19	686.94	0.2
Reach-1	50950	4375	967.6	980.74	0.34	981.08	0.000537	4.85	1151.35	243.72	0.27
Reach-1	50950	3336	967.6	979.03	0.32	979.35	0.00062	4.62	806.39	139.19	0.28
Reach-1	50950	2047	967.6	976.66	0.28	976.91	0.000729	4.04	521.48	102.33	0.29
Reach-1	50950	1761	967.6	976.1	0.25	976.33	0.000732	3.83	466.88	93.98	0.28
Reach-1	50950	1670	967.6	975.92	0.25	976.14	0.000727	3.75	450.33	91.31	0.28
Reach-1	50950	1612	967.6	975.8	0.24	976.01	0.000724	3.7	439.55	89.52	0.28
Reach-1	50950	1422	967.6	975.41	0.22	975.61	0.000708	3.51	406.01	83.71	0.27
Reach-1	50950	976	967.6	974.34	0.17	974.48	0.000663	3.03	322.14	74.43	0.26
Reach-1	50950	460	967.6	972.69	0.11	972.77	0.000559	2.23	206.13	66.84	0.22
Reach-1	50950	134	967.6	971.19	0.04	971.21	0.000286	1.2	112.08	56.37	0.15
Reach-1	51000	8721	967.58	987.13	0.19	987.3	0.000189	4	4159.41	770	0.17
Reach-1	51000	7239	967.58	985.1	0.25	985.35	0.000279	4.46	2610.42	700.86	0.2
Reach-1	51000	4375	967.58	980.79	0.31	981.11	0.000482	4.65	1170.96	263.97	0.25
Reach-1	51000	3336	967.58	979.08	0.3	979.38	0.000556	4.44	800.64	129.79	0.26
Reach-1	51000	2047	967.58	976.72	0.24	976.94	0.000613	3.78	548.9	95.01	0.26
Reach-1	51000	1761	967.58	976.16	0.22	976.36	0.000618	3.57	496.9	91.58	0.26
Reach-1	51000	1670	967.58	975.99	0.21	976.17	0.000618	3.49	480.55	90.48	0.26
Reach-1	51000	1612	967.58	975.87	0.21	976.05	0.000619	3.44	469.74	89.74	0.26
Reach-1	51000	1422	967.58	975.47	0.19	975.64	0.000616	3.27	435.15	87.33	0.25
Reach-1	51000	976	967.58	974.39	0.15	974.51	0.00059	2.84	343.67	80.63	0.24
Reach-1	51000	460	967.58	972.73	0.09	972.8	0.000492	2.11	218.51	70.43	0.21
Reach-1	51000	134	967.58	971.21	0.03	971.23	0.000253	1.13	118.84	59.62	0.14
Reach-1	51050	8721	965.87	987.14	0.18	987.3	0.000171	3.89	4263.65	750	0.16
Reach-1	51050	7239	965.87	985.11	0.24	985.36	0.000256	4.38	2744.19	750	0.2
Reach-1	51050	4375	965.87	980.86	0.25	981.13	0.000375	4.27	1226.45	237.75	0.23
Reach-1	51050	3336	965.87	979.17	0.23	979.41	0.000401	3.96	902.46	145.54	0.23
Reach-1	51050	2047	965.87	976.8	0.17	976.97	0.000405	3.29	636.09	101.86	0.22
Reach-1	51050	1761	965.87	976.24	0.16	976.39	0.000396	3.08	580.09	98.04	0.21
Reach-1	51050	1670	965.87	976.06	0.15	976.2	0.000391	3	562.46	96.8	0.21
Reach-1	51050	1612	965.87	975.94	0.15	976.07	0.000389	2.96	550.81	95.98	0.21
Reach-1	51050	1422	965.87	975.54	0.13	975.66	0.000376	2.79	513.51	93.29	0.2

HEC-RAS Plan: Housatonic small scale existing n=0.033 output

Reach-1	51050	976	965.87	974.45	0.1	974.53	0.000342	2.35	415.16	85.79	0.19
Reach-1	51050	460	965.87	972.77	0.05	972.81	0.000232	1.64	281.05	74.36	0.15
Reach-1	51050	134	965.87	971.23	0.01	971.24	0.000078	0.77	174.6	63.85	0.08
Reach-1	51100	8721	967.51	987.15	0.18	987.31	0.000177	3.88	4300.68	780	0.17
Reach-1	51100	7239	967.51	985.12	0.25	985.38	0.000275	4.44	2721.16	780	0.2
Reach-1	51100	4375	967.51	980.86	0.28	981.16	0.000433	4.44	1105.6	197.42	0.24
Reach-1	51100	3336	967.51	979.18	0.25	979.43	0.000463	4.09	851.93	122.09	0.24
Reach-1	51100	2047	967.51	976.81	0.2	977	0.000499	3.45	598.49	97.99	0.24
Reach-1	51100	1761	967.51	976.25	0.18	976.41	0.000499	3.25	544.4	95.05	0.23
Reach-1	51100	1670	967.51	976.07	0.17	976.23	0.000498	3.18	527.27	94.1	0.23
Reach-1	51100	1612	967.51	975.95	0.17	976.1	0.000498	3.14	515.94	93.47	0.23
Reach-1	51100	1422	967.51	975.55	0.16	975.69	0.000482	2.97	479.45	91.4	0.23
Reach-1	51100	976	967.51	974.45	0.12	974.56	0.000449	2.55	382.14	85.64	0.21
Reach-1	51100	460	967.51	972.78	0.07	972.83	0.000375	1.87	245.83	76.85	0.18
Reach-1	51100	134	967.51	971.24	0.02	971.25	0.000189	0.99	134.84	65.53	0.12
Reach-1	51150	8721	967.58	987.16	0.19	987.33	0.000182	3.98	4162.23	720	0.17
Reach-1	51150	7239	967.58	985.13	0.25	985.39	0.000276	4.51	2704.87	720	0.2
Reach-1	51150	4375	967.58	980.87	0.28	981.17	0.000427	4.49	1119.43	196.2	0.24
Reach-1	51150	3336	967.58	979.19	0.25	979.45	0.000451	4.12	853.96	120.92	0.24
Reach-1	51150	2047	967.58	976.83	0.2	977.02	0.00047	3.45	602.33	97.99	0.23
Reach-1	51150	1761	967.58	976.27	0.18	976.43	0.000465	3.24	548.37	94.77	0.23
Reach-1	51150	1670	967.58	976.09	0.17	976.25	0.000462	3.17	531.32	93.73	0.23
Reach-1	51150	1612	967.58	975.97	0.17	976.12	0.00046	3.12	520.04	93.03	0.23
Reach-1	51150	1422	967.58	975.57	0.15	975.71	0.000451	2.95	483.75	90.76	0.22
Reach-1	51150	976	967.58	974.47	0.12	974.57	0.000422	2.52	387.39	84.44	0.21
Reach-1	51150	460	967.58	972.79	0.07	972.84	0.000325	1.81	253.55	74.77	0.17
Reach-1	51150	134	967.58	971.25	0.02	971.26	0.00015	0.93	144.81	65.88	0.11
Reach-1	51200	8721	967.58	987.17	0.18	987.33	0.000178	3.87	4370.95	770	0.17
Reach-1	51200	7239	967.58	985.15	0.25	985.4	0.000284	4.47	2811.45	770	0.21
Reach-1	51200	4375	967.58	980.9	0.28	981.19	0.000437	4.41	1171.59	186.84	0.24
Reach-1	51200	3336	967.58	979.21	0.26	979.47	0.000488	4.14	894.79	150.27	0.25
Reach-1	51200	2047	967.58	976.85	0.22	977.05	0.000564	3.6	580.26	106.03	0.25
Reach-1	51200	1761	967.58	976.29	0.2	976.47	0.000572	3.41	522.39	100.85	0.25
Reach-1	51200	1670	967.58	976.11	0.19	976.28	0.000573	3.34	504.31	99.17	0.25
Reach-1	51200	1612	967.58	975.99	0.19	976.16	0.000575	3.29	492.42	98.06	0.25
Reach-1	51200	1422	967.58	975.59	0.18	975.75	0.000576	3.14	454.4	94.4	0.25
Reach-1	51200	976	967.58	974.49	0.14	974.61	0.000555	2.74	356.09	84.21	0.23
Reach-1	51200	460	967.58	972.81	0.09	972.87	0.00044	2.03	226.18	70.6	0.2
Reach-1	51200	134	967.58	971.25	0.03	971.27	0.000207	1.07	125.59	58.8	0.13
Reach-1	51250	8721	968.45	987.19	0.19	987.35	0.000184	3.94	4291.55	710	0.17
Reach-1	51250	7239	968.45	985.17	0.26	985.41	0.000286	4.51	2852.7	710	0.21
Reach-1	51250	4375	968.45	980.89	0.32	981.23	0.000504	4.77	1097.83	196.87	0.26
Reach-1	51250	3336	968.45	979.21	0.3	979.52	0.000565	4.49	807.72	148.4	0.27
Reach-1	51250	2047	968.45	976.87	0.24	977.09	0.000614	3.81	546.88	93.88	0.26
Reach-1	51250	1761	968.45	976.31	0.22	976.51	0.000616	3.59	495.24	90.87	0.26
Reach-1	51250	1670	968.45	976.13	0.21	976.32	0.000615	3.52	478.92	89.9	0.26
Reach-1	51250	1612	968.45	976.01	0.21	976.2	0.000616	3.47	468.13	89.25	0.26
Reach-1	51250	1422	968.45	975.62	0.19	975.78	0.000613	3.29	433.27	87.12	0.25
Reach-1	51250	976	968.45	974.51	0.16	974.64	0.000615	2.87	340.56	81.2	0.25
Reach-1	51250	460	968.45	972.83	0.1	972.9	0.000571	2.18	211.16	72.11	0.22
Reach-1	51250	134	968.45	971.26	0.04	971.29	0.000416	1.28	105.02	63.7	0.18

HEC-RAS Plan: Housatonic small scale existing n=0.033 output

Reach-1	51300	8721	968.25	987.21	0.16	987.35	0.00016	3.67	4511.24	740	0.16
Reach-1	51300	7239	968.25	985.24	0.2	985.43	0.000228	4.02	3110.72	639.59	0.18
Reach-1	51300	4375	968.25	981.01	0.24	981.26	0.000381	4.15	1343.62	269.97	0.23
Reach-1	51300	3336	968.25	979.32	0.23	979.55	0.000434	3.93	962.1	187.24	0.23
Reach-1	51300	2047	968.25	976.95	0.2	977.13	0.000502	3.43	613.6	123.69	0.24
Reach-1	51300	1761	968.25	976.38	0.18	976.54	0.000507	3.25	548.28	107.39	0.24
Reach-1	51300	1670	968.25	976.2	0.18	976.35	0.000503	3.18	529.15	102.13	0.23
Reach-1	51300	1612	968.25	976.08	0.17	976.23	0.000502	3.14	516.94	98.63	0.23
Reach-1	51300	1422	968.25	975.68	0.16	975.81	0.000492	2.98	478.68	94.4	0.23
Reach-1	51300	976	968.25	974.57	0.13	974.67	0.000478	2.58	377.85	87.39	0.22
Reach-1	51300	460	968.25	972.86	0.08	972.92	0.000414	1.93	237.8	76.59	0.19
Reach-1	51300	134	968.25	971.28	0.03	971.3	0.000248	1.07	124.84	66.62	0.14
Reach-1	51350	8721	968.47	987.2	0.2	987.37	0.000204	4.04	4137.29	740	0.18
Reach-1	51350	7239	968.47	985.23	0.24	985.45	0.000276	4.31	2821.26	519.67	0.2
Reach-1	51350	4375	968.47	981	0.29	981.29	0.000482	4.5	1204.11	230.57	0.25
Reach-1	51350	3336	968.47	979.31	0.29	979.59	0.000573	4.33	871.05	178.62	0.27
Reach-1	51350	2047	968.47	976.94	0.25	977.17	0.000698	3.82	546.85	104.77	0.28
Reach-1	51350	1761	968.47	976.38	0.23	976.59	0.000697	3.64	489.75	97.83	0.27
Reach-1	51350	1670	968.47	976.2	0.23	976.4	0.000691	3.57	472.14	95.59	0.27
Reach-1	51350	1612	968.47	976.08	0.22	976.27	0.000689	3.53	460.63	94.1	0.27
Reach-1	51350	1422	968.47	975.68	0.21	975.85	0.000672	3.36	424.14	89.19	0.26
Reach-1	51350	976	968.47	974.57	0.17	974.71	0.000641	2.94	332.42	78.72	0.25
Reach-1	51350	460	968.47	972.88	0.11	972.95	0.000597	2.23	206.04	70.29	0.23
Reach-1	51350	134	968.47	971.3	0.05	971.33	0.000455	1.32	101.41	62.45	0.18
Reach-1	51400	8721	968.6	987.17	0.25	987.41	0.000252	4.55	3596.59	630	0.2
Reach-1	51400	7239	968.6	985.21	0.29	985.49	0.000328	4.76	2524.92	460.72	0.22
Reach-1	51400	4375	968.6	980.99	0.34	981.34	0.000545	4.89	1088.11	214.36	0.27
Reach-1	51400	3336	968.6	979.31	0.31	979.62	0.000599	4.55	815.68	135.2	0.27
Reach-1	51400	2047	968.6	976.96	0.26	977.2	0.000692	3.95	533.19	103.18	0.28
Reach-1	51400	1761	968.6	976.4	0.24	976.62	0.000705	3.75	477.26	96.06	0.28
Reach-1	51400	1670	968.6	976.22	0.24	976.43	0.000707	3.67	460.02	93.76	0.28
Reach-1	51400	1612	968.6	976.1	0.23	976.3	0.00071	3.63	448.77	92.22	0.27
Reach-1	51400	1422	968.6	975.7	0.22	975.88	0.00071	3.46	413.06	87.66	0.27
Reach-1	51400	976	968.6	974.59	0.18	974.74	0.000699	3.03	322.54	77.75	0.26
Reach-1	51400	460	968.6	972.9	0.12	972.98	0.000676	2.33	197.57	69.36	0.24
Reach-1	51400	134	968.6	971.32	0.05	971.35	0.000566	1.42	94.43	61.58	0.2
Reach-1	51450	8721	967.86	987.24	0.2	987.42	0.0002	4.04	3814.65	567.95	0.17
Reach-1	51450	7239	967.86	985.29	0.23	985.51	0.000261	4.25	2783.28	492.09	0.2
Reach-1	51450	4375	967.86	981.11	0.26	981.37	0.000416	4.29	1267.8	236.98	0.23
Reach-1	51450	3336	967.86	979.41	0.25	979.66	0.000467	4.04	940.11	163.51	0.24
Reach-1	51450	2047	967.86	977.05	0.21	977.24	0.000542	3.53	604.58	119.86	0.25
Reach-1	51450	1761	967.86	976.48	0.19	976.65	0.00054	3.34	539.59	109.41	0.24
Reach-1	51450	1670	967.86	976.29	0.19	976.46	0.000534	3.28	519.82	106.03	0.24
Reach-1	51450	1612	967.86	976.17	0.18	976.33	0.00053	3.23	507.02	103.78	0.24
Reach-1	51450	1422	967.86	975.77	0.17	975.92	0.000512	3.07	466.84	96.38	0.23
Reach-1	51450	976	967.86	974.66	0.13	974.77	0.000466	2.64	370.35	80.66	0.22
Reach-1	51450	460	967.86	972.95	0.08	973.01	0.000388	1.93	238.85	73.08	0.19
Reach-1	51450	134	967.86	971.35	0.03	971.37	0.00023	1.05	127.52	65.98	0.13
Reach-1	51500	8721	969.45	987.31	0.15	987.44	0.000156	3.55	4389.97	580	0.16
Reach-1	51500	7239	969.45	985.36	0.19	985.53	0.000221	3.88	3260.48	580	0.18

HEC-RAS Plan: Housatonic small scale existing n=0.033 output

Reach-1	51500	4375	969.45	981.12	0.28	981.4	0.000452	4.38	1204.47	262.12	0.24
Reach-1	51500	3336	969.45	979.43	0.26	979.68	0.000507	4.1	896.5	149.21	0.25
Reach-1	51500	2047	969.45	977.07	0.22	977.27	0.000617	3.61	582.63	116.36	0.26
Reach-1	51500	1761	969.45	976.5	0.21	976.68	0.000637	3.45	518.84	108.48	0.26
Reach-1	51500	1670	969.45	976.32	0.2	976.49	0.000639	3.39	499.11	105.92	0.26
Reach-1	51500	1612	969.45	976.19	0.2	976.37	0.000641	3.35	486.26	104.22	0.26
Reach-1	51500	1422	969.45	975.79	0.19	975.95	0.000644	3.21	445.4	98.62	0.26
Reach-1	51500	976	969.45	974.68	0.16	974.8	0.000639	2.84	343.65	85.72	0.25
Reach-1	51500	460	969.45	972.96	0.11	973.04	0.000664	2.24	205.31	75.61	0.24
Reach-1	51500	134	969.45	971.36	0.06	971.4	0.000679	1.46	92.02	66.18	0.22
Reach-1	51600	8721	969.35	987.34	0.14	987.45	0.000148	3.39	4352.13	500	0.15
Reach-1	51600	7239	969.35	985.42	0.17	985.56	0.000197	3.59	3393.72	500	0.17
Reach-1	51600	4375	969.35	981.18	0.27	981.45	0.000458	4.3	1377.23	404.32	0.24
Reach-1	51600	3336	969.35	979.46	0.28	979.74	0.000578	4.24	853.75	190.86	0.27
Reach-1	51600	2047	969.35	977.12	0.25	977.34	0.000725	3.76	545.96	104.83	0.28
Reach-1	51600	1761	969.35	976.56	0.23	976.76	0.00072	3.59	490.37	95.01	0.28
Reach-1	51600	1670	969.35	976.37	0.22	976.57	0.000725	3.53	473.05	93.92	0.28
Reach-1	51600	1612	969.35	976.25	0.22	976.44	0.00073	3.49	461.67	93.19	0.28
Reach-1	51600	1422	969.35	975.85	0.21	976.02	0.000728	3.35	424.68	90.8	0.27
Reach-1	51600	976	969.35	974.73	0.18	974.87	0.000736	2.98	327.23	84.16	0.27
Reach-1	51600	460	969.35	973.03	0.13	973.11	0.000806	2.39	192.07	73.99	0.26
Reach-1	51600	134	969.35	971.44	0.08	971.48	0.000962	1.63	82.02	64.53	0.26
Reach-1	51650	8721	969.35	987.36	0.13	987.47	0.000126	3.28	4463.08	470	0.14
Reach-1	51650	7239	969.35	985.45	0.14	985.57	0.000159	3.39	3565.39	470	0.15
Reach-1	51650	4375	969.35	981.26	0.21	981.47	0.000314	3.84	1615.42	429.78	0.21
Reach-1	51650	3336	969.35	979.55	0.21	979.77	0.000383	3.78	1002.36	281.85	0.22
Reach-1	51650	2047	969.35	977.22	0.17	977.37	0.000398	3.18	652.07	101.75	0.21
Reach-1	51650	1761	969.35	976.65	0.15	976.79	0.000394	2.98	594.95	99.88	0.21
Reach-1	51650	1670	969.35	976.47	0.14	976.6	0.000392	2.91	576.62	99.28	0.21
Reach-1	51650	1612	969.35	976.34	0.14	976.47	0.000391	2.87	564.52	98.88	0.21
Reach-1	51650	1422	969.35	975.94	0.13	976.05	0.000385	2.72	524.78	97.55	0.2
Reach-1	51650	976	969.35	974.81	0.1	974.9	0.000383	2.34	416.77	93.83	0.2
Reach-1	51650	460	969.35	973.09	0.07	973.14	0.000373	1.77	260.2	88.18	0.18
Reach-1	51650	134	969.35	971.5	0.03	971.51	0.000343	1.08	123.72	82.93	0.16
Reach-1	51700	8721	969.03	987.36	0.16	987.49	0.00016	3.66	4087.91	430	0.16
Reach-1	51700	7239	969.03	985.44	0.18	985.59	0.000204	3.81	3262.47	430	0.17
Reach-1	51700	4375	969.03	981.24	0.27	981.5	0.000421	4.4	1492.93	384.23	0.24
Reach-1	51700	3336	969.03	979.52	0.3	979.81	0.000546	4.46	920.2	262.78	0.26
Reach-1	51700	2047	969.03	977.19	0.25	977.42	0.000608	3.86	534.3	84.46	0.26
Reach-1	51700	1761	969.03	976.63	0.22	976.83	0.000603	3.63	487.52	82.4	0.26
Reach-1	51700	1670	969.03	976.45	0.22	976.64	0.000599	3.54	472.57	81.74	0.26
Reach-1	51700	1612	969.03	976.33	0.21	976.51	0.000598	3.49	462.71	81.3	0.25
Reach-1	51700	1422	969.03	975.92	0.19	976.09	0.000586	3.31	430.43	79.83	0.25
Reach-1	51700	976	969.03	974.81	0.15	974.93	0.000553	2.84	343.39	75.74	0.24
Reach-1	51700	460	969.03	973.1	0.09	973.17	0.000481	2.1	219.38	69.49	0.21
Reach-1	51700	134	969.03	971.51	0.04	971.53	0.000321	1.18	113.63	63.68	0.16
Reach-1	51750	8721	968.83	987.25	0.32	987.55	0.000326	5.15	2797.58	360	0.22
Reach-1	51750	7239	968.83	985.3	0.38	985.67	0.000433	5.45	2095.05	360	0.25
Reach-1	51750	4375	968.83	981.11	0.46	981.6	0.000743	5.68	884.37	197.61	0.31
Reach-1	51750	3336	968.83	979.47	0.42	979.89	0.0008	5.25	665.09	92.3	0.32
Reach-1	51750	2047	968.83	977.17	0.33	977.48	0.000871	4.45	465.87	80.98	0.31

HEC-RAS Plan: Housatonic small scale existing n=0.033 output

Reach-1	51750	1761	968.83	976.61	0.31	976.88	0.000884	4.21	421.1	78.21	0.31
Reach-1	51750	1670	968.83	976.43	0.3	976.69	0.000884	4.12	407.09	77.33	0.31
Reach-1	51750	1612	968.83	976.31	0.29	976.56	0.000887	4.07	397.86	76.74	0.31
Reach-1	51750	1422	968.83	975.91	0.27	976.14	0.000889	3.87	367.81	74.78	0.3
Reach-1	51750	976	968.83	974.8	0.22	974.98	0.000878	3.39	287.88	69.32	0.29
Reach-1	51750	460	968.83	973.11	0.15	973.21	0.000816	2.59	177.44	60.98	0.27
Reach-1	51750	134	968.83	971.52	0.06	971.56	0.00061	1.54	87.17	53.19	0.21
Reach-1	51800	8721	968.4	987.24	0.35	987.58	0.000346	5.36	2703.36	370	0.23
Reach-1	51800	7239	968.4	985.29	0.41	985.7	0.00046	5.69	1980.48	370	0.26
Reach-1	51800	4375	968.4	981.14	0.47	981.64	0.000726	5.74	851.68	214.89	0.31
Reach-1	51800	3336	968.4	979.51	0.41	979.93	0.000751	5.22	670.36	89.09	0.31
Reach-1	51800	2047	968.4	977.22	0.31	977.52	0.000771	4.35	478.19	79.03	0.3
Reach-1	51800	1761	968.4	976.66	0.28	976.92	0.000766	4.09	434.59	76.56	0.29
Reach-1	51800	1670	968.4	976.48	0.27	976.73	0.000761	4	420.89	75.77	0.29
Reach-1	51800	1612	968.4	976.36	0.27	976.61	0.000759	3.94	411.86	75.25	0.29
Reach-1	51800	1422	968.4	975.97	0.25	976.18	0.000748	3.73	382.4	73.5	0.28
Reach-1	51800	976	968.4	974.86	0.2	975.02	0.000731	3.21	303.62	68.62	0.27
Reach-1	51800	460	968.4	973.16	0.12	973.25	0.000621	2.38	193.23	61.13	0.24
Reach-1	51800	134	968.4	971.55	0.04	971.58	0.000388	1.33	100.68	54.06	0.17
Reach-1	51850	8721	968.03	987.24	0.34	987.59	0.000324	5.33	2625.93	380	0.22
Reach-1	51850	7239	968.03	985.31	0.38	985.73	0.000403	5.5	1923.82	335.67	0.24
Reach-1	51850	4375	968.03	981.32	0.33	981.68	0.00048	4.93	977.91	109.28	0.25
Reach-1	51850	3336	968.03	979.67	0.29	979.97	0.000477	4.44	805.25	100.58	0.25
Reach-1	51850	2047	968.03	977.36	0.21	977.56	0.000445	3.6	586.6	88.34	0.23
Reach-1	51850	1761	968.03	976.79	0.18	976.96	0.000427	3.35	537.17	85.33	0.22
Reach-1	51850	1670	968.03	976.6	0.17	976.77	0.00042	3.27	521.62	84.36	0.22
Reach-1	51850	1612	968.03	976.48	0.17	976.64	0.000415	3.21	511.39	83.72	0.22
Reach-1	51850	1422	968.03	976.08	0.15	976.22	0.000397	3.02	478.04	81.58	0.21
Reach-1	51850	976	968.03	974.95	0.11	975.05	0.000351	2.51	389.63	75.64	0.19
Reach-1	51850	460	968.03	973.22	0.06	973.27	0.000254	1.73	265.59	68.59	0.16
Reach-1	51850	134	968.03	971.58	0.02	971.59	0.000112	0.86	156.72	64.2	0.1
Reach-1	51900	8721	967.51	987.22	0.38	987.63	0.000372	5.62	2464.36	375	0.24
Reach-1	51900	7239	967.51	985.28	0.44	985.77	0.000482	5.91	1735.48	365.23	0.27
Reach-1	51900	4375	967.51	981.3	0.38	981.72	0.000568	5.25	876.67	93.15	0.28
Reach-1	51900	3336	967.51	979.67	0.33	980.01	0.000567	4.72	729.31	87.11	0.27
Reach-1	51900	2047	967.51	977.36	0.24	977.59	0.00054	3.83	538.07	78.81	0.25
Reach-1	51900	1761	967.51	976.79	0.21	976.99	0.000524	3.58	493.89	76.76	0.24
Reach-1	51900	1670	967.51	976.61	0.2	976.8	0.000517	3.49	479.91	76.11	0.24
Reach-1	51900	1612	967.51	976.49	0.2	976.67	0.000513	3.43	470.7	75.67	0.24
Reach-1	51900	1422	967.51	976.09	0.18	976.25	0.000495	3.23	440.49	74.22	0.23
Reach-1	51900	976	967.51	974.96	0.13	975.08	0.000433	2.72	359.34	70.17	0.21
Reach-1	51900	460	967.51	973.23	0.07	973.28	0.000308	1.89	243.09	63.93	0.17
Reach-1	51900	134	967.51	971.59	0.02	971.6	0.000132	0.93	143.32	58.04	0.1
Reach-1	51948	8721	969.8	987.63	0.09	987.67	0.000113	2.56	9321.23	2572.54	0.12
Reach-1	51948	7239	969.8	985.65	0.24	985.83	0.000371	4.17	4486.12	2218.35	0.22
Reach-1	51948	4375	969.8	981.25	0.54	981.8	0.001059	5.95	735.74	83.34	0.35
Reach-1	51948	3336	969.8	979.61	0.49	980.09	0.001101	5.53	602.73	78.97	0.35
Reach-1	51948	2047	969.8	977.31	0.39	977.66	0.001094	4.77	429.41	71.02	0.34
Reach-1	51948	1761	969.8	976.74	0.36	977.06	0.001083	4.52	389.74	69.67	0.34
Reach-1	51948	1670	969.8	976.56	0.35	976.87	0.001076	4.43	377.14	69.24	0.33
Reach-1	51948	1612	969.8	976.44	0.34	976.74	0.001072	4.37	368.82	68.95	0.33

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Reach-1	51948	1422	969.8	976.04	0.32	976.31	0.001054	4.16	341.47	67.99	0.33
Reach-1	51948	976	969.8	974.93	0.26	975.13	0.001054	3.65	267.04	65.31	0.32
Reach-1	51948	460	969.8	973.2	0.19	973.33	0.001159	2.9	158.44	59.63	0.31
Reach-1	51948	134	969.8	971.58	0.11	971.64	0.001386	1.98	67.73	52.52	0.31
Reach-1	51973 Bridge										
Reach-1	52000	8721	969.7	987.67	0.08	987.71	0.000101	2.42	10041.66	2573.08	0.11
Reach-1	52000	7239	969.7	985.8	0.19	985.91	0.000285	3.74	5428.13	2281.28	0.18
Reach-1	52000	4375	969.7	981.8	0.57	982.37	0.001083	6.15	858.63	261.54	0.35
Reach-1	52000	3336	969.7	979.58	0.64	980.19	0.001494	6.3	529.65	71	0.41
Reach-1	52000	2047	969.7	977.97	0.42	978.35	0.001157	4.92	416.46	68.82	0.35
Reach-1	52000	1761	969.7	977.39	0.38	977.73	0.001145	4.67	376.74	66.78	0.35
Reach-1	52000	1670	969.7	977.19	0.37	977.52	0.00114	4.59	363.8	66.11	0.34
Reach-1	52000	1612	969.7	977.08	0.37	977.39	0.001131	4.53	356.04	65.7	0.34
Reach-1	52000	1422	969.7	976.65	0.34	976.94	0.001112	4.33	328.62	64.23	0.34
Reach-1	52000	976	969.7	975.49	0.28	975.71	0.001093	3.81	256.07	60.18	0.33
Reach-1	52000	460	969.7	973.68	0.2	973.82	0.001148	3.01	152.95	53.91	0.31
Reach-1	52000	134	969.7	971.98	0.11	972.04	0.001319	2.02	66.41	48.02	0.3
Reach-1	52023	8721	968.5	987.51	0.27	987.78	0.000281	4.69	3200.69	630	0.2
Reach-1	52023	7239	968.5	985.62	0.34	986	0.000395	5.11	2028.87	548.89	0.24
Reach-1	52023	4375	968.5	982.11	0.28	982.41	0.000428	4.42	1032.45	113.18	0.24
Reach-1	52023	3336	968.5	979.97	0.27	980.25	0.000524	4.22	804.93	99.89	0.25
Reach-1	52023	2047	968.5	978.22	0.17	978.38	0.000399	3.25	635.81	93.33	0.21
Reach-1	52023	1761	968.5	977.62	0.15	977.76	0.000391	3.05	580.04	91.06	0.21
Reach-1	52023	1670	968.5	977.42	0.15	977.55	0.000387	2.98	561.79	90.31	0.21
Reach-1	52023	1612	968.5	977.29	0.15	977.43	0.000384	2.94	550.72	89.85	0.21
Reach-1	52023	1422	968.5	976.85	0.13	976.97	0.000375	2.78	511.73	88.2	0.2
Reach-1	52023	976	968.5	975.65	0.1	975.74	0.000352	2.39	408.44	82.82	0.19
Reach-1	52023	460	968.5	973.79	0.06	973.84	0.000267	1.73	265.41	71.21	0.16
Reach-1	52023	134	968.5	972.04	0.02	972.06	0.00012	0.89	150.36	60.27	0.1
Reach-1	52073	7180	969.2	987.56	0.25	987.8	0.000237	4.51	2608.65	340	0.19
Reach-1	52073	5960	969.2	985.74	0.27	986.02	0.000294	4.67	1990.73	340	0.21
Reach-1	52073	3602	969.2	982.16	0.25	982.43	0.000351	4.27	963.49	132.54	0.22
Reach-1	52073	2746	969.2	980.03	0.24	980.27	0.000407	4.04	732.79	99.21	0.23
Reach-1	52073	1686	969.2	978.26	0.15	978.4	0.000307	3.07	569.96	85.07	0.19
Reach-1	52073	1450	969.2	977.65	0.13	977.78	0.000298	2.87	519.69	81.26	0.19
Reach-1	52073	1375	969.2	977.45	0.13	977.57	0.000294	2.8	503.4	80.26	0.18
Reach-1	52073	1328	969.2	977.33	0.12	977.44	0.000291	2.75	493.53	79.64	0.18
Reach-1	52073	1171	969.2	976.89	0.11	976.99	0.000281	2.59	459.04	77.44	0.18
Reach-1	52073	804	969.2	975.68	0.08	975.76	0.000261	2.18	369.24	71.41	0.17
Reach-1	52073	379	969.2	973.82	0.05	973.85	0.000207	1.55	243.88	63.38	0.14
Reach-1	52073	110	969.2	972.05	0.01	972.06	0.000099	0.8	137.94	56.98	0.09
Reach-1	52148.*	7180	968.53	987.7	0.14	987.82	0.000137	3.36	4362.98	860	0.14
Reach-1	52148.*	5960	968.53	985.86	0.19	986.04	0.000208	3.83	2827.86	767	0.17
Reach-1	52148.*	3602	968.53	982.26	0.18	982.46	0.000268	3.61	1109.1	139.05	0.19
Reach-1	52148.*	2746	968.53	980.12	0.18	980.31	0.000329	3.48	836.38	116.94	0.2
Reach-1	52148.*	1686	968.53	978.31	0.12	978.42	0.000267	2.7	637.88	102.91	0.18
Reach-1	52148.*	1450	968.53	977.7	0.11	977.8	0.000265	2.54	576.69	96.79	0.17
Reach-1	52148.*	1375	968.53	977.5	0.1	977.59	0.000264	2.49	557.26	94.47	0.17
Reach-1	52148.*	1328	968.53	977.37	0.1	977.46	0.000262	2.45	545.57	93.1	0.17
Reach-1	52148.*	1171	968.53	976.92	0.09	977.01	0.000256	2.32	504.94	88.15	0.17

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Reach-1	52148.*	804	968.53	975.71	0.07	975.77	0.000233	1.99	404.6	79.51	0.16
Reach-1	52148.*	379	968.53	973.84	0.04	973.87	0.00018	1.44	264.09	70.28	0.13
Reach-1	52148.*	110	968.53	972.06	0.01	972.07	0.000089	0.75	146.93	61.54	0.09
Reach-1	52200	7180	969	987.5	0.36	987.93	0.000345	5.47	1577.31	120	0.23
Reach-1	52200	5960	969	985.73	0.33	986.11	0.000353	5.15	1366.19	118.31	0.23
Reach-1	52200	3602	969	982.23	0.24	982.49	0.000326	4.18	962.58	107.52	0.21
Reach-1	52200	2746	969	980.11	0.22	980.34	0.000373	3.93	752.73	92.73	0.22
Reach-1	52200	1686	969	978.31	0.14	978.44	0.000281	2.99	591.82	86.13	0.18
Reach-1	52200	1450	969	977.7	0.12	977.82	0.000271	2.79	540.17	83.55	0.18
Reach-1	52200	1375	969	977.5	0.12	977.61	0.000268	2.72	523.36	82.57	0.18
Reach-1	52200	1328	969	977.37	0.12	977.48	0.000265	2.67	513.15	81.97	0.18
Reach-1	52200	1171	969	976.94	0.1	977.03	0.000254	2.51	477.79	79.86	0.17
Reach-1	52200	804	969	975.73	0.08	975.8	0.000232	2.11	384.84	74.02	0.16
Reach-1	52200	379	969	973.85	0.04	973.88	0.000191	1.49	253.76	66.12	0.13
Reach-1	52200	110	969	972.07	0.01	972.08	0.000104	0.79	139.94	61.67	0.09
Reach-1	52243	7180	968.6	987.72	0.25	987.96	0.00023	4.53	2713.03	362	0.19
Reach-1	52243	5960	968.6	985.85	0.28	986.14	0.000292	4.74	2036.42	362	0.21
Reach-1	52243	3602	968.6	982.22	0.27	982.51	0.00036	4.43	923.4	134.84	0.22
Reach-1	52243	2746	968.6	980.1	0.25	980.36	0.000406	4.14	709.33	90.53	0.23
Reach-1	52243	1686	968.6	978.31	0.15	978.46	0.000299	3.12	559.87	77.7	0.19
Reach-1	52243	1450	968.6	977.7	0.13	977.83	0.000286	2.9	513.65	75.2	0.18
Reach-1	52243	1375	968.6	977.5	0.13	977.62	0.000281	2.83	498.57	74.49	0.18
Reach-1	52243	1328	968.6	977.37	0.12	977.49	0.000278	2.78	489.39	74.06	0.18
Reach-1	52243	1171	968.6	976.95	0.11	977.05	0.000264	2.61	458.17	72.57	0.17
Reach-1	52243	804	968.6	975.74	0.08	975.82	0.000236	2.17	373.13	68.35	0.16
Reach-1	52243	379	968.6	973.86	0.04	973.9	0.000184	1.51	250.62	62.11	0.13
Reach-1	52243	110	968.6	972.08	0.01	972.09	0.000085	0.76	144.26	57.05	0.08
Reach-1	52273.*	7180	968.55	987.91	0.09	987.98	0.000095	2.72	5629.57	1084.47	0.12
Reach-1	52273.*	5960	968.55	986.05	0.13	986.16	0.000151	3.16	3713.54	976.06	0.15
Reach-1	52273.*	3602	968.55	982.36	0.17	982.53	0.000262	3.4	1228.76	324.37	0.19
Reach-1	52273.*	2746	968.55	980.21	0.17	980.38	0.000347	3.36	834.15	128.08	0.21
Reach-1	52273.*	1686	968.55	978.36	0.12	978.47	0.000285	2.65	635.68	94.08	0.18
Reach-1	52273.*	1450	968.55	977.74	0.1	977.84	0.00027	2.5	579.14	89.9	0.17
Reach-1	52273.*	1375	968.55	977.54	0.1	977.63	0.000266	2.45	560.89	88.86	0.17
Reach-1	52273.*	1328	968.55	977.41	0.1	977.51	0.000263	2.42	549.8	88.26	0.17
Reach-1	52273.*	1171	968.55	976.98	0.09	977.06	0.000251	2.29	511.56	86.18	0.17
Reach-1	52273.*	804	968.55	975.76	0.07	975.82	0.000224	1.96	409.97	80.37	0.15
Reach-1	52273.*	379	968.55	973.87	0.04	973.9	0.000176	1.42	267.08	71.41	0.13
Reach-1	52273.*	110	968.55	972.08	0.01	972.09	0.000091	0.75	146.94	62.9	0.09
Reach-1	52350	7180	969	987.69	0.35	988.09	0.00034	5.33	1610.32	124.06	0.23
Reach-1	52350	5960	969	985.89	0.32	986.25	0.000351	5.02	1392.35	118.67	0.23
Reach-1	52350	3602	969	982.33	0.23	982.58	0.000336	4.11	986.28	109.77	0.21
Reach-1	52350	2746	969	980.19	0.23	980.43	0.000405	3.95	757.08	104.78	0.23
Reach-1	52350	1686	969	978.36	0.15	978.5	0.000318	3.07	571.85	90.56	0.19
Reach-1	52350	1450	969	977.75	0.13	977.87	0.000303	2.87	519.56	81.45	0.19
Reach-1	52350	1375	969	977.54	0.13	977.66	0.000297	2.8	503.22	79.25	0.18
Reach-1	52350	1328	969	977.42	0.12	977.53	0.000292	2.75	493.42	77.91	0.18
Reach-1	52350	1171	969	976.99	0.11	977.09	0.000276	2.59	460.97	73.34	0.18
Reach-1	52350	804	969	975.77	0.08	975.84	0.00024	2.17	375.18	68.02	0.16
Reach-1	52350	379	969	973.89	0.04	973.92	0.000183	1.51	251.5	63.36	0.13
Reach-1	52350	110	969	972.09	0.01	972.1	0.000102	0.79	139.92	61.12	0.09

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Reach-1	52398.*	7180	968.58	988.09	0.06	988.13	0.000067	2.25	6995.22	1275.56	0.1
Reach-1	52398.*	5960	968.58	986.22	0.09	986.29	0.000109	2.64	4695.71	1184.57	0.13
Reach-1	52398.*	3602	968.58	982.47	0.14	982.6	0.000225	3.06	1613.7	508.4	0.17
Reach-1	52398.*	2746	968.58	980.29	0.16	980.45	0.000334	3.24	884.65	186.6	0.2
Reach-1	52398.*	1686	968.58	978.42	0.11	978.52	0.000276	2.58	652.26	98.58	0.18
Reach-1	52398.*	1450	968.58	977.8	0.1	977.89	0.000255	2.44	593.32	91.82	0.17
Reach-1	52398.*	1375	968.58	977.59	0.1	977.68	0.000252	2.39	574.52	90.83	0.17
Reach-1	52398.*	1328	968.58	977.46	0.09	977.55	0.000249	2.36	563.08	90.21	0.17
Reach-1	52398.*	1171	968.58	977.02	0.09	977.1	0.000238	2.24	523.46	88.06	0.16
Reach-1	52398.*	804	968.58	975.79	0.07	975.85	0.000213	1.92	419.2	82.13	0.15
Reach-1	52398.*	379	968.58	973.9	0.04	973.93	0.000169	1.39	272.15	72.94	0.13
Reach-1	52398.*	110	968.58	972.1	0.01	972.11	0.000089	0.74	148.91	64.24	0.09
Reach-1	52400	7180	968	987.87	0.3	988.22	0.000262	5.1	1812.97	140	0.21
Reach-1	52400	5960	968	986.05	0.27	986.36	0.000263	4.77	1566.11	129.3	0.2
Reach-1	52400	3602	968	982.41	0.19	982.63	0.000239	3.86	1112.51	120.39	0.19
Reach-1	52400	2746	968	980.27	0.18	980.46	0.000268	3.64	859.67	115.24	0.19
Reach-1	52400	1686	968	978.41	0.11	978.52	0.000193	2.73	666.23	90.12	0.16
Reach-1	52400	1450	968	977.79	0.1	977.89	0.000181	2.52	613.36	83.1	0.15
Reach-1	52400	1375	968	977.59	0.09	977.68	0.000177	2.46	596.4	82.4	0.15
Reach-1	52400	1328	968	977.46	0.09	977.55	0.000174	2.41	586.06	81.98	0.15
Reach-1	52400	1171	968	977.03	0.08	977.11	0.000162	2.25	550.88	80.5	0.14
Reach-1	52400	804	968	975.81	0.06	975.86	0.000136	1.84	454.86	76.47	0.13
Reach-1	52400	379	968	973.91	0.03	973.93	0.000095	1.23	314.81	71.25	0.1
Reach-1	52400	110	968	972.11	0.01	972.11	0.00004	0.58	190.98	66.3	0.06
Reach-1	52490	7180	969.2	988.13	0.16	988.26	0.00015	3.62	3420.81	400	0.15
Reach-1	52490	5960	969.2	986.23	0.18	986.4	0.000191	3.79	2663.76	400	0.17
Reach-1	52490	3602	969.2	982.44	0.2	982.65	0.000285	3.85	1252.93	263.55	0.2
Reach-1	52490	2746	969.2	980.28	0.21	980.5	0.00036	3.79	829.73	152.89	0.21
Reach-1	52490	1686	969.2	978.41	0.14	978.55	0.000293	2.96	592.67	98.66	0.19
Reach-1	52490	1450	969.2	977.79	0.12	977.91	0.000286	2.77	537.06	84.36	0.18
Reach-1	52490	1375	969.2	977.59	0.12	977.7	0.000284	2.71	519.95	83.46	0.18
Reach-1	52490	1328	969.2	977.46	0.12	977.57	0.000282	2.66	509.52	82.9	0.18
Reach-1	52490	1171	969.2	977.04	0.11	977.14	0.000271	2.51	474.97	81.04	0.17
Reach-1	52490	804	969.2	975.82	0.08	975.89	0.000259	2.13	379.14	75.62	0.16
Reach-1	52490	379	969.2	973.92	0.05	973.96	0.000236	1.56	242.63	69.3	0.15
Reach-1	52490	110	969.2	972.12	0.02	972.13	0.000178	0.9	121.65	64.79	0.12
Reach-1	52523	7180	968.61	988.25	0.05	988.28	0.000047	2	8445.65	1473.75	0.09
Reach-1	52523	5960	968.61	986.37	0.07	986.41	0.000073	2.29	5783.39	1291.58	0.1
Reach-1	52523	3602	968.61	982.58	0.1	982.67	0.000148	2.69	2263.55	636.49	0.14
Reach-1	52523	2746	968.61	980.38	0.14	980.52	0.000252	3.03	1164.91	362.49	0.18
Reach-1	52523	1686	968.61	978.46	0.1	978.56	0.00024	2.51	681.37	145.8	0.17
Reach-1	52523	1450	968.61	977.83	0.09	977.92	0.00024	2.38	610.08	94.17	0.16
Reach-1	52523	1375	968.61	977.63	0.09	977.71	0.000236	2.33	590.79	93.14	0.16
Reach-1	52523	1328	968.61	977.5	0.09	977.58	0.000233	2.29	579.04	92.51	0.16
Reach-1	52523	1171	968.61	977.07	0.08	977.14	0.000222	2.17	539.39	90.34	0.16
Reach-1	52523	804	968.61	975.84	0.06	975.89	0.000199	1.86	432.13	84.19	0.14
Reach-1	52523	379	968.61	973.93	0.04	973.96	0.000157	1.35	280.83	74.67	0.12
Reach-1	52523	110	968.61	972.13	0.01	972.13	0.000082	0.71	153.99	65.63	0.08
Reach-1	52630	7180	968.6	988.01	0.33	988.39	0.000298	5.26	1710.75	126	0.22
Reach-1	52630	5960	968.6	986.17	0.3	986.52	0.000308	4.97	1478.83	126	0.22

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Reach-1	52630	3602	968.6	982.49	0.23	982.74	0.000296	4.12	1022.46	120.04	0.2
Reach-1	52630	2746	968.6	980.34	0.22	980.58	0.000343	3.91	772.96	106.42	0.21
Reach-1	52630	1686	968.6	978.46	0.13	978.6	0.000257	2.97	598.36	83.29	0.18
Reach-1	52630	1450	968.6	977.84	0.12	977.96	0.000246	2.76	547.33	80.44	0.17
Reach-1	52630	1375	968.6	977.63	0.11	977.75	0.000242	2.69	530.94	79.5	0.17
Reach-1	52630	1328	968.6	977.52	0.11	977.63	0.000237	2.64	521.75	78.97	0.17
Reach-1	52630	1171	968.6	977.08	0.1	977.18	0.000226	2.47	487.74	76.98	0.16
Reach-1	52630	804	968.6	975.86	0.07	975.93	0.000199	2.06	396.59	72.19	0.15
Reach-1	52630	379	968.6	973.95	0.04	973.98	0.00016	1.43	265.5	64.81	0.12
Reach-1	52630	110	968.6	972.13	0.01	972.14	0.000071	0.72	153.81	58.47	0.08
Reach-1	52773	7180	967.5	988.07	0.34	988.44	0.000303	5.37	1872.29	165	0.22
Reach-1	52773	5960	967.5	986.21	0.33	986.57	0.000327	5.2	1565.58	165	0.22
Reach-1	52773	3602	967.5	982.52	0.26	982.79	0.000324	4.39	993.08	121.82	0.21
Reach-1	52773	2746	967.5	980.38	0.24	980.63	0.000356	4.1	762.77	96.15	0.22
Reach-1	52773	1686	967.5	978.48	0.14	978.63	0.000262	3.1	593.01	84.42	0.18
Reach-1	52773	1450	967.5	977.86	0.13	977.99	0.000249	2.88	541.43	81.31	0.17
Reach-1	52773	1375	967.5	977.66	0.12	977.78	0.000243	2.81	524.89	80.28	0.17
Reach-1	52773	1328	967.5	977.54	0.12	977.66	0.000238	2.75	515.84	79.72	0.17
Reach-1	52773	1171	967.5	977.11	0.1	977.21	0.000224	2.58	481.43	77.53	0.16
Reach-1	52773	804	967.5	975.88	0.07	975.95	0.00019	2.12	390.26	71.11	0.15
Reach-1	52773	379	967.5	973.96	0.04	973.99	0.000134	1.42	267.37	56.89	0.12
Reach-1	52773	110	967.5	972.14	0.01	972.15	0.000046	0.65	168.46	52.05	0.06
Reach-1	52873	7180	968	988.21	0.24	988.47	0.000212	4.51	2265.55	220	0.18
Reach-1	52873	5960	968	986.34	0.24	986.61	0.000233	4.41	1854.69	220	0.19
Reach-1	52873	3602	968	982.61	0.19	982.83	0.000236	3.78	1087.1	144.41	0.18
Reach-1	52873	2746	968	980.48	0.17	980.67	0.00025	3.47	849.13	99.63	0.18
Reach-1	52873	1686	968	978.55	0.1	978.65	0.000179	2.59	671.08	84.41	0.15
Reach-1	52873	1450	968	977.92	0.09	978.01	0.000167	2.39	619.64	79.69	0.14
Reach-1	52873	1375	968	977.72	0.08	977.8	0.000163	2.33	603.26	78.86	0.14
Reach-1	52873	1328	968	977.6	0.08	977.68	0.000159	2.28	594.23	78.41	0.14
Reach-1	52873	1171	968	977.15	0.07	977.22	0.000149	2.12	559.21	76.6	0.13
Reach-1	52873	804	968	975.92	0.05	975.96	0.000122	1.72	467.77	71.66	0.12
Reach-1	52873	379	968	973.98	0.02	974	0.000077	1.13	335.42	65.75	0.09
Reach-1	52873	110	968	972.15	0.01	972.15	0.000024	0.5	218.97	61.73	0.05
Reach-1	52883	7180	969.61	988.47	0.05	988.5	0.000047	1.93	8684.93	1483.36	0.08
Reach-1	52883	5960	969.61	986.59	0.06	986.63	0.000074	2.24	5982.44	1335.66	0.1
Reach-1	52883	3602	969.61	982.75	0.11	982.84	0.000167	2.74	2286.66	657.46	0.15
Reach-1	52883	2746	969.61	980.52	0.16	980.67	0.00032	3.23	1131.43	379.36	0.2
Reach-1	52883	1686	969.61	978.54	0.14	978.66	0.000356	2.84	608.78	153	0.2
Reach-1	52883	1450	969.61	977.91	0.13	978.02	0.000366	2.72	533.68	93.1	0.2
Reach-1	52883	1375	969.61	977.7	0.12	977.81	0.000365	2.67	514.48	91.92	0.2
Reach-1	52883	1328	969.61	977.58	0.12	977.69	0.000362	2.64	503.94	91.26	0.2
Reach-1	52883	1171	969.61	977.13	0.11	977.23	0.000358	2.53	463.17	88.66	0.19
Reach-1	52883	804	969.61	975.9	0.1	975.97	0.000355	2.25	357.99	81.58	0.19
Reach-1	52883	379	969.61	973.96	0.07	974.01	0.000377	1.8	210.64	70.48	0.18
Reach-1	52883	110	969.61	972.15	0.03	972.17	0.000314	1.16	94.95	53.91	0.15
Reach-1	52921	7180	969.7	988.39	0.17	988.53	0.000203	3.57	4413.24	1425.5	0.17
Reach-1	52921	5960	969.7	986.44	0.26	986.7	0.000362	4.33	2191.19	849.32	0.22
Reach-1	52921	3602	969.7	982.64	0.27	982.91	0.000526	4.18	861.64	97.87	0.25
Reach-1	52921	2746	969.7	980.45	0.29	980.73	0.000677	4.19	655.15	91.38	0.28
Reach-1	52921	1686	969.7	978.52	0.2	978.7	0.000559	3.46	487.9	79.18	0.25

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Reach-1	52921	1450	969.7	977.89	0.19	978.06	0.000555	3.3	439.3	76.1	0.24
Reach-1	52921	1375	969.7	977.68	0.19	977.85	0.000553	3.25	423.56	75.07	0.24
Reach-1	52921	1328	969.7	977.57	0.18	977.73	0.000547	3.2	414.93	74.5	0.24
Reach-1	52921	1171	969.7	977.11	0.17	977.26	0.000539	3.07	381.56	72.26	0.24
Reach-1	52921	804	969.7	975.88	0.14	976	0.000523	2.71	296.41	66.2	0.23
Reach-1	52921	379	969.7	973.95	0.1	974.02	0.00053	2.14	177.37	57.64	0.21
Reach-1	52921	110	969.7	972.15	0.05	972.18	0.000581	1.4	78.41	52.28	0.2
Reach-1	52928	Bridge									
Reach-1	52935	7180	969.7	989.61	0.07	989.71	0.000077	3.07	6370.47	1785.08	0.14
Reach-1	52935	5960	969.7	987.13	0.12	987.35	0.000163	3.98	2849.74	1053.47	0.19
Reach-1	52935	3602	969.7	982.64	0.15	982.91	0.000302	4.18	861.98	97.87	0.25
Reach-1	52935	2746	969.7	980.46	0.16	980.73	0.000388	4.19	655.55	91.4	0.28
Reach-1	52935	1686	969.7	978.52	0.12	978.71	0.00032	3.45	488.18	79.2	0.25
Reach-1	52935	1450	969.7	977.89	0.11	978.06	0.000318	3.3	439.55	76.12	0.24
Reach-1	52935	1375	969.7	977.69	0.11	977.85	0.000317	3.24	423.82	75.09	0.24
Reach-1	52935	1328	969.7	977.57	0.1	977.73	0.000313	3.2	415.19	74.52	0.24
Reach-1	52935	1171	969.7	977.12	0.1	977.26	0.000309	3.07	381.8	72.28	0.24
Reach-1	52935	804	969.7	975.88	0.08	976	0.0003	2.71	296.54	66.21	0.23
Reach-1	52935	379	969.7	973.95	0.06	974.03	0.000304	2.14	177.46	57.65	0.21
Reach-1	52935	110	969.7	972.16	0.03	972.19	0.000324	1.39	79.13	52.32	0.2
Reach-1	52970	7180	967.8	989.51	0.16	989.82	0.000134	4.82	2169.49	184	0.19
Reach-1	52970	5960	967.8	987.08	0.16	987.4	0.000158	4.8	1723.17	184	0.2
Reach-1	52970	3602	967.8	982.65	0.13	982.91	0.000176	4.17	978.01	101.08	0.2
Reach-1	52970	2746	967.8	980.53	0.12	980.75	0.000192	3.86	771.41	92.21	0.21
Reach-1	52970	1686	967.8	978.6	0.07	978.73	0.000142	2.92	602.55	82.89	0.17
Reach-1	52970	1450	967.8	977.97	0.07	978.09	0.000135	2.71	551.76	79.87	0.17
Reach-1	52970	1375	967.8	977.77	0.06	977.87	0.000132	2.64	535.27	78.87	0.16
Reach-1	52970	1328	967.8	977.65	0.06	977.75	0.000129	2.58	526.15	78.31	0.16
Reach-1	52970	1171	967.8	977.19	0.05	977.29	0.000123	2.42	490.99	76.11	0.16
Reach-1	52970	804	967.8	975.96	0.04	976.02	0.000105	1.99	404.08	63.88	0.14
Reach-1	52970	379	967.8	974.02	0.02	974.04	0.000064	1.33	285.58	58.05	0.11
Reach-1	52970	110	967.8	972.19	0	972.19	0.00002	0.6	184.4	52.97	0.06
Reach-1	53033	7180	969.78	989.71	0.07	989.84	0.000075	3.26	3652.74	498.04	0.14
Reach-1	53033	5960	969.78	987.25	0.09	987.43	0.000108	3.51	2467.65	436.81	0.17
Reach-1	53033	3602	969.78	982.76	0.1	982.93	0.00017	3.4	1147.32	185.5	0.19
Reach-1	53033	2746	969.78	980.59	0.11	980.77	0.00024	3.4	811.18	125.57	0.22
Reach-1	53033	1686	969.78	978.62	0.08	978.74	0.000218	2.83	596.56	100.38	0.2
Reach-1	53033	1450	969.78	977.98	0.07	978.1	0.000221	2.71	534.24	96.39	0.2
Reach-1	53033	1375	969.78	977.77	0.07	977.88	0.000221	2.67	514.19	95.07	0.2
Reach-1	53033	1328	969.78	977.66	0.07	977.77	0.00022	2.64	503.11	94.33	0.2
Reach-1	53033	1171	969.78	977.2	0.07	977.3	0.00022	2.54	460.46	91.44	0.2
Reach-1	53033	804	969.78	975.95	0.06	976.04	0.000225	2.29	351.65	83.61	0.2
Reach-1	53033	379	969.78	974	0.05	974.06	0.000262	1.89	200.45	71.32	0.2
Reach-1	53033	110	969.78	972.18	0.03	972.2	0.00033	1.35	81.6	57.6	0.2
Reach-1	53073	7180	969.81	989.66	0.1	989.87	0.000107	3.78	2246.39	172.5	0.17
Reach-1	53073	5960	969.81	987.23	0.11	987.44	0.000133	3.78	1827.64	172.5	0.18
Reach-1	53073	3602	969.81	982.75	0.11	982.95	0.00021	3.6	1062.07	159.98	0.21
Reach-1	53073	2746	969.81	980.58	0.13	980.79	0.000319	3.68	749.3	124.18	0.25
Reach-1	53073	1686	969.81	978.61	0.1	978.77	0.000319	3.17	532.5	100.73	0.24
Reach-1	53073	1450	969.81	977.98	0.1	978.13	0.000332	3.08	470.06	95.31	0.24

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Reach-1	53073	1375	969.81	977.77	0.1	977.91	0.000336	3.05	450.22	93.53	0.25
Reach-1	53073	1328	969.81	977.65	0.1	977.79	0.000336	3.02	439.3	92.53	0.24
Reach-1	53073	1171	969.81	977.19	0.09	977.32	0.000343	2.95	397.6	88.61	0.25
Reach-1	53073	804	969.81	975.95	0.09	976.07	0.000372	2.73	294.27	78.03	0.25
Reach-1	53073	379	969.81	973.99	0.07	974.08	0.00043	2.37	160.04	58.56	0.25
Reach-1	53073	110	969.81	972.18	0.04	972.22	0.000403	1.6	68.92	43.66	0.22
Reach-1	53108	7180	969.84	989.63	0.13	989.88	0.000125	4.39	2397.4	204.5	0.19
Reach-1	53108	5960	969.84	987.2	0.14	987.47	0.000156	4.45	1901.38	204.5	0.2
Reach-1	53108	3602	969.84	982.71	0.15	982.98	0.000227	4.24	1015.01	154.13	0.23
Reach-1	53108	2746	969.84	980.57	0.15	980.82	0.00029	4.12	742.32	115.24	0.25
Reach-1	53108	1686	969.84	978.61	0.11	978.79	0.000272	3.35	532.23	99.89	0.23
Reach-1	53108	1450	969.84	977.97	0.1	978.13	0.000287	3.21	469.84	94.85	0.23
Reach-1	53108	1375	969.84	977.77	0.1	977.92	0.000292	3.16	450.7	93.25	0.23
Reach-1	53108	1328	969.84	977.65	0.1	977.8	0.000292	3.12	439.85	92.34	0.23
Reach-1	53108	1171	969.84	977.19	0.09	977.33	0.000305	3.01	398.28	88.73	0.24
Reach-1	53108	804	969.84	975.96	0.09	976.07	0.000364	2.74	294.66	78.81	0.25
Reach-1	53108	379	969.84	974	0.07	974.08	0.000409	2.33	162.48	58.52	0.25
Reach-1	53108	110	969.84	972.19	0.04	972.23	0.000421	1.6	68.94	45.34	0.23
Reach-1	53140	7180	969	989.6	0.14	989.89	0.000127	4.6	2219.83	175	0.18
Reach-1	53140	5960	969	987.19	0.15	987.47	0.000149	4.55	1796.61	175	0.19
Reach-1	53140	3602	969	982.74	0.13	982.98	0.000176	4.04	1043.88	134.68	0.2
Reach-1	53140	2746	969	980.62	0.12	980.83	0.000193	3.75	809.47	101.21	0.2
Reach-1	53140	1686	969	978.67	0.07	978.8	0.00015	2.88	619.85	93.01	0.17
Reach-1	53140	1450	969	978.03	0.07	978.14	0.000146	2.69	561.36	90.33	0.17
Reach-1	53140	1375	969	977.83	0.06	977.93	0.000143	2.63	543.15	88.96	0.17
Reach-1	53140	1328	969	977.71	0.06	977.81	0.000141	2.58	532.78	88.12	0.17
Reach-1	53140	1171	969	977.25	0.06	977.34	0.000136	2.42	493.19	84.82	0.16
Reach-1	53140	804	969	976.02	0.04	976.09	0.000121	2.02	398	68.33	0.15
Reach-1	53140	379	969	974.06	0.02	974.09	0.000095	1.42	266.59	66.06	0.12
Reach-1	53140	110	969	972.22	0.01	972.23	0.000054	0.75	146.89	64.22	0.09
Reach-1	53233	7180	968	989.65	0.15	989.9	0.000124	4.71	2890.35	300	0.18
Reach-1	53233	5960	968	987.18	0.17	987.49	0.000164	4.98	2149.18	300	0.21
Reach-1	53233	3602	968	982.69	0.18	983.03	0.000225	4.8	932.41	131.14	0.23
Reach-1	53233	2746	968	980.58	0.16	980.88	0.000241	4.44	706.55	92.56	0.23
Reach-1	53233	1686	968	978.65	0.1	978.82	0.000176	3.34	544.77	77.25	0.19
Reach-1	53233	1450	968	978.02	0.08	978.17	0.000166	3.1	497.12	73.23	0.19
Reach-1	53233	1375	968	977.82	0.08	977.96	0.000162	3.01	482.49	71.95	0.18
Reach-1	53233	1328	968	977.7	0.08	977.84	0.000158	2.95	474.17	71.21	0.18
Reach-1	53233	1171	968	977.25	0.07	977.36	0.000149	2.76	442.43	68.32	0.17
Reach-1	53233	804	968	976.02	0.05	976.1	0.000124	2.25	363.56	60.48	0.15
Reach-1	53233	379	968	974.07	0.02	974.1	0.000087	1.5	252.46	53.25	0.12
Reach-1	53233	110	968	972.24	0.01	972.25	0.000031	0.7	158.12	50.07	0.07
Reach-1	53278	7180	969.97	989.66	0.13	989.91	0.000125	4.4	2398.53	204.5	0.19
Reach-1	53278	5960	969.97	987.23	0.14	987.5	0.000156	4.45	1902.81	204.5	0.2
Reach-1	53278	3602	969.97	982.78	0.15	983.05	0.000226	4.23	1021.58	157.03	0.23
Reach-1	53278	2746	969.97	980.64	0.15	980.9	0.000287	4.11	745.92	115.82	0.25
Reach-1	53278	1686	969.97	978.65	0.11	978.83	0.000275	3.36	531.34	100.21	0.23
Reach-1	53278	1450	969.97	978.02	0.1	978.18	0.00029	3.22	469.14	95.21	0.24
Reach-1	53278	1375	969.97	977.81	0.1	977.96	0.000295	3.17	449.51	93.57	0.24
Reach-1	53278	1328	969.97	977.69	0.1	977.85	0.000295	3.13	438.77	92.67	0.24
Reach-1	53278	1171	969.97	977.24	0.09	977.38	0.000307	3.02	397.69	89.12	0.24

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Reach-1	53278	804	969.97	976.01	0.09	976.13	0.00037	2.75	293.9	79.44	0.25
Reach-1	53278	379	969.97	974.04	0.07	974.13	0.000434	2.37	159.88	58.84	0.25
Reach-1	53278	110	969.97	972.22	0.04	972.26	0.000491	1.68	65.59	45.04	0.24
Reach-1	53303	7180	969.99	989.67	0.13	989.91	0.000116	4.29	2477.35	204.5	0.18
Reach-1	53303	5960	969.99	987.27	0.13	987.51	0.000143	4.31	1985.56	204.5	0.19
Reach-1	53303	3602	969.99	982.81	0.14	983.06	0.000205	4.1	1091.15	173.07	0.22
Reach-1	53303	2746	969.99	980.68	0.14	980.91	0.000256	3.96	792.06	121.13	0.24
Reach-1	53303	1686	969.99	978.67	0.1	978.83	0.000242	3.23	564.44	105.33	0.22
Reach-1	53303	1450	969.99	978.03	0.09	978.18	0.000253	3.09	498.84	100.32	0.22
Reach-1	53303	1375	969.99	977.83	0.09	977.97	0.000255	3.03	478.98	98.75	0.22
Reach-1	53303	1328	969.99	977.72	0.09	977.85	0.000255	2.99	467.61	97.84	0.22
Reach-1	53303	1171	969.99	977.26	0.08	977.39	0.000262	2.87	424.16	94.29	0.22
Reach-1	53303	804	969.99	976.03	0.07	976.14	0.000304	2.59	314.09	84.62	0.23
Reach-1	53303	379	969.99	974.05	0.07	974.14	0.000468	2.32	163.44	66	0.26
Reach-1	53303	110	969.99	972.23	0.04	972.27	0.00049	1.68	65.65	45.05	0.24
Reach-1	53383	7180	968.6	989.56	0.19	989.97	0.000164	5.36	1717.78	116	0.21
Reach-1	53383	5960	968.6	987.19	0.18	987.57	0.00018	5.16	1441.82	116	0.22
Reach-1	53383	3602	968.6	982.8	0.14	983.08	0.000188	4.35	945.07	98.09	0.21
Reach-1	53383	2746	968.6	980.7	0.13	980.94	0.000202	4.01	749.03	88.57	0.21
Reach-1	53383	1686	968.6	978.7	0.08	978.84	0.000153	3.05	581.08	78.95	0.18
Reach-1	53383	1450	968.6	978.06	0.07	978.19	0.000146	2.83	532.07	75.81	0.17
Reach-1	53383	1375	968.6	977.87	0.07	977.98	0.000142	2.75	517.33	74.84	0.17
Reach-1	53383	1328	968.6	977.75	0.07	977.86	0.000139	2.7	508.74	74.26	0.17
Reach-1	53383	1171	968.6	977.3	0.06	977.4	0.000132	2.53	475.85	72.01	0.16
Reach-1	53383	804	968.6	976.08	0.04	976.15	0.000113	2.08	391.46	65.89	0.15
Reach-1	53383	379	968.6	974.12	0.02	974.16	0.000079	1.41	269.2	59.41	0.12
Reach-1	53383	110	968.6	972.28	0.01	972.28	0.00003	0.67	164.57	53.83	0.07
Reach-1	53533	7180	967.4	989.61	0.19	990	0.000172	5.35	1830.89	130	0.21
Reach-1	53533	5960	967.4	987.22	0.19	987.6	0.000192	5.19	1520.45	130	0.22
Reach-1	53533	3602	967.4	982.82	0.15	983.11	0.000204	4.43	962.42	108.63	0.21
Reach-1	53533	2746	967.4	980.72	0.14	980.97	0.000219	4.1	751.06	92.13	0.21
Reach-1	53533	1686	967.4	978.72	0.08	978.87	0.000163	3.11	580.77	79.69	0.18
Reach-1	53533	1450	967.4	978.09	0.07	978.21	0.000154	2.89	531.08	76.29	0.17
Reach-1	53533	1375	967.4	977.89	0.07	978.01	0.000149	2.8	516.32	75.47	0.17
Reach-1	53533	1328	967.4	977.78	0.07	977.89	0.000146	2.75	507.63	75.09	0.17
Reach-1	53533	1171	967.4	977.33	0.06	977.43	0.000135	2.57	474.21	73.59	0.16
Reach-1	53533	804	967.4	976.1	0.04	976.17	0.000109	2.09	388.75	64.88	0.14
Reach-1	53533	379	967.4	974.14	0.02	974.17	0.000068	1.38	275.03	54.21	0.11
Reach-1	53533	110	967.4	972.28	0	972.29	0.000022	0.62	177.01	51.42	0.06
Reach-1	53538	7180	970.18	989.78	0.11	990.01	0.000105	3.98	2076.32	140	0.17
Reach-1	53538	5960	970.18	987.39	0.11	987.61	0.000122	3.88	1741.69	140	0.18
Reach-1	53538	3602	970.18	982.94	0.1	983.13	0.000157	3.46	1120.94	136.54	0.19
Reach-1	53538	2746	970.18	980.81	0.1	980.98	0.000204	3.37	846.63	120.73	0.21
Reach-1	53538	1686	970.18	978.75	0.08	978.87	0.000207	2.79	611.11	109.25	0.2
Reach-1	53538	1450	970.18	978.11	0.07	978.22	0.000223	2.69	542.14	106.05	0.2
Reach-1	53538	1375	970.18	977.91	0.07	978.02	0.000228	2.65	520.92	105.04	0.21
Reach-1	53538	1328	970.18	977.79	0.07	977.9	0.000229	2.62	508.67	104.46	0.21
Reach-1	53538	1171	970.18	977.34	0.07	977.44	0.000244	2.54	461.61	102.18	0.21
Reach-1	53538	804	970.18	976.09	0.06	976.18	0.000289	2.37	339.65	92.81	0.22
Reach-1	53538	379	970.18	974.11	0.05	974.18	0.000332	2.07	183.24	68.02	0.22
Reach-1	53538	110	970.18	972.27	0.04	972.3	0.000399	1.5	73.39	51.14	0.22

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Reach-1	53573	7180	969.2	989.76	0.13	990.03	0.000124	4.28	1958.21	140	0.18
Reach-1	53573	5960	969.2	987.37	0.13	987.63	0.000144	4.18	1623.49	140	0.19
Reach-1	53573	3602	969.2	982.93	0.11	983.14	0.000185	3.73	1020.01	123.27	0.2
Reach-1	53573	2746	969.2	980.79	0.12	981	0.000235	3.61	776.93	106.76	0.22
Reach-1	53573	1686	969.2	978.76	0.08	978.89	0.000221	2.95	572.44	93.71	0.21
Reach-1	53573	1450	969.2	978.12	0.08	978.24	0.000229	2.82	513.81	89.45	0.21
Reach-1	53573	1375	969.2	977.91	0.08	978.03	0.000229	2.77	495.85	88.08	0.21
Reach-1	53573	1328	969.2	977.8	0.08	977.91	0.000226	2.73	485.57	87.27	0.2
Reach-1	53573	1171	969.2	977.35	0.07	977.45	0.000221	2.62	446.85	84.16	0.2
Reach-1	53573	804	969.2	976.1	0.06	976.18	0.000209	2.32	347	75.55	0.19
Reach-1	53573	379	969.2	974.14	0.04	974.19	0.000183	1.78	212.38	62.09	0.17
Reach-1	53573	110	969.2	972.3	0.01	972.31	0.000106	1.01	108.91	50.3	0.12
Reach-1	53683	7180	968	989.75	0.15	990.05	0.000131	4.74	2223.63	200	0.19
Reach-1	53683	5960	968	987.35	0.16	987.66	0.000157	4.75	1743.71	200	0.2
Reach-1	53683	3602	968	982.91	0.14	983.18	0.000183	4.19	956.35	102.52	0.21
Reach-1	53683	2746	968	980.79	0.13	981.02	0.000203	3.9	751.11	91.2	0.21
Reach-1	53683	1686	968	978.77	0.08	978.91	0.000161	3	577.73	80.41	0.18
Reach-1	53683	1450	968	978.14	0.07	978.26	0.000155	2.8	527.65	77.01	0.18
Reach-1	53683	1375	968	977.93	0.07	978.05	0.000153	2.73	512.23	75.98	0.18
Reach-1	53683	1328	968	977.82	0.07	977.93	0.00015	2.67	503.4	75.44	0.17
Reach-1	53683	1171	968	977.37	0.06	977.47	0.000144	2.51	470.04	73.35	0.17
Reach-1	53683	804	968	976.12	0.04	976.19	0.000132	2.1	382.09	67.56	0.16
Reach-1	53683	379	968	974.17	0.02	974.2	0.0001	1.49	255.18	62.6	0.13
Reach-1	53683	110	968	972.32	0.01	972.32	0.000045	0.75	145.91	55.21	0.08
Reach-1	53773	7180	968	989.68	0.2	990.09	0.000159	5.5	1761.55	111	0.21
Reach-1	53773	5960	968	987.32	0.19	987.71	0.000171	5.25	1500.06	111	0.22
Reach-1	53773	3602	968	982.91	0.14	983.19	0.000174	4.41	1011.36	108.31	0.21
Reach-1	53773	2746	968	980.8	0.13	981.04	0.000182	4.03	799.42	92.72	0.21
Reach-1	53773	1686	968	978.79	0.08	978.93	0.000133	3.05	621.75	83.74	0.17
Reach-1	53773	1450	968	978.15	0.07	978.27	0.000125	2.82	569.67	80.92	0.16
Reach-1	53773	1375	968	977.95	0.06	978.07	0.000122	2.74	553.52	80.02	0.16
Reach-1	53773	1328	968	977.84	0.06	977.95	0.000119	2.68	544.25	79.5	0.16
Reach-1	53773	1171	968	977.39	0.06	977.49	0.000111	2.5	509.3	77.62	0.15
Reach-1	53773	804	968	976.14	0.04	976.2	0.000092	2.05	414.72	73.3	0.14
Reach-1	53773	379	968	974.18	0.02	974.21	0.000061	1.35	284.7	59.28	0.1
Reach-1	53773	110	968	972.33	0	972.33	0.000021	0.61	181.42	52.54	0.06
Reach-1	53833	7180	969.3	989.94	0.1	990.12	0.000087	3.89	3326.31	400	0.16
Reach-1	53833	5960	969.3	987.5	0.12	987.73	0.000118	4.13	2350.7	400	0.18
Reach-1	53833	3602	969.3	982.99	0.11	983.21	0.000154	3.82	1062.46	126.62	0.19
Reach-1	53833	2746	969.3	980.86	0.11	981.06	0.000174	3.57	830.12	101.27	0.2
Reach-1	53833	1686	969.3	978.81	0.07	978.93	0.000144	2.78	631.13	92.45	0.17
Reach-1	53833	1450	969.3	978.17	0.06	978.28	0.000141	2.61	572.93	89.47	0.17
Reach-1	53833	1375	969.3	977.97	0.06	978.07	0.000139	2.55	555.14	88.54	0.17
Reach-1	53833	1328	969.3	977.86	0.06	977.95	0.000137	2.5	544.93	88	0.17
Reach-1	53833	1171	969.3	977.41	0.05	977.5	0.000133	2.36	506.5	85.93	0.16
Reach-1	53833	804	969.3	976.16	0.04	976.22	0.000124	2	404.9	77.33	0.15
Reach-1	53833	379	969.3	974.19	0.02	974.22	0.000111	1.46	259.04	71.1	0.13
Reach-1	53833	110	969.3	972.33	0.01	972.34	0.000073	0.82	133.46	63.53	0.1
Reach-1	53930	7180	970.5	989.81	0.18	990.19	0.000153	5.23	1794.2	121	0.21
Reach-1	53930	5960	970.5	987.42	0.18	987.78	0.00017	5.05	1505.05	121	0.22

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Reach-1	53930	3602	970.5	982.97	0.14	983.24	0.000182	4.25	1012.55	101.21	0.21
Reach-1	53930	2746	970.5	980.85	0.13	981.09	0.000205	3.98	800.89	98.3	0.22
Reach-1	53930	1686	970.5	978.82	0.09	978.96	0.000169	3.11	605.88	91.95	0.19
Reach-1	53930	1450	970.5	978.18	0.08	978.31	0.000166	2.92	547.83	89.15	0.19
Reach-1	53930	1375	970.5	977.98	0.07	978.1	0.000164	2.85	530.15	88.27	0.19
Reach-1	53930	1328	970.5	977.86	0.07	977.98	0.000161	2.8	520	87.77	0.18
Reach-1	53930	1171	970.5	977.42	0.07	977.53	0.000156	2.64	481.79	85.84	0.18
Reach-1	53930	804	970.5	976.16	0.05	976.24	0.000148	2.25	378.52	77.31	0.17
Reach-1	53930	379	970.5	974.2	0.03	974.24	0.000147	1.66	233.83	70.59	0.16
Reach-1	53930	110	970.5	972.33	0.02	972.35	0.000152	1.03	107.26	64.99	0.14
Reach-1	53983	7180	969.3	990.05	0.09	990.22	0.000082	3.77	3136.41	280	0.15
Reach-1	53983	5960	969.3	987.62	0.1	987.81	0.000102	3.84	2455.65	280	0.16
Reach-1	53983	3602	969.3	983.05	0.11	983.25	0.000144	3.69	1235.61	216.7	0.19
Reach-1	53983	2746	969.3	980.91	0.1	981.1	0.000168	3.52	856.65	134.04	0.19
Reach-1	53983	1686	969.3	978.86	0.07	978.97	0.000136	2.72	645.4	91.5	0.17
Reach-1	53983	1450	969.3	978.22	0.06	978.32	0.000133	2.55	587.19	89.18	0.16
Reach-1	53983	1375	969.3	978.02	0.06	978.11	0.000131	2.49	569.37	88.45	0.16
Reach-1	53983	1328	969.3	977.89	0.06	977.98	0.000129	2.44	558.22	88	0.16
Reach-1	53983	1171	969.3	977.45	0.05	977.53	0.000124	2.3	519.71	86.41	0.16
Reach-1	53983	804	969.3	976.18	0.04	976.24	0.000117	1.95	414.73	78.76	0.15
Reach-1	53983	379	969.3	974.21	0.02	974.24	0.000104	1.42	267.02	71.8	0.13
Reach-1	53983	110	969.3	972.34	0.01	972.35	0.000069	0.8	137.89	66.08	0.1
Reach-1	54083	7180	969.5	990.06	0.1	990.23	0.000084	3.77	3203.53	300	0.15
Reach-1	54083	5960	969.5	987.63	0.11	987.82	0.000107	3.89	2473.16	300	0.17
Reach-1	54083	3602	969.5	983.06	0.11	983.27	0.000155	3.75	1244.51	207.42	0.19
Reach-1	54083	2746	969.5	980.92	0.11	981.12	0.000193	3.65	865.4	146.31	0.21
Reach-1	54083	1686	969.5	978.86	0.08	978.99	0.000169	2.9	620.68	104.22	0.19
Reach-1	54083	1450	969.5	978.22	0.07	978.34	0.000171	2.74	555.42	98.09	0.19
Reach-1	54083	1375	969.5	978.02	0.07	978.13	0.00017	2.69	535.92	96.18	0.18
Reach-1	54083	1328	969.5	977.9	0.07	978.01	0.000169	2.64	524.51	95.15	0.18
Reach-1	54083	1171	969.5	977.46	0.06	977.55	0.000167	2.51	483.26	91.39	0.18
Reach-1	54083	804	969.5	976.19	0.05	976.27	0.000174	2.19	373.04	84.27	0.18
Reach-1	54083	379	969.5	974.22	0.04	974.27	0.000225	1.77	214.58	75.98	0.18
Reach-1	54083	110	969.5	972.35	0.03	972.38	0.000426	1.37	80.35	67.57	0.22
Reach-1	54183	7180	969.5	989.97	0.15	990.28	0.000132	4.67	1861.46	121	0.19
Reach-1	54183	5960	969.5	987.57	0.14	987.86	0.000148	4.5	1570.68	121	0.2
Reach-1	54183	3602	969.5	983.07	0.12	983.29	0.000167	3.88	1031.97	113.12	0.2
Reach-1	54183	2746	969.5	980.93	0.11	981.13	0.000192	3.65	804.43	100.12	0.2
Reach-1	54183	1686	969.5	978.88	0.07	979.01	0.000161	2.86	608.31	91.11	0.18
Reach-1	54183	1450	969.5	978.24	0.07	978.35	0.00016	2.69	550.51	88.28	0.18
Reach-1	54183	1375	969.5	978.03	0.07	978.14	0.000158	2.63	532.89	87.4	0.18
Reach-1	54183	1328	969.5	977.91	0.06	978.01	0.000157	2.58	522.11	86.87	0.17
Reach-1	54183	1171	969.5	977.48	0.06	977.57	0.000152	2.44	484.68	85.02	0.17
Reach-1	54183	804	969.5	976.21	0.04	976.28	0.000142	2.08	386.46	72.92	0.16
Reach-1	54183	379	969.5	974.24	0.03	974.28	0.000123	1.53	247.83	67.73	0.14
Reach-1	54183	110	969.5	972.38	0.01	972.39	0.000087	0.87	126.09	62.82	0.11
Reach-1	54283	7180	969.5	989.99	0.15	990.3	0.000123	4.7	2084.18	170	0.19
Reach-1	54283	5960	969.5	987.57	0.15	987.88	0.000143	4.62	1673.1	170	0.2
Reach-1	54283	3602	969.5	983.07	0.12	983.3	0.000159	3.97	1047.14	110.19	0.2
Reach-1	54283	2746	969.5	980.94	0.11	981.15	0.000179	3.72	819.68	103.43	0.2
Reach-1	54283	1686	969.5	978.89	0.07	979.02	0.000146	2.89	618.16	90.61	0.18

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Reach-1	54283	1450	969.5	978.25	0.07	978.36	0.000142	2.7	561.69	84.89	0.17
Reach-1	54283	1375	969.5	978.05	0.06	978.16	0.00014	2.64	544.84	83.11	0.17
Reach-1	54283	1328	969.5	977.92	0.06	978.03	0.000139	2.59	534.26	82.42	0.17
Reach-1	54283	1171	969.5	977.49	0.06	977.58	0.000132	2.43	499.22	81.03	0.16
Reach-1	54283	804	969.5	976.23	0.04	976.3	0.000124	2.06	399.48	76.97	0.15
Reach-1	54283	379	969.5	974.26	0.03	974.3	0.000116	1.5	254.14	71.04	0.14
Reach-1	54283	110	969.5	972.39	0.01	972.4	0.000092	0.88	125.78	66.04	0.11
Reach-1	54383	7180	969	989.9	0.22	990.36	0.00018	5.87	1805.87	159.84	0.23
Reach-1	54383	5960	969	987.5	0.22	987.93	0.000196	5.63	1455.19	125.25	0.23
Reach-1	54383	3602	969	983.03	0.17	983.35	0.000205	4.74	955.59	99.67	0.23
Reach-1	54383	2746	969	980.91	0.15	981.19	0.000222	4.39	753.77	90.96	0.23
Reach-1	54383	1686	969	978.89	0.1	979.06	0.000169	3.36	578.46	82.66	0.2
Reach-1	54383	1450	969	978.25	0.09	978.4	0.000161	3.13	526.32	80.02	0.19
Reach-1	54383	1375	969	978.05	0.08	978.19	0.000158	3.05	510.42	79.2	0.19
Reach-1	54383	1328	969	977.92	0.08	978.05	0.000155	2.99	500.24	78.55	0.18
Reach-1	54383	1171	969	977.5	0.07	977.61	0.000145	2.79	467.37	76.14	0.18
Reach-1	54383	804	969	976.24	0.05	976.32	0.000125	2.31	376.07	69.01	0.16
Reach-1	54383	379	969	974.28	0.03	974.31	0.000094	1.57	248.98	60.91	0.13
Reach-1	54383	110	969	972.4	0.01	972.41	0.000046	0.78	141.88	53.59	0.08
Reach-1	54483	7180	969.5	989.92	0.23	990.38	0.000206	5.81	1740.14	150	0.23
Reach-1	54483	5960	969.5	987.5	0.24	987.97	0.000244	5.77	1378.1	143.81	0.25
Reach-1	54483	3602	969.5	983	0.2	983.38	0.000282	5.03	842.93	101.72	0.25
Reach-1	54483	2746	969.5	980.89	0.19	981.23	0.000326	4.76	640.51	89.66	0.26
Reach-1	54483	1686	969.5	978.89	0.12	979.1	0.000268	3.72	473.73	75.91	0.23
Reach-1	54483	1450	969.5	978.25	0.11	978.44	0.000263	3.49	426.86	70.93	0.23
Reach-1	54483	1375	969.5	978.05	0.11	978.23	0.000259	3.4	412.89	69.38	0.22
Reach-1	54483	1328	969.5	977.92	0.11	978.09	0.000257	3.35	403.96	68.15	0.22
Reach-1	54483	1171	969.5	977.5	0.1	977.65	0.000246	3.14	376.18	63.73	0.21
Reach-1	54483	804	969.5	976.24	0.07	976.35	0.000228	2.66	302.14	55.83	0.2
Reach-1	54483	379	969.5	974.28	0.04	974.34	0.000183	1.92	197.69	51.13	0.17
Reach-1	54483	110	969.5	972.41	0.01	972.43	0.000106	1.04	106.07	46.92	0.12
Reach-1	54683	7180	968.4	990.01	0.2	990.42	0.000177	5.48	1804.93	150	0.22
Reach-1	54683	5960	968.4	987.6	0.2	988.02	0.000203	5.39	1445.38	144.41	0.23
Reach-1	54683	3602	968.4	983.13	0.16	983.43	0.000218	4.57	922.95	99.66	0.22
Reach-1	54683	2746	968.4	981.02	0.15	981.29	0.000239	4.26	722.65	90.71	0.23
Reach-1	54683	1686	968.4	978.98	0.1	979.15	0.000189	3.28	547.26	80.82	0.2
Reach-1	54683	1450	968.4	978.34	0.08	978.48	0.000182	3.06	496.3	77.31	0.19
Reach-1	54683	1375	968.4	978.14	0.08	978.28	0.000178	2.98	480.82	76.21	0.19
Reach-1	54683	1328	968.4	978.01	0.08	978.14	0.000176	2.93	470.85	75.49	0.19
Reach-1	54683	1171	968.4	977.58	0.07	977.69	0.000167	2.75	438.99	73.36	0.18
Reach-1	54683	804	968.4	976.31	0.05	976.39	0.00015	2.29	351.42	61.81	0.16
Reach-1	54683	379	968.4	974.33	0.03	974.36	0.000094	1.56	243.14	51.3	0.13
Reach-1	54683	110	968.4	972.43	0.01	972.44	0.000037	0.74	148.25	48.6	0.07
Reach-1	54783	7180	970.14	990.24	0.11	990.45	0.000108	3.98	2874.78	395.18	0.17
Reach-1	54783	5960	970.14	987.82	0.12	988.05	0.000137	4.05	2093.72	289.63	0.19
Reach-1	54783	3602	970.14	983.24	0.13	983.47	0.000213	3.93	1032.64	172.93	0.22
Reach-1	54783	2746	970.14	981.09	0.14	981.32	0.000289	3.89	720.14	118.35	0.25
Reach-1	54783	1686	970.14	979.01	0.1	979.17	0.000282	3.25	518.9	85.56	0.23
Reach-1	54783	1450	970.14	978.36	0.1	978.51	0.000286	3.12	464.27	82.24	0.23
Reach-1	54783	1375	970.14	978.15	0.1	978.3	0.000285	3.07	447.64	81.2	0.23
Reach-1	54783	1328	970.14	978.02	0.09	978.16	0.000285	3.04	436.92	80.52	0.23

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Reach-1	54783	1171	970.14	977.59	0.09	977.72	0.00028	2.91	402.62	78.32	0.23
Reach-1	54783	804	970.14	976.31	0.08	976.41	0.00029	2.62	306.44	71.78	0.22
Reach-1	54783	379	970.14	974.32	0.06	974.39	0.000345	2.18	173.68	61.62	0.23
Reach-1	54783	110	970.14	972.42	0.03	972.46	0.000333	1.51	72.72	43.67	0.21
Reach-1	54790	7180	968.8	990.2	0.14	990.47	0.000122	4.52	2167.11	160	0.18
Reach-1	54790	5960	968.8	987.8	0.14	988.07	0.00014	4.42	1785.4	155.59	0.19
Reach-1	54790	3602	968.8	983.25	0.12	983.47	0.00017	3.93	1101.97	136.7	0.2
Reach-1	54790	2746	968.8	981.12	0.12	981.33	0.000199	3.73	841.25	114.19	0.21
Reach-1	54790	1686	968.8	979.04	0.08	979.17	0.000175	2.98	612.7	105.17	0.19
Reach-1	54790	1450	968.8	978.39	0.07	978.51	0.000176	2.82	545.53	102.36	0.19
Reach-1	54790	1375	968.8	978.19	0.07	978.3	0.000175	2.76	524.78	101.48	0.19
Reach-1	54790	1328	968.8	978.05	0.07	978.17	0.000175	2.72	511.37	100.9	0.19
Reach-1	54790	1171	968.8	977.62	0.06	977.72	0.000171	2.58	468.42	97.52	0.18
Reach-1	54790	804	968.8	976.34	0.05	976.42	0.000159	2.22	362.28	68.85	0.17
Reach-1	54790	379	968.8	974.36	0.03	974.4	0.000122	1.61	235.97	59.56	0.14
Reach-1	54790	110	968.8	972.45	0.01	972.46	0.000064	0.85	129.42	53.02	0.1
Reach-1	54900	7180	970	990.26	0.12	990.49	0.000105	4.18	2516.53	250	0.17
Reach-1	54900	5960	970	987.83	0.13	988.08	0.000128	4.21	1910.97	242.13	0.18
Reach-1	54900	3602	970	983.29	0.11	983.49	0.000152	3.69	1156.04	132.82	0.19
Reach-1	54900	2746	970	981.16	0.1	981.35	0.00018	3.51	890.77	118.55	0.2
Reach-1	54900	1686	970	979.07	0.07	979.19	0.000162	2.83	651.1	110.14	0.18
Reach-1	54900	1450	970	978.42	0.07	978.53	0.000165	2.68	581.03	107.55	0.18
Reach-1	54900	1375	970	978.22	0.07	978.33	0.000165	2.63	559.22	106.73	0.18
Reach-1	54900	1328	970	978.09	0.06	978.19	0.000165	2.59	545.11	106.2	0.18
Reach-1	54900	1171	970	977.66	0.06	977.75	0.000163	2.46	499.49	104.46	0.18
Reach-1	54900	804	970	976.37	0.05	976.44	0.000174	2.17	372.36	86.78	0.18
Reach-1	54900	379	970	974.38	0.04	974.42	0.000183	1.71	221.94	69.88	0.17
Reach-1	54900	110	970	972.46	0.02	972.48	0.000195	1.13	97.45	60.32	0.16
Reach-1	54935	7180	970	990.26	0.12	990.5	0.000116	4.25	2446.53	250	0.17
Reach-1	54935	5960	970	987.83	0.13	988.09	0.000143	4.29	1840.9	241.19	0.19
Reach-1	54935	3602	970	983.29	0.11	983.5	0.00017	3.75	1124.02	124.61	0.19
Reach-1	54935	2746	970	981.17	0.11	981.36	0.000203	3.58	867.58	116.28	0.21
Reach-1	54935	1686	970	979.08	0.08	979.21	0.000186	2.89	633.43	108.13	0.19
Reach-1	54935	1450	970	978.44	0.07	978.55	0.00019	2.75	564.77	105.62	0.19
Reach-1	54935	1375	970	978.23	0.07	978.34	0.00019	2.7	543.36	104.82	0.19
Reach-1	54935	1328	970	978.1	0.07	978.21	0.00019	2.66	529.49	104.3	0.19
Reach-1	54935	1171	970	977.67	0.06	977.77	0.00019	2.53	484.68	102.61	0.18
Reach-1	54935	804	970	976.38	0.06	976.46	0.000208	2.25	359.21	86.33	0.18
Reach-1	54935	379	970	974.38	0.04	974.44	0.000274	1.85	204.81	74.61	0.2
Reach-1	54935	110	970	972.48	0.03	972.5	0.000268	1.29	85.07	53.5	0.18
Reach-1	54970	7180	970.2	990.25	0.13	990.5	0.000117	4.35	2463.74	250	0.18
Reach-1	54970	5960	970.2	987.83	0.14	988.1	0.000145	4.42	1857.59	245.37	0.19
Reach-1	54970	3602	970.2	983.3	0.12	983.52	0.000176	3.91	1056.15	115.95	0.2
Reach-1	54970	2746	970.2	981.17	0.12	981.37	0.000207	3.71	818.51	107.33	0.21
Reach-1	54970	1686	970.2	979.09	0.08	979.22	0.000183	2.96	604.28	98.91	0.19
Reach-1	54970	1450	970.2	978.45	0.07	978.57	0.000185	2.8	541.69	96.32	0.19
Reach-1	54970	1375	970.2	978.24	0.07	978.36	0.000184	2.74	522.17	95.49	0.19
Reach-1	54970	1328	970.2	978.11	0.07	978.23	0.000184	2.7	509.54	94.96	0.19
Reach-1	54970	1171	970.2	977.68	0.06	977.78	0.000181	2.56	469.07	91.37	0.18
Reach-1	54970	804	970.2	976.39	0.05	976.47	0.000191	2.24	359.29	78.79	0.18
Reach-1	54970	379	970.2	974.39	0.04	974.44	0.000215	1.78	212.94	69.85	0.18

HEC-RAS Plan: Housatonic small scale existing n=0.033 output

Reach-1	54970	110	970.2	972.49	0.03	972.51	0.000323	1.28	85.75	63.76	0.19
Reach-1	55030	7180	970.2	990.24	0.13	990.52	0.000116	4.42	2006.47	140	0.18
Reach-1	55030	5960	970.2	987.84	0.13	988.11	0.00013	4.29	1670.79	137.89	0.18
Reach-1	55030	3602	970.2	983.32	0.11	983.52	0.000147	3.69	1076.62	117.33	0.19
Reach-1	55030	2746	970.2	981.21	0.1	981.39	0.000164	3.44	847.83	101.77	0.19
Reach-1	55030	1686	970.2	979.12	0.07	979.23	0.000137	2.69	644.76	92.53	0.17
Reach-1	55030	1450	970.2	978.48	0.06	978.57	0.000134	2.52	586.36	89.7	0.16
Reach-1	55030	1375	970.2	978.27	0.06	978.37	0.000133	2.46	568.17	88.8	0.16
Reach-1	55030	1328	970.2	978.14	0.06	978.23	0.000132	2.42	556.42	88.21	0.16
Reach-1	55030	1171	970.2	977.7	0.05	977.79	0.000127	2.28	518.61	85.8	0.16
Reach-1	55030	804	970.2	976.41	0.04	976.47	0.000123	1.95	412.51	78.97	0.15
Reach-1	55030	379	970.2	974.41	0.02	974.45	0.000115	1.45	260.7	73.55	0.14
Reach-1	55030	110	970.2	972.51	0.01	972.52	0.000101	0.88	124.83	69.17	0.12
Reach-1	55100	7180	968.3	990.22	0.16	990.56	0.000142	4.95	2005.64	200	0.19
Reach-1	55100	5960	968.3	987.79	0.17	988.14	0.000166	4.91	1525.15	189.34	0.21
Reach-1	55100	3602	968.3	983.29	0.13	983.55	0.000172	4.11	947.06	92.49	0.2
Reach-1	55100	2746	968.3	981.19	0.12	981.41	0.000182	3.77	762.2	83.57	0.2
Reach-1	55100	1686	968.3	979.12	0.07	979.25	0.000138	2.86	598.42	74.78	0.17
Reach-1	55100	1450	968.3	978.49	0.06	978.59	0.000131	2.65	551.51	72.06	0.16
Reach-1	55100	1375	968.3	978.28	0.06	978.38	0.000128	2.58	536.94	71.2	0.16
Reach-1	55100	1328	968.3	978.15	0.06	978.25	0.000126	2.53	527.56	70.64	0.16
Reach-1	55100	1171	968.3	977.72	0.05	977.8	0.000117	2.36	497.39	68.34	0.15
Reach-1	55100	804	968.3	976.43	0.04	976.48	0.000096	1.94	413.43	63	0.13
Reach-1	55100	379	968.3	974.43	0.02	974.46	0.000061	1.3	292.04	58.95	0.1
Reach-1	55100	110	968.3	972.52	0	972.53	0.000021	0.6	183.04	55.06	0.06
Reach-1	55181	7180	970.46	990.3	0.15	990.58	0.000183	4.52	2677.42	752.18	0.19
Reach-1	55181	5960	970.46	987.78	0.18	988.16	0.000218	4.95	1203.56	314.2	0.22
Reach-1	55181	3602	970.46	983.3	0.14	983.57	0.000226	4.17	862.9	76.01	0.22
Reach-1	55181	2746	970.46	981.19	0.13	981.43	0.000252	3.91	702.76	75.98	0.23
Reach-1	55181	1686	970.46	979.13	0.09	979.28	0.000212	3.09	546.37	75.94	0.2
Reach-1	55181	1450	970.46	978.49	0.08	978.62	0.000212	2.92	497.37	75.94	0.2
Reach-1	55181	1375	970.46	978.28	0.08	978.41	0.000212	2.85	481.92	75.93	0.2
Reach-1	55181	1328	970.46	978.15	0.08	978.27	0.000211	2.81	471.86	75.93	0.2
Reach-1	55181	1171	970.46	977.72	0.07	977.83	0.000208	2.67	438.91	75.92	0.2
Reach-1	55181	804	970.46	976.42	0.06	976.51	0.000219	2.36	340.92	75.03	0.19
Reach-1	55181	379	970.46	974.42	0.04	974.48	0.000234	1.9	199.1	64.63	0.19
Reach-1	55181	110	970.46	972.52	0.02	972.54	0.000205	1.23	89.37	50.79	0.16

Reach-1 55195.5 Bridge

Reach-1	55210	7180	970.46	990.32	0.15	990.61	0.000182	4.51	2695.2	753.68	0.19
Reach-1	55210	5960	970.46	988.2	0.17	988.57	0.000201	4.82	1235.37	362.06	0.21
Reach-1	55210	3602	970.46	983.32	0.14	983.59	0.000224	4.17	864.51	76.01	0.22
Reach-1	55210	2746	970.46	981.19	0.13	981.43	0.000251	3.91	702.83	75.98	0.23
Reach-1	55210	1686	970.46	979.15	0.09	979.3	0.00021	3.08	548.11	75.95	0.2
Reach-1	55210	1450	970.46	978.49	0.08	978.62	0.000212	2.91	497.63	75.94	0.2
Reach-1	55210	1375	970.46	978.29	0.08	978.41	0.000211	2.85	482.14	75.93	0.2
Reach-1	55210	1328	970.46	978.15	0.08	978.28	0.000211	2.81	472.06	75.93	0.2
Reach-1	55210	1171	970.46	977.72	0.07	977.83	0.000207	2.67	438.99	75.92	0.2
Reach-1	55210	804	970.46	976.42	0.06	976.51	0.000219	2.36	340.97	75.03	0.19
Reach-1	55210	379	970.46	974.42	0.04	974.48	0.000234	1.9	199.11	64.63	0.19
Reach-1	55210	110	970.46	972.52	0.02	972.54	0.000205	1.23	89.39	50.79	0.16

HEC-RAS Plan: Housatonic small scale existing n=0.033 output

Reach-1	55258	7180	970.5	990.43	0.1	990.62	0.000101	3.65	2782.6	400	0.16
Reach-1	55258	5960	970.5	988.39	0.1	988.59	0.000122	3.67	2006.77	348.86	0.17
Reach-1	55258	3602	970.5	983.41	0.11	983.61	0.000187	3.53	1020.29	106.09	0.2
Reach-1	55258	2746	970.5	981.26	0.1	981.45	0.000217	3.43	800.96	97.84	0.21
Reach-1	55258	1686	970.5	979.18	0.07	979.3	0.000183	2.78	605.74	89.87	0.19
Reach-1	55258	1450	970.5	978.52	0.07	978.63	0.000182	2.65	547.34	87.34	0.19
Reach-1	55258	1375	970.5	978.32	0.07	978.42	0.00018	2.6	529.47	86.56	0.19
Reach-1	55258	1328	970.5	978.17	0.06	978.28	0.00018	2.57	517.05	86	0.18
Reach-1	55258	1171	970.5	977.74	0.06	977.83	0.000174	2.44	479.78	84.33	0.18
Reach-1	55258	804	970.5	976.44	0.05	976.51	0.000173	2.15	373.77	79.36	0.17
Reach-1	55258	379	970.5	974.44	0.04	974.48	0.000185	1.7	222.41	71.68	0.17
Reach-1	55258	110	970.5	972.53	0.02	972.55	0.000202	1.15	95.78	60.13	0.16

Profile O utput Table - Standard Table 3
HEC-RAS Plan: Housatonic small scale proposed output

Rivers 1
Hydraul ic Reaches = 1
River Stations = 227
Plans 1
Profiles = 12

Reach	River St	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Shear Chan (lb/sq ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	0	14492	948.3	954.11	1.17	956.36	0.003481	13.5	1570.85	393.82	0.99
Reach-1	0	12028	948.3	954.01	0.85	955.63	0.002563	11.45	1530.62	389.33	0.85
Reach-1	0	7270	948.3	952.65	0.99	954.84	0.003869	11.87	612.57	307.91	1.01
Reach-1	0	5543	948.3	951.93	0.88	953.76	0.004065	10.85	510.87	293.99	1.01
Reach-1	0	3402	948.3	950.92	0.71	952.25	0.004461	9.23	368.61	274.48	1.01
Reach-1	0	2926	948.3	950.68	0.66	951.87	0.004574	8.77	333.76	269.7	1
Reach-1	0	2775	948.3	950.59	0.64	951.75	0.004632	8.62	321.95	268.07	1
Reach-1	0	2679	948.3	950.54	0.63	951.67	0.004667	8.52	314.42	267.04	1
Reach-1	0	2364	948.3	950.36	0.6	951.4	0.004798	8.18	288.97	263.54	1.01
Reach-1	0	1622	948.3	949.9	0.51	950.71	0.005162	7.21	224.93	180.45	1
Reach-1	0	764	948.3	949.27	0.36	949.76	0.006047	5.62	136.05	172.95	1.01
Reach-1	0	222	948.3	948.73	0.21	948.94	0.007903	3.72	59.62	166.49	1.01
Reach-1	35213	14492	951.76	966.02	0.06	966.07	0.000091	3.52	10428.48	1470.11	0.18
Reach-1	35213	12028	951.76	965.13	0.06	965.18	0.000095	3.41	9125.74	1465.64	0.18
Reach-1	35213	7270	951.76	963.63	0.04	963.67	0.00008	2.83	6941.28	1458.17	0.17
Reach-1	35213	5543	951.76	962.8	0.04	962.84	0.000082	2.69	5729.5	1454.01	0.17
Reach-1	35213	3402	951.76	961.62	0.04	961.66	0.000085	2.47	4015.15	1448.1	0.16
Reach-1	35213	2926	951.76	961.32	0.04	961.36	0.000086	2.41	3579.9	1446.59	0.16
Reach-1	35213	2775	951.76	961.22	0.03	961.26	0.000086	2.39	3435.83	1446.1	0.16
Reach-1	35213	2679	951.76	961.15	0.03	961.19	0.000086	2.38	3340.96	1445.77	0.16
Reach-1	35213	2364	951.76	960.93	0.03	960.98	0.000087	2.33	3023.67	1444.67	0.16
Reach-1	35213	1622	951.76	960.3	0.03	960.35	0.000087	2.17	2136.36	1345.16	0.16
Reach-1	35213	764	951.76	959.1	0.02	959.15	0.000083	1.9	807.84	780.44	0.15
Reach-1	35213	222	951.76	956.42	0.01	956.45	0.000063	1.27	174.58	53.88	0.12
Reach-1	36688	14492	952.7	966.13	0.05	966.18	0.000067	3.08	11740.73	1686.13	0.16
Reach-1	36688	12028	952.7	965.25	0.05	965.3	0.00007	2.98	10251.66	1685.25	0.16
Reach-1	36688	7270	952.7	963.74	0.03	963.77	0.00006	2.49	7701.37	1683.74	0.15
Reach-1	36688	5543	952.7	962.91	0.03	962.94	0.000062	2.37	6305.11	1682.91	0.14
Reach-1	36688	3402	952.7	961.73	0.03	961.76	0.000061	2.13	4328.76	1643.65	0.14
Reach-1	36688	2926	952.7	961.43	0.02	961.46	0.000059	2.03	3842.13	1601.36	0.14
Reach-1	36688	2775	952.7	961.33	0.02	961.36	0.000058	2	3683.61	1587.34	0.14
Reach-1	36688	2679	952.7	961.26	0.02	961.3	0.000057	1.98	3580.15	1578.13	0.13
Reach-1	36688	2364	952.7	961.04	0.02	961.08	0.000055	1.89	3237.83	1547.24	0.13
Reach-1	36688	1622	952.7	960.41	0.02	960.44	0.000048	1.65	2327.25	1329.12	0.12
Reach-1	36688	764	952.7	959.21	0.01	959.23	0.000035	1.25	1068.19	688.32	0.1
Reach-1	36688	222	952.7	956.51	0.01	956.52	0.000041	0.91	244.44	92.54	0.1
Reach-1	37238	14492	952.6	966.07	0.13	966.29	0.00018	5.03	6306.67	1013.51	0.26
Reach-1	37238	12028	952.6	965.19	0.12	965.41	0.000186	4.86	5417.98	1007.35	0.26
Reach-1	37238	7270	952.6	963.7	0.09	963.86	0.000154	3.99	3919.02	996.88	0.23
Reach-1	37238	5543	952.6	962.87	0.08	963.03	0.000151	3.72	3099.99	991.12	0.23
Reach-1	37238	3402	952.6	961.71	0.06	961.84	0.000129	3.1	1965.43	903.86	0.2

HEC-RAS Plan: Housatonic small scale proposed output

Reach-1	37238	2926	952.6	961.42	0.05	961.53	0.000117	2.87	1712.35	820.96	0.19
Reach-1	37238	2775	952.6	961.32	0.05	961.43	0.000113	2.79	1633.87	793.49	0.19
Reach-1	37238	2679	952.6	961.26	0.05	961.36	0.00011	2.74	1583.69	775.42	0.19
Reach-1	37238	2364	952.6	961.04	0.04	961.14	0.0001	2.55	1424.01	714.88	0.18
Reach-1	37238	1622	952.6	960.42	0.03	960.48	0.000073	2.04	1034.46	539.4	0.15
Reach-1	37238	764	952.6	959.22	0.01	959.25	0.000037	1.26	650.37	207.65	0.1
Reach-1	37238	222	952.6	956.53	0.01	956.54	0.000038	0.82	271.43	114	0.09
Reach-1	37588	14492	952.8	965.87	0.4	966.61	0.00064	8.71	3294.08	578.31	0.48
Reach-1	37588	12028	952.8	964.99	0.38	965.72	0.000673	8.42	2795.53	565.46	0.48
Reach-1	37588	7270	952.8	963.56	0.27	964.1	0.000554	6.85	1998.72	544.29	0.42
Reach-1	37588	5543	952.8	962.74	0.24	963.25	0.000552	6.37	1559.92	532.27	0.42
Reach-1	37588	3402	952.8	961.61	0.18	962.01	0.000469	5.31	979.26	486.74	0.37
Reach-1	37588	2926	952.8	961.32	0.15	961.68	0.000429	4.94	842.3	477.83	0.36
Reach-1	37588	2775	952.8	961.23	0.15	961.57	0.000414	4.81	797.78	474.9	0.35
Reach-1	37588	2679	952.8	961.17	0.14	961.5	0.000404	4.72	768.71	472.98	0.34
Reach-1	37588	2364	952.8	960.97	0.12	961.26	0.000365	4.4	673.35	460.06	0.33
Reach-1	37588	1622	952.8	960.38	0.08	960.57	0.000251	3.44	473.49	148.64	0.27
Reach-1	37588	764	952.8	959.22	0.03	959.29	0.000121	2.08	367.51	88.12	0.18
Reach-1	37588	222	952.8	956.55	0.02	956.58	0.000213	1.58	140.58	79.45	0.21
Reach-1	38568	13000	953.87	966.63	0.31	967.18	0.000499	7.75	3691.74	726.33	0.42
Reach-1	38568	10790	953.87	965.76	0.32	966.34	0.000549	7.66	3062.57	717.61	0.44
Reach-1	38568	6521	953.87	964.09	0.28	964.66	0.000585	6.96	1879.05	700.93	0.44
Reach-1	38568	4972	953.87	963.28	0.25	963.82	0.00059	6.49	1354.49	571.7	0.43
Reach-1	38568	3052	953.87	962.08	0.19	962.5	0.000526	5.41	798.56	359.83	0.4
Reach-1	38568	2625	953.87	961.76	0.16	962.14	0.000485	5.05	690.19	313.23	0.38
Reach-1	38568	2489	953.87	961.65	0.16	962.01	0.000468	4.91	657.03	298.87	0.37
Reach-1	38568	2404	953.87	961.58	0.15	961.93	0.000458	4.83	636.08	289.43	0.37
Reach-1	38568	2120	953.87	961.34	0.13	961.65	0.000417	4.52	569.76	257.29	0.35
Reach-1	38568	1455	953.87	960.64	0.09	960.84	0.000311	3.65	421.98	164.42	0.3
Reach-1	38568	686	953.87	959.35	0.04	959.43	0.00017	2.34	293.14	76.75	0.21
Reach-1	38568	199	953.87	956.75	0.03	956.79	0.00021	1.73	115.15	56.05	0.21
Reach-1	38966	13000	954.3	964.83	1.75	969.59	0.003575	17.51	742.58	78.77	1
Reach-1	38966	10790	954.3	963.74	1.59	967.93	0.003583	16.41	657.48	78.65	1
Reach-1	38966	6521	954.3	963.76	0.58	965.28	0.001301	9.9	658.8	78.65	0.6
Reach-1	38966	4972	954.3	963.25	0.39	964.25	0.000921	8.04	618.24	78.59	0.51
Reach-1	38966	3052	954.3	962.24	0.2	962.74	0.000531	5.66	539.32	78.47	0.38
Reach-1	38966	2625	954.3	961.93	0.16	962.33	0.000455	5.1	514.66	78.44	0.35
Reach-1	38966	2489	954.3	961.82	0.15	962.19	0.000431	4.92	506.01	78.43	0.34
Reach-1	38966	2404	954.3	961.74	0.15	962.1	0.000417	4.81	500.3	78.42	0.34
Reach-1	38966	2120	954.3	961.5	0.12	961.8	0.000366	4.41	481.26	78.39	0.31
Reach-1	38966	1455	954.3	960.78	0.08	960.96	0.000256	3.43	424.45	78.31	0.26
Reach-1	38966	686	954.3	959.43	0.03	959.5	0.000142	2.15	318.86	78.15	0.19
Reach-1	38966	199	954.3	956.85	0.03	956.89	0.000302	1.69	117.87	77.85	0.24
Reach-1	38988	Bridge									
Reach-1	39010	13000	954.3	966.17	1.29	969.82	0.002378	15.32	848.73	78.93	0.82
Reach-1	39010	10790	954.3	964.89	1.18	968.13	0.002409	14.43	747.98	78.78	0.83
Reach-1	39010	6521	954.3	963.86	0.56	965.34	0.001256	9.79	666.37	78.66	0.59
Reach-1	39010	4972	954.3	963.3	0.38	964.29	0.000901	7.99	622.59	78.6	0.5
Reach-1	39010	3052	954.3	962.27	0.2	962.76	0.000525	5.64	541.23	78.48	0.38
Reach-1	39010	2625	954.3	961.95	0.16	962.35	0.00045	5.08	516.27	78.44	0.35

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Reach-1	39010	2489	954.3	961.84	0.15	962.21	0.000427	4.9	507.52	78.43	0.34
Reach-1	39010	2404	954.3	961.77	0.15	962.12	0.000412	4.79	502.29	78.42	0.33
Reach-1	39010	2120	954.3	961.52	0.12	961.82	0.000362	4.39	483.01	78.39	0.31
Reach-1	39010	1455	954.3	960.78	0.08	960.96	0.000256	3.43	424.62	78.31	0.26
Reach-1	39010	686	954.3	959.43	0.03	959.5	0.000142	2.15	318.93	78.15	0.19
Reach-1	39010	199	954.3	956.87	0.03	956.91	0.000291	1.67	119.29	77.85	0.24
Reach-1	39108	13000	953.5	969.14	0.36	970.16	0.000451	8.59	2165.62	322.85	0.41
Reach-1	39108	10790	953.5	967.34	0.38	968.44	0.00056	8.69	1615.64	286.77	0.45
Reach-1	39108	6521	953.5	964.58	0.31	965.49	0.000517	7.63	854.1	165.37	0.42
Reach-1	39108	4972	953.5	963.76	0.22	964.39	0.000399	6.34	784.62	122.72	0.37
Reach-1	39108	3052	953.5	962.5	0.12	962.81	0.000246	4.51	676.86	101.59	0.28
Reach-1	39108	2625	953.5	962.14	0.1	962.39	0.000212	4.06	646.33	95.6	0.26
Reach-1	39108	2489	953.5	962.01	0.09	962.25	0.000201	3.91	635.81	93.54	0.25
Reach-1	39108	2404	953.5	961.94	0.09	962.16	0.000194	3.82	629.46	93.07	0.25
Reach-1	39108	2120	953.5	961.67	0.07	961.86	0.000171	3.5	606.43	91.95	0.23
Reach-1	39108	1455	953.5	960.87	0.05	960.98	0.00012	2.7	538.72	88.63	0.19
Reach-1	39108	686	953.5	959.47	0.02	959.51	0.00006	1.63	419.87	83.94	0.13
Reach-1	39108	199	953.5	956.9	0.01	956.91	0.000044	0.94	210.76	78.8	0.1
Reach-1	39408	13000	954.19	969.97	0.16	970.32	0.000215	5.65	4355.13	684.15	0.29
Reach-1	39408	10790	954.19	968.19	0.19	968.63	0.000305	6.05	3188.01	628.59	0.33
Reach-1	39408	6521	954.19	965.07	0.25	965.68	0.000579	6.53	1360.86	456.69	0.43
Reach-1	39408	4972	954.19	963.96	0.24	964.54	0.000666	6.25	939.61	301.15	0.45
Reach-1	39408	3052	954.19	962.54	0.18	962.96	0.00066	5.18	600.72	177.17	0.43
Reach-1	39408	2625	954.19	962.16	0.17	962.53	0.000655	4.87	540.05	144.12	0.42
Reach-1	39408	2489	954.19	962.03	0.16	962.39	0.000654	4.77	522.19	132.84	0.42
Reach-1	39408	2404	954.19	961.95	0.16	962.3	0.000644	4.69	512.04	128.86	0.42
Reach-1	39408	2120	954.19	961.67	0.14	961.98	0.00059	4.45	476.57	121.79	0.4
Reach-1	39408	1455	954.19	960.86	0.1	961.08	0.000442	3.77	385.67	101.42	0.34
Reach-1	39408	686	954.19	959.46	0.05	959.56	0.000228	2.58	265.83	74.95	0.24
Reach-1	39408	199	954.19	956.9	0.03	956.95	0.000258	1.91	104.36	51.15	0.24
Reach-1	39486	13000	955.1	968.99	0.61	970.79	0.00094	10.81	1298.95	188.29	0.52
Reach-1	39486	10790	955.1	967.38	0.57	969.03	0.000976	10.3	1054.63	116.2	0.53
Reach-1	39486	6521	955.1	964.87	0.36	965.85	0.000756	7.95	820.54	90	0.46
Reach-1	39486	4972	955.1	963.92	0.27	964.63	0.000619	6.76	735.41	90	0.42
Reach-1	39486	3052	955.1	962.62	0.15	963	0.000402	4.94	618.34	90	0.33
Reach-1	39486	2625	955.1	962.26	0.13	962.57	0.000352	4.48	585.93	90	0.31
Reach-1	39486	2489	955.1	962.14	0.12	962.43	0.000337	4.33	574.73	90	0.3
Reach-1	39486	2404	955.1	962.06	0.11	962.34	0.000326	4.23	567.87	90	0.3
Reach-1	39486	2120	955.1	961.78	0.1	962.02	0.000293	3.91	542.73	90	0.28
Reach-1	39486	1455	955.1	960.96	0.06	961.11	0.00022	3.1	468.84	90	0.24
Reach-1	39486	686	955.1	959.51	0.03	959.58	0.000139	2.03	338.75	90	0.18
Reach-1	39486	199	955.1	956.92	0.04	956.98	0.000526	1.88	105.72	90	0.31
Reach-1	39503 Bridge										
Reach-1	39520	13000	955.1	971.06	0.41	972.28	0.000566	9.03	1786.86	281.58	0.41
Reach-1	39520	10790	955.1	969.89	0.35	970.94	0.000518	8.3	1486.79	228.76	0.39
Reach-1	39520	6521	955.1	964.9	0.36	965.87	0.000749	7.92	823.07	90	0.46
Reach-1	39520	4972	955.1	963.95	0.27	964.65	0.000612	6.74	737.97	90	0.41
Reach-1	39520	3052	955.1	962.64	0.15	963.02	0.000398	4.92	620.01	90	0.33
Reach-1	39520	2625	955.1	962.26	0.13	962.57	0.000352	4.48	586.16	90	0.31
Reach-1	39520	2489	955.1	962.14	0.12	962.43	0.000336	4.33	574.96	90	0.3

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Reach-1	39520	2404	955.1	962.06	0.11	962.34	0.000326	4.23	568.09	90	0.3
Reach-1	39520	2120	955.1	961.78	0.1	962.02	0.000293	3.9	542.94	90	0.28
Reach-1	39520	1455	955.1	960.96	0.06	961.11	0.00022	3.1	468.97	90	0.24
Reach-1	39520	686	955.1	959.51	0.03	959.58	0.000139	2.02	338.83	90	0.18
Reach-1	39520	199	955.1	956.96	0.04	957.01	0.000478	1.83	108.82	90	0.29
Reach-1	39618	13000	953.1	972.24	0.07	972.4	0.000071	3.76	5609.16	621.77	0.17
Reach-1	39618	10790	953.1	970.9	0.06	971.04	0.000072	3.54	4811.83	559.32	0.17
Reach-1	39618	6521	953.1	965.77	0.09	965.98	0.000168	3.98	2361.26	439.12	0.24
Reach-1	39618	4972	953.1	964.54	0.08	964.74	0.000182	3.74	1828.66	427.6	0.24
Reach-1	39618	3052	953.1	962.92	0.06	963.06	0.000179	3.14	1182.37	344.75	0.23
Reach-1	39618	2625	953.1	962.49	0.06	962.62	0.000176	2.96	1039.86	313.63	0.23
Reach-1	39618	2489	953.1	962.34	0.06	962.47	0.000175	2.89	996.17	303.46	0.22
Reach-1	39618	2404	953.1	962.26	0.05	962.38	0.000173	2.85	969.99	297.19	0.22
Reach-1	39618	2120	953.1	961.94	0.05	962.05	0.000169	2.69	880.42	275.39	0.22
Reach-1	39618	1455	953.1	961.05	0.04	961.14	0.000163	2.31	658.78	222.53	0.21
Reach-1	39618	686	953.1	959.54	0.02	959.58	0.000061	1.64	418.29	83.92	0.13
Reach-1	39618	199	953.1	957.01	0.01	957.02	0.000043	0.93	213.77	78	0.1
Reach-1	43958	13000	953.5	972.64	0.06	972.71	0.000068	3.5	11008.53	1197.67	0.16
Reach-1	43958	10790	953.5	971.3	0.06	971.37	0.000074	3.43	9411.39	1186.73	0.16
Reach-1	43958	6521	953.5	966.67	0.13	966.87	0.000259	4.91	4002.93	1148.89	0.29
Reach-1	43958	4972	953.5	965.53	0.14	965.77	0.000311	4.92	2742.82	1021.83	0.31
Reach-1	43958	3052	953.5	963.89	0.13	964.13	0.000332	4.51	1483.32	599.4	0.31
Reach-1	43958	2625	953.5	963.44	0.12	963.66	0.000321	4.28	1240.87	469.69	0.3
Reach-1	43958	2489	953.5	963.28	0.11	963.5	0.000318	4.21	1172.72	436.57	0.3
Reach-1	43958	2404	953.5	963.19	0.11	963.4	0.000316	4.17	1131.68	425.53	0.3
Reach-1	43958	2120	953.5	962.85	0.1	963.04	0.000304	3.97	993.16	375.45	0.29
Reach-1	43958	1455	953.5	961.91	0.08	962.08	0.000285	3.52	690.71	306.51	0.27
Reach-1	43958	686	953.5	959.99	0.07	960.13	0.000329	2.98	252.59	156.54	0.28
Reach-1	43958	199	953.5	957.36	0.04	957.44	0.000309	2.28	87.23	35.21	0.26
Reach-1	44218.*	13000	954.81	972.59	0.12	972.76	0.000137	4.97	7333.74	833.87	0.23
Reach-1	44218.*	10790	954.81	971.25	0.12	971.43	0.000149	4.88	6223.9	823.6	0.23
Reach-1	44218.*	6521	954.81	966.53	0.28	967.07	0.000548	7.01	2429.55	785.17	0.42
Reach-1	44218.*	4972	954.81	965.33	0.32	966.03	0.000737	7.37	1493.98	755.17	0.47
Reach-1	44218.*	3052	954.81	963.75	0.26	964.36	0.000737	6.46	671.21	244.99	0.46
Reach-1	44218.*	2625	954.81	963.32	0.24	963.88	0.000708	6.11	568.13	230.95	0.45
Reach-1	44218.*	2489	954.81	963.18	0.23	963.71	0.000694	5.98	535.64	226.74	0.44
Reach-1	44218.*	2404	954.81	963.09	0.23	963.61	0.000684	5.89	515.63	224.1	0.44
Reach-1	44218.*	2120	954.81	962.78	0.2	963.25	0.000646	5.57	451.69	164.88	0.42
Reach-1	44218.*	1455	954.81	961.9	0.15	962.23	0.000534	4.63	322.57	105.32	0.38
Reach-1	44218.*	686	954.81	960.06	0.1	960.25	0.000505	3.51	195.52	61.21	0.35
Reach-1	44218.*	199	954.81	957.43	0.11	957.6	0.001046	3.35	59.34	34.72	0.45
Reach-1	44468	13000	956.07	972.37	0.28	972.93	0.000336	7.68	4024.62	470.58	0.36
Reach-1	44468	10790	956.07	971.04	0.27	971.59	0.000362	7.47	3398.17	469.37	0.37
Reach-1	44468	6521	956.07	966.09	0.62	967.56	0.001323	10.37	1158.2	432.86	0.64
Reach-1	44468	4972	956.07	965.01	0.61	966.53	0.001515	10.07	693.93	423.99	0.67
Reach-1	44468	3052	956.07	963.75	0.39	964.69	0.001142	7.76	398.99	83.19	0.57
Reach-1	44468	2625	956.07	963.37	0.34	964.16	0.001048	7.16	369.38	73.26	0.54
Reach-1	44468	2489	956.07	963.24	0.32	963.99	0.001012	6.95	359.9	72.32	0.53
Reach-1	44468	2404	956.07	963.15	0.31	963.88	0.000989	6.82	353.94	71.73	0.52
Reach-1	44468	2120	956.07	962.85	0.27	963.49	0.000913	6.38	332.88	68.87	0.5
Reach-1	44468	1455	956.07	961.99	0.19	962.42	0.000745	5.26	276.56	63.15	0.44

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Reach-1	44468	686	956.07	960.16	0.14	960.43	0.000822	4.16	164.95	58.89	0.44
Reach-1	44468	199	956.07	957.75	0.28	958.14	0.004329	5.01	39.72	37.85	0.86
Reach-1	44718	8721	957.33	971.86	0.46	973.29	0.00059	9.75	1030.08	89	0.47
Reach-1	44718	7239	957.33	970.7	0.4	971.89	0.000554	8.9	926.4	89	0.45
Reach-1	44718	4375	957.33	966.89	0.36	967.86	0.000727	7.95	587.22	88.8	0.48
Reach-1	44718	3336	957.33	966.17	0.26	966.86	0.000571	6.65	524.61	86.12	0.42
Reach-1	44718	2047	957.33	964.52	0.17	964.94	0.000479	5.21	397.46	69.79	0.37
Reach-1	44718	1761	957.33	964.02	0.15	964.39	0.000465	4.88	363.25	67.89	0.36
Reach-1	44718	1670	957.33	963.86	0.15	964.21	0.00046	4.77	352.05	67.26	0.36
Reach-1	44718	1612	957.33	963.75	0.14	964.09	0.000456	4.69	345.04	66.86	0.36
Reach-1	44718	1422	957.33	963.38	0.13	963.69	0.000446	4.45	320.52	65.44	0.35
Reach-1	44718	976	957.33	962.36	0.1	962.58	0.000419	3.82	255.69	61.2	0.33
Reach-1	44718	460	957.33	960.46	0.08	960.62	0.000541	3.18	144.72	56.55	0.35
Reach-1	44718	134	957.33	958.71	0.09	958.82	0.001449	2.73	49.04	51.53	0.49
Reach-1	44778	8721	957.51	971.91	0.46	973.33	0.000603	9.63	980.71	82.3	0.47
Reach-1	44778	7239	957.51	970.74	0.39	971.93	0.000574	8.81	884.21	82.3	0.46
Reach-1	44778	4375	957.51	966.94	0.37	967.92	0.000798	7.98	571.36	82.3	0.5
Reach-1	44778	3336	957.51	966.19	0.27	966.89	0.00065	6.74	511.19	78.78	0.45
Reach-1	44778	2047	957.51	964.52	0.19	964.98	0.00057	5.41	383.45	73.29	0.4
Reach-1	44778	1761	957.51	964.02	0.17	964.42	0.00057	5.12	347.04	71.36	0.4
Reach-1	44778	1670	957.51	963.85	0.17	964.24	0.00057	5.02	335.22	70.72	0.4
Reach-1	44778	1612	957.51	963.75	0.17	964.13	0.000568	4.95	327.87	70.32	0.4
Reach-1	44778	1422	957.51	963.38	0.15	963.72	0.000569	4.72	302.15	68.91	0.39
Reach-1	44778	976	957.51	962.36	0.13	962.63	0.000598	4.17	233.84	64.8	0.39
Reach-1	44778	460	957.51	960.46	0.12	960.68	0.00085	3.74	123.05	52.84	0.43
Reach-1	44778	134	957.51	958.77	0.16	958.97	0.003377	3.59	37.3	48.97	0.73
Reach-1	44818	8721	957.37	971.91	0.48	973.37	0.000715	9.74	932.96	79.5	0.49
Reach-1	44818	7239	957.37	970.73	0.42	971.96	0.000675	8.94	839.58	79.5	0.47
Reach-1	44818	4375	957.37	966.92	0.4	967.97	0.000928	8.22	537.28	77.8	0.53
Reach-1	44818	3336	957.37	966.2	0.3	966.95	0.000751	6.95	481.64	75.1	0.47
Reach-1	44818	2047	957.37	964.52	0.21	965.02	0.000658	5.64	362.95	67.55	0.43
Reach-1	44818	1761	957.37	964.01	0.19	964.46	0.000651	5.35	328.91	65.92	0.42
Reach-1	44818	1670	957.37	963.85	0.19	964.28	0.000648	5.25	317.95	65.38	0.42
Reach-1	44818	1612	957.37	963.74	0.18	964.16	0.000643	5.18	311.19	65.05	0.42
Reach-1	44818	1422	957.37	963.38	0.17	963.76	0.000634	4.95	287.45	63.87	0.41
Reach-1	44818	976	957.37	962.36	0.14	962.65	0.000632	4.36	224.04	60.61	0.4
Reach-1	44818	460	957.37	960.47	0.14	960.72	0.001081	3.98	115.52	54.49	0.48
Reach-1	44818	134	957.37	958.91	0.13	959.08	0.002009	3.33	40.2	39.9	0.59
Reach-1	44863	8721	957.3	971.89	0.52	973.43	0.000781	10.02	930.91	100.45	0.5
Reach-1	44863	7239	957.3	970.73	0.44	972.02	0.000729	9.17	825.23	80.95	0.48
Reach-1	44863	4375	957.3	966.95	0.41	968.02	0.000954	8.31	531.05	74.92	0.53
Reach-1	44863	3336	957.3	966.21	0.3	966.98	0.000764	7.01	477.02	71.24	0.47
Reach-1	44863	2047	957.3	964.57	0.2	965.05	0.000631	5.58	366.77	64.44	0.41
Reach-1	44863	1761	957.3	964.06	0.19	964.49	0.000616	5.27	334.46	63.31	0.4
Reach-1	44863	1670	957.3	963.89	0.18	964.31	0.00061	5.15	324	62.94	0.4
Reach-1	44863	1612	957.3	963.79	0.17	964.19	0.000604	5.08	317.5	62.71	0.4
Reach-1	44863	1422	957.3	963.42	0.16	963.79	0.000589	4.83	294.67	61.88	0.39
Reach-1	44863	976	957.3	962.41	0.13	962.68	0.000568	4.19	233	59.63	0.37
Reach-1	44863	460	957.3	960.56	0.12	960.76	0.000875	3.66	125.83	56.08	0.43
Reach-1	44863	134	957.3	959.03	0.12	959.19	0.002456	3.14	42.7	53.16	0.62

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Reach-1	44918	8721	957.23	972.17	0.44	973.5	0.000626	9.28	979.58	80.8	0.45
Reach-1	44918	7239	957.23	970.96	0.38	972.07	0.000589	8.51	881.53	80.8	0.44
Reach-1	44918	4375	957.23	967.19	0.34	968.09	0.000741	7.61	579.16	77.25	0.47
Reach-1	44918	3336	957.23	966.38	0.25	967.03	0.000606	6.46	517.59	74.78	0.42
Reach-1	44918	2047	957.23	964.67	0.17	965.09	0.000495	5.15	397.57	67.01	0.37
Reach-1	44918	1761	957.23	964.16	0.15	964.53	0.000475	4.84	363.65	65.26	0.36
Reach-1	44918	1670	957.23	963.99	0.15	964.34	0.000467	4.73	352.71	64.77	0.36
Reach-1	44918	1612	957.23	963.89	0.14	964.23	0.000462	4.66	345.91	64.51	0.35
Reach-1	44918	1422	957.23	963.52	0.13	963.82	0.000445	4.42	322.08	63.57	0.35
Reach-1	44918	976	957.23	962.49	0.1	962.71	0.00041	3.78	258.19	60.99	0.32
Reach-1	44918	460	957.23	960.65	0.08	960.8	0.000488	3.06	150.21	56.62	0.33
Reach-1	44918	134	957.23	959.18	0.04	959.24	0.000465	1.92	69.9	52.24	0.29
Reach-1	44963	8721	957.43	972.17	0.45	973.53	0.000689	9.36	944.98	83.57	0.47
Reach-1	44963	7239	957.43	970.95	0.4	972.11	0.000661	8.63	846.18	80.17	0.46
Reach-1	44963	4375	957.43	967.17	0.38	968.15	0.000928	7.96	549.88	76.25	0.52
Reach-1	44963	3336	957.43	966.36	0.29	967.08	0.000766	6.83	488.71	74.33	0.47
Reach-1	44963	2047	957.43	964.65	0.2	965.13	0.000636	5.55	368.59	66.8	0.42
Reach-1	44963	1761	957.43	964.14	0.19	964.57	0.000624	5.26	334.79	65.1	0.41
Reach-1	44963	1670	957.43	963.97	0.18	964.39	0.000619	5.16	323.9	64.55	0.41
Reach-1	44963	1612	957.43	963.87	0.18	964.27	0.000614	5.08	317.14	64.2	0.4
Reach-1	44963	1422	957.43	963.5	0.16	963.86	0.0006	4.84	293.54	62.97	0.4
Reach-1	44963	976	957.43	962.47	0.13	962.75	0.000579	4.23	230.85	59.5	0.38
Reach-1	44963	460	957.43	960.64	0.11	960.84	0.000771	3.58	128.32	53.43	0.41
Reach-1	44963	134	957.43	959.18	0.08	959.28	0.001218	2.58	51.91	51.05	0.45
Reach-1	45013	8721	956.32	972.5	0.36	973.58	0.000511	8.37	1059.93	87.43	0.41
Reach-1	45013	7239	956.32	971.25	0.31	972.16	0.000484	7.69	951.74	85.41	0.39
Reach-1	45013	4375	956.32	967.49	0.27	968.21	0.000595	6.81	642.72	79.37	0.42
Reach-1	45013	3336	956.32	966.6	0.2	967.13	0.000496	5.83	572.17	78.8	0.38
Reach-1	45013	2047	956.32	964.83	0.14	965.17	0.000389	4.67	438.76	71.05	0.33
Reach-1	45013	1761	956.32	964.31	0.12	964.61	0.000378	4.38	401.75	70.3	0.32
Reach-1	45013	1670	956.32	964.14	0.12	964.42	0.000373	4.29	389.66	70.05	0.32
Reach-1	45013	1612	956.32	964.03	0.12	964.31	0.000369	4.22	382.08	69.9	0.32
Reach-1	45013	1422	956.32	963.65	0.11	963.9	0.000359	4	355.51	69.35	0.31
Reach-1	45013	976	956.32	962.6	0.08	962.78	0.000327	3.44	283.99	65.38	0.29
Reach-1	45013	460	956.32	960.77	0.06	960.88	0.000316	2.66	173.03	58.1	0.27
Reach-1	45013	134	956.32	959.28	0.02	959.31	0.000211	1.5	89.42	53.41	0.2
Reach-1	45073	8721	956.84	972.34	0.46	973.71	0.000697	9.4	943.66	84.3	0.48
Reach-1	45073	7239	956.84	971.1	0.41	972.28	0.00068	8.72	840.27	82.77	0.47
Reach-1	45073	4375	956.84	967.33	0.4	968.36	0.001002	8.15	536.76	78.1	0.55
Reach-1	45073	3336	956.84	966.47	0.32	967.25	0.000879	7.1	470.02	76.64	0.51
Reach-1	45073	2047	956.84	964.72	0.24	965.27	0.00082	5.98	342.35	69.25	0.47
Reach-1	45073	1761	956.84	964.19	0.23	964.71	0.000831	5.74	306.85	66.87	0.47
Reach-1	45073	1670	956.84	964.02	0.22	964.52	0.000831	5.65	295.49	65.96	0.47
Reach-1	45073	1612	956.84	963.92	0.22	964.4	0.000829	5.59	288.46	65.38	0.47
Reach-1	45073	1422	956.84	963.54	0.21	963.99	0.000826	5.38	264.19	63.35	0.46
Reach-1	45073	976	956.84	962.5	0.18	962.87	0.000843	4.85	201.41	57.78	0.46
Reach-1	45073	460	956.84	960.67	0.17	960.97	0.001272	4.4	104.47	47.91	0.53
Reach-1	45073	134	956.84	959.23	0.1	959.37	0.001366	3.08	43.56	36.27	0.49
Reach-1	45123	8721	957.45	972.47	0.43	973.75	0.000663	9.11	994.19	96.97	0.47
Reach-1	45123	7239	957.45	971.2	0.39	972.32	0.000658	8.49	872.16	95.45	0.46
Reach-1	45123	4375	957.45	967.42	0.39	968.41	0.000992	8	547.77	81.58	0.54

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Reach-1	45123	3336	957.45	966.52	0.31	967.29	0.000906	7.02	475.11	80.35	0.51
Reach-1	45123	2047	957.45	964.76	0.24	965.31	0.000847	5.97	342.61	69.94	0.48
Reach-1	45123	1761	957.45	964.24	0.23	964.75	0.00085	5.74	306.95	66.9	0.47
Reach-1	45123	1670	957.45	964.07	0.22	964.56	0.000849	5.65	295.59	65.9	0.47
Reach-1	45123	1612	957.45	963.96	0.22	964.44	0.000846	5.59	288.57	65.28	0.47
Reach-1	45123	1422	957.45	963.58	0.21	964.03	0.000849	5.38	264.29	63.51	0.46
Reach-1	45123	976	957.45	962.54	0.18	962.91	0.000893	4.86	200.91	58.79	0.46
Reach-1	45123	460	957.45	960.72	0.2	961.06	0.001842	4.66	98.68	53.98	0.61
Reach-1	45123	134	957.45	959.18	0.31	959.57	0.00611	5.03	26.64	32.53	0.98
Reach-1	45173	8721	955.31	972.4	0.47	973.83	0.000673	9.64	961.52	83.3	0.47
Reach-1	45173	7239	955.31	971.17	0.41	972.38	0.000634	8.86	858.85	83.3	0.45
Reach-1	45173	4375	955.31	967.52	0.35	968.45	0.000742	7.76	570.68	73.91	0.47
Reach-1	45173	3336	955.31	966.65	0.26	967.33	0.000611	6.61	507.47	71.98	0.43
Reach-1	45173	2047	955.31	964.93	0.17	965.36	0.000488	5.23	391.56	63.23	0.37
Reach-1	45173	1761	955.31	964.42	0.16	964.79	0.000464	4.9	359.49	61.86	0.36
Reach-1	45173	1670	955.31	964.25	0.15	964.61	0.000455	4.78	349.04	61.41	0.35
Reach-1	45173	1612	955.31	964.14	0.14	964.49	0.000448	4.71	342.49	61.12	0.35
Reach-1	45173	1422	955.31	963.77	0.13	964.07	0.000427	4.45	319.69	60.12	0.34
Reach-1	45173	976	955.31	962.73	0.1	962.95	0.000376	3.77	258.94	57.36	0.31
Reach-1	45173	460	955.31	960.99	0.06	961.11	0.000339	2.82	162.97	52.71	0.28
Reach-1	45173	134	955.31	959.59	0.02	959.62	0.000133	1.41	95.15	43.76	0.17
Reach-1	45223	8721	956.74	972.28	0.54	973.93	0.000726	10.39	929.71	88.3	0.51
Reach-1	45223	7239	956.74	971.07	0.47	972.47	0.000705	9.58	822.15	87.81	0.5
Reach-1	45223	4375	956.74	967.42	0.42	968.56	0.000926	8.54	520.61	75.34	0.53
Reach-1	45223	3336	956.74	966.59	0.32	967.41	0.000781	7.29	459.57	70.24	0.48
Reach-1	45223	2047	956.74	964.89	0.22	965.42	0.000648	5.83	351.06	59.87	0.42
Reach-1	45223	1761	956.74	964.38	0.2	964.85	0.000613	5.48	321.22	57.73	0.41
Reach-1	45223	1670	956.74	964.21	0.19	964.66	0.0006	5.36	311.6	57.02	0.4
Reach-1	45223	1612	956.74	964.11	0.18	964.54	0.00059	5.27	305.6	56.57	0.4
Reach-1	45223	1422	956.74	963.74	0.17	964.12	0.000558	4.99	284.88	55	0.39
Reach-1	45223	976	956.74	962.71	0.13	962.99	0.000484	4.23	230.69	51.57	0.35
Reach-1	45223	460	956.74	960.99	0.08	961.14	0.00041	3.14	146.33	45.86	0.31
Reach-1	45223	134	956.74	959.6	0.02	959.63	0.000173	1.56	85.91	41.02	0.19
Reach-1	45273	8721	956.99	973.72	0.15	974.07	0.000195	5.48	3379.42	553.28	0.27
Reach-1	45273	7239	956.99	972.19	0.16	972.59	0.000244	5.63	2551.23	527.22	0.3
Reach-1	45273	4375	956.99	967.92	0.28	968.64	0.000692	6.84	699.67	220.59	0.46
Reach-1	45273	3336	956.99	966.88	0.25	967.48	0.000712	6.2	538.81	100.56	0.46
Reach-1	45273	2047	956.99	965	0.19	965.46	0.000624	5.39	379.49	73.74	0.42
Reach-1	45273	1761	956.99	964.47	0.18	964.88	0.000632	5.17	340.66	71.39	0.42
Reach-1	45273	1670	956.99	964.29	0.18	964.69	0.000634	5.09	328.11	70.61	0.42
Reach-1	45273	1612	956.99	964.18	0.17	964.57	0.000634	5.03	320.26	70.12	0.42
Reach-1	45273	1422	956.99	963.79	0.17	964.16	0.00064	4.85	293.17	68.4	0.41
Reach-1	45273	976	956.99	962.73	0.14	963.03	0.000657	4.37	223.38	62.41	0.41
Reach-1	45273	460	956.99	960.99	0.11	961.19	0.000703	3.64	126.3	48.94	0.4
Reach-1	45273	134	956.99	959.6	0.04	959.66	0.000409	2.05	65.24	40.04	0.28
Reach-1	45333	8721	956.78	973.34	0.31	974.26	0.000473	7.7	1132.41	89.7	0.38
Reach-1	45333	7239	956.78	971.92	0.28	972.73	0.000468	7.2	1005.42	89.7	0.38
Reach-1	45333	4375	956.78	967.99	0.27	968.69	0.000651	6.7	652.68	89.7	0.44
Reach-1	45333	3336	956.78	966.97	0.22	967.52	0.000609	5.94	561.19	89.7	0.42
Reach-1	45333	2047	956.78	965.11	0.16	965.5	0.000491	4.99	410.23	72.47	0.37
Reach-1	45333	1761	956.78	964.57	0.15	964.92	0.000482	4.74	371.45	69.92	0.36

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Reach-1	45333	1670	956.78	964.39	0.14	964.72	0.000478	4.65	358.95	69.07	0.36
Reach-1	45333	1612	956.78	964.29	0.14	964.61	0.000471	4.58	352.03	68.6	0.36
Reach-1	45333	1422	956.78	963.9	0.13	964.19	0.00046	4.37	325.58	67.1	0.35
Reach-1	45333	976	956.78	962.85	0.1	963.06	0.000386	3.74	260.76	59.67	0.32
Reach-1	45333	460	956.78	961.1	0.07	961.23	0.000367	2.85	161.29	54.56	0.29
Reach-1	45333	134	956.78	959.65	0.02	959.69	0.000244	1.59	84.18	51.49	0.22
Reach-1	45393	8721	957.68	973.36	0.31	974.29	0.000423	7.83	1192.46	98.7	0.38
Reach-1	45393	7239	957.68	971.94	0.28	972.76	0.000421	7.31	1052.83	98.7	0.38
Reach-1	45393	4375	957.68	968.02	0.27	968.73	0.000587	6.75	666.21	98.7	0.43
Reach-1	45393	3336	957.68	967.01	0.22	967.56	0.000537	5.95	565.89	97.4	0.4
Reach-1	45393	2047	957.68	965.15	0.16	965.53	0.000479	4.95	413.9	74.77	0.37
Reach-1	45393	1761	957.68	964.6	0.15	964.95	0.000475	4.71	373.6	72.26	0.37
Reach-1	45393	1670	957.68	964.42	0.14	964.75	0.000473	4.63	360.59	71.43	0.36
Reach-1	45393	1612	957.68	964.32	0.14	964.64	0.000467	4.56	353.36	70.96	0.36
Reach-1	45393	1422	957.68	963.93	0.13	964.22	0.00046	4.36	325.85	69.16	0.35
Reach-1	45393	976	957.68	962.86	0.11	963.09	0.000443	3.83	254.94	64.3	0.34
Reach-1	45393	460	957.68	961.11	0.08	961.26	0.000512	3.1	148.48	58.12	0.34
Reach-1	45393	134	957.68	959.65	0.04	959.71	0.000548	2.01	66.68	53.36	0.32
Reach-1	45433	8721	957.03	973.24	0.36	974.37	0.000436	8.6	1119.15	89.3	0.41
Reach-1	45433	7239	957.03	971.86	0.31	972.82	0.000427	7.94	995.62	89.3	0.39
Reach-1	45433	4375	957.03	968.01	0.27	968.77	0.000538	6.99	652.14	89.3	0.42
Reach-1	45433	3336	957.03	967.02	0.21	967.59	0.00047	6.03	563.97	89.3	0.38
Reach-1	45433	2047	957.03	965.19	0.15	965.55	0.000411	4.84	422.81	68.77	0.34
Reach-1	45433	1761	957.03	964.64	0.13	964.96	0.000398	4.57	385.37	66.94	0.34
Reach-1	45433	1670	957.03	964.45	0.13	964.76	0.000393	4.47	373.22	66.34	0.33
Reach-1	45433	1612	957.03	964.36	0.13	964.66	0.000385	4.39	366.94	66.02	0.33
Reach-1	45433	1422	957.03	963.97	0.12	964.24	0.00037	4.17	341.31	64.72	0.32
Reach-1	45433	976	957.03	962.91	0.09	963.11	0.000331	3.55	275.09	61.36	0.3
Reach-1	45433	460	957.03	961.17	0.06	961.28	0.000305	2.67	172.42	56.45	0.27
Reach-1	45433	134	957.03	959.7	0.02	959.73	0.000189	1.46	91.94	52.86	0.19
Reach-1	45488	8721	956.96	973.66	0.25	974.43	0.000333	7.05	1298.48	104.3	0.34
Reach-1	45488	7239	956.96	972.2	0.22	972.87	0.000333	6.59	1146.41	104.3	0.34
Reach-1	45488	4375	956.96	968.25	0.21	968.81	0.000452	6.01	734.23	104.3	0.38
Reach-1	45488	3336	956.96	967.19	0.17	967.63	0.000417	5.3	629.31	91.59	0.36
Reach-1	45488	2047	956.96	965.27	0.13	965.58	0.000385	4.44	461.51	83.15	0.33
Reach-1	45488	1761	956.96	964.71	0.12	964.99	0.000388	4.24	415.11	80.53	0.33
Reach-1	45488	1670	956.96	964.52	0.12	964.79	0.000388	4.17	400.1	79.66	0.33
Reach-1	45488	1612	956.96	964.41	0.11	964.67	0.000386	4.12	391.56	79.16	0.33
Reach-1	45488	1422	956.96	964.01	0.11	964.25	0.000383	3.95	360.4	77.31	0.32
Reach-1	45488	976	956.96	962.95	0.09	963.14	0.000377	3.47	280.87	72.39	0.31
Reach-1	45488	460	956.96	961.18	0.07	961.31	0.000466	2.88	159.82	64.63	0.32
Reach-1	45488	134	956.96	959.69	0.04	959.75	0.000597	1.97	67.93	59.08	0.32
Reach-1	45528	8721	957.51	973.5	0.32	974.52	0.000411	8.17	1188.37	100.4	0.39
Reach-1	45528	7239	957.51	972.07	0.29	972.95	0.000413	7.61	1044.39	100.4	0.38
Reach-1	45528	4375	957.51	968.15	0.27	968.89	0.000563	6.87	652.28	98.04	0.42
Reach-1	45528	3336	957.51	967.12	0.22	967.68	0.000511	5.99	556.81	78.92	0.39
Reach-1	45528	2047	957.51	965.24	0.16	965.62	0.000468	4.92	415.88	72.74	0.36
Reach-1	45528	1761	957.51	964.68	0.15	965.02	0.000474	4.69	375.42	71.55	0.36
Reach-1	45528	1670	957.51	964.49	0.14	964.82	0.000476	4.61	362.18	71.16	0.36
Reach-1	45528	1612	957.51	964.39	0.14	964.71	0.000473	4.55	354.63	70.93	0.36
Reach-1	45528	1422	957.51	963.99	0.13	964.29	0.000473	4.35	326.81	70.09	0.36

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Reach-1	45528	976	957.51	962.94	0.11	963.17	0.000487	3.84	254.04	67.85	0.35
Reach-1	45528	460	957.51	961.18	0.09	961.35	0.000689	3.3	139.53	61.73	0.39
Reach-1	45528	134	957.51	959.69	0.08	959.8	0.001266	2.59	51.74	52.67	0.46
Reach-1	45578	8721	957.74	973.43	0.37	974.58	0.000455	8.84	1203.02	108.5	0.41
Reach-1	45578	7239	957.74	972	0.34	973.01	0.000455	8.24	1048.47	108.05	0.41
Reach-1	45578	4375	957.74	968.11	0.31	968.95	0.000596	7.4	637.49	102.93	0.44
Reach-1	45578	3336	957.74	967.09	0.24	967.73	0.000525	6.41	538.3	89.46	0.4
Reach-1	45578	2047	957.74	965.24	0.17	965.65	0.00047	5.15	397.59	65.52	0.37
Reach-1	45578	1761	957.74	964.68	0.15	965.05	0.000468	4.87	361.62	64.27	0.36
Reach-1	45578	1670	957.74	964.5	0.15	964.85	0.000465	4.77	349.85	63.86	0.36
Reach-1	45578	1612	957.74	964.4	0.15	964.74	0.000459	4.7	343.15	63.62	0.36
Reach-1	45578	1422	957.74	964.01	0.13	964.32	0.000448	4.46	318.49	62.74	0.35
Reach-1	45578	976	957.74	962.96	0.1	963.19	0.000419	3.84	254.19	60.38	0.33
Reach-1	45578	460	957.74	961.24	0.07	961.38	0.000446	3	153.51	56.49	0.32
Reach-1	45578	134	957.74	959.78	0.03	959.83	0.000387	1.82	73.83	52.69	0.27
Reach-1	45608	8721	956.88	973.24	0.48	974.69	0.000579	10	1142.54	113.48	0.46
Reach-1	45608	7239	956.88	971.83	0.43	973.11	0.00058	9.34	984.57	110.79	0.46
Reach-1	45608	4375	956.88	967.95	0.4	969.04	0.000761	8.44	568.96	103.39	0.49
Reach-1	45608	3336	956.88	966.99	0.3	967.8	0.000652	7.26	472.21	84.24	0.45
Reach-1	45608	2047	956.88	965.19	0.2	965.7	0.000552	5.72	358.02	56.73	0.4
Reach-1	45608	1761	956.88	964.64	0.19	965.09	0.000539	5.38	327.62	55.22	0.39
Reach-1	45608	1670	956.88	964.46	0.18	964.89	0.000532	5.26	317.7	54.86	0.38
Reach-1	45608	1612	956.88	964.36	0.17	964.77	0.000523	5.17	312.06	54.68	0.38
Reach-1	45608	1422	956.88	963.98	0.16	964.35	0.0005	4.88	291.25	54	0.37
Reach-1	45608	976	956.88	962.95	0.12	963.21	0.000441	4.12	236.67	52.19	0.34
Reach-1	45608	460	956.88	961.25	0.07	961.39	0.000368	3.03	151.89	47.31	0.3
Reach-1	45608	134	956.88	959.8	0.02	959.84	0.00018	1.56	86.07	43.43	0.19
Reach-1	45668	8721	957.32	974.71	0.06	974.83	0.000074	3.6	5617.52	707.2	0.17
Reach-1	45668	7239	957.32	973.09	0.07	973.23	0.00009	3.65	4486.51	689.46	0.18
Reach-1	45668	4375	957.32	968.87	0.11	969.15	0.000237	4.47	1733.52	615.36	0.28
Reach-1	45668	3336	957.32	967.56	0.12	967.87	0.000305	4.51	948.67	568.75	0.31
Reach-1	45668	2047	957.32	965.5	0.11	965.75	0.000351	4.03	507.78	99.85	0.32
Reach-1	45668	1761	957.32	964.9	0.1	965.14	0.000369	3.92	449.71	95.92	0.32
Reach-1	45668	1670	957.32	964.71	0.1	964.94	0.000375	3.87	431	94.62	0.32
Reach-1	45668	1612	957.32	964.59	0.1	964.82	0.000376	3.84	420.23	93.86	0.32
Reach-1	45668	1422	957.32	964.17	0.1	964.39	0.000387	3.73	381.59	91.1	0.32
Reach-1	45668	976	957.32	963.07	0.09	963.25	0.000432	3.43	284.64	83.75	0.33
Reach-1	45668	460	957.32	961.27	0.08	961.42	0.000593	3.11	148.03	64.21	0.36
Reach-1	45668	134	957.32	959.81	0.03	959.87	0.000334	1.89	70.83	42.06	0.26
Reach-1	45708	8721	957.53	973.83	0.49	975.23	0.000695	9.92	1151	107.3	0.46
Reach-1	45708	7239	957.53	972.32	0.45	973.59	0.000694	9.36	988.77	107.3	0.45
Reach-1	45708	4375	957.53	968.27	0.43	969.43	0.000898	8.69	554.41	107.3	0.51
Reach-1	45708	3336	957.53	967.18	0.34	968.07	0.000794	7.6	443.58	67.63	0.47
Reach-1	45708	2047	957.53	965.29	0.23	965.87	0.000668	6.07	337.26	53.19	0.42
Reach-1	45708	1761	957.53	964.73	0.21	965.24	0.000651	5.72	307.67	52.66	0.42
Reach-1	45708	1670	957.53	964.55	0.21	965.04	0.000646	5.61	297.92	52.49	0.41
Reach-1	45708	1612	957.53	964.44	0.2	964.91	0.000637	5.51	292.32	52.39	0.41
Reach-1	45708	1422	957.53	964.05	0.18	964.47	0.000619	5.23	271.74	52.02	0.4
Reach-1	45708	976	957.53	962.99	0.14	963.31	0.000577	4.49	217.46	51.03	0.38
Reach-1	45708	460	957.53	961.27	0.1	961.46	0.000629	3.52	130.79	49.41	0.38
Reach-1	45708	134	957.53	959.82	0.04	959.89	0.00042	2.06	65.11	40.96	0.29

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Reach-1	45758	8721	956.61	974.06	0.39	975.28	0.000536	8.9	1029	80.05	0.41
Reach-1	45758	7239	956.61	972.6	0.35	973.64	0.000516	8.23	913.85	77.13	0.4
Reach-1	45758	4375	956.61	968.73	0.28	969.51	0.000571	7.09	626.05	71.98	0.41
Reach-1	45758	3336	956.61	967.55	0.23	968.14	0.000513	6.2	541.97	70.64	0.38
Reach-1	45758	2047	956.61	965.51	0.17	965.91	0.000486	5.09	402.31	65.82	0.36
Reach-1	45758	1761	956.61	964.92	0.15	965.29	0.00048	4.83	364.23	63.94	0.36
Reach-1	45758	1670	956.61	964.73	0.15	965.08	0.000478	4.75	351.88	63.32	0.35
Reach-1	45758	1612	956.61	964.62	0.15	964.96	0.000473	4.68	344.72	62.96	0.35
Reach-1	45758	1422	956.61	964.2	0.13	964.51	0.000461	4.46	318.99	61.64	0.35
Reach-1	45758	976	956.61	963.11	0.11	963.34	0.000435	3.85	253.24	58.74	0.33
Reach-1	45758	460	956.61	961.35	0.07	961.49	0.000417	2.97	154.67	52.81	0.31
Reach-1	45758	134	956.61	959.86	0.03	959.91	0.000242	1.66	80.53	45.65	0.22
Reach-1	45813	8721	957.03	974.1	0.38	975.31	0.00046	8.88	1079.26	88.29	0.41
Reach-1	45813	7239	957.03	972.63	0.34	973.67	0.000456	8.23	951.67	84.82	0.4
Reach-1	45813	4375	957.03	968.75	0.28	969.54	0.000549	7.14	637.55	78.01	0.42
Reach-1	45813	3336	957.03	967.56	0.23	968.17	0.000509	6.27	545.92	76.4	0.39
Reach-1	45813	2047	957.03	965.53	0.17	965.94	0.000478	5.17	397.36	65.68	0.37
Reach-1	45813	1761	957.03	964.94	0.16	965.31	0.000463	4.9	359.79	62.7	0.36
Reach-1	45813	1670	957.03	964.75	0.15	965.11	0.000457	4.81	347.74	61.72	0.35
Reach-1	45813	1612	957.03	964.63	0.15	964.98	0.00045	4.73	340.8	61.14	0.35
Reach-1	45813	1422	957.03	964.22	0.13	964.54	0.000431	4.5	316.05	59.05	0.34
Reach-1	45813	976	957.03	963.13	0.1	963.36	0.000397	3.86	253.15	56.73	0.32
Reach-1	45813	460	957.03	961.38	0.07	961.51	0.000394	2.94	156.38	53.67	0.3
Reach-1	45813	134	957.03	959.88	0.03	959.93	0.000265	1.69	79.16	47.05	0.23
Reach-1	45826	8721	957.95	975.01	0.16	975.4	0.000197	5.82	3259.77	570.98	0.28
Reach-1	45826	7239	957.95	973.2	0.2	973.73	0.000285	6.37	2005.5	439.24	0.33
Reach-1	45826	4375	957.95	968.81	0.29	969.55	0.000654	7.06	829.51	266.52	0.46
Reach-1	45826	3336	957.95	967.5	0.29	968.21	0.000795	6.83	546.2	210.96	0.49
Reach-1	45826	2047	957.95	965.37	0.3	966.02	0.001139	6.49	315.37	73.68	0.55
Reach-1	45826	1761	957.95	964.76	0.3	965.41	0.001227	6.47	272.22	67.57	0.57
Reach-1	45826	1670	957.95	964.56	0.3	965.2	0.001254	6.45	258.84	65.56	0.57
Reach-1	45826	1612	957.95	964.44	0.3	965.08	0.001259	6.41	251.35	64.41	0.57
Reach-1	45826	1422	957.95	964.02	0.29	964.64	0.001294	6.32	225.06	60.19	0.58
Reach-1	45826	976	957.95	962.93	0.27	963.47	0.001315	5.91	165.23	49.42	0.57
Reach-1	45826	460	957.95	961.2	0.23	961.61	0.001582	5.13	89.62	38.17	0.59
Reach-1	45826	134	957.95	959.82	0.1	959.97	0.00107	3.11	43.06	29.16	0.45
Reach-1	45853	8721	957.98	974.51	0.36	975.63	0.000479	8.53	1062.55	87.12	0.4
Reach-1	45853	7239	957.98	972.89	0.33	973.88	0.000486	8.02	925.7	81.57	0.4
Reach-1	45853	4375	957.98	968.77	0.3	969.59	0.000634	7.25	605.12	74.78	0.44
Reach-1	45853	3336	957.98	967.59	0.25	968.24	0.000601	6.44	517.94	72.95	0.42
Reach-1	45853	2047	957.98	965.61	0.19	966.07	0.000603	5.45	375.76	69.52	0.41
Reach-1	45853	1761	957.98	965.03	0.18	965.46	0.000612	5.23	336.58	67.04	0.41
Reach-1	45853	1670	957.98	964.84	0.18	965.25	0.000614	5.16	323.9	66.21	0.41
Reach-1	45853	1612	957.98	964.73	0.18	965.13	0.000612	5.09	316.47	65.73	0.41
Reach-1	45853	1422	957.98	964.32	0.17	964.69	0.000613	4.9	289.95	63.95	0.41
Reach-1	45853	976	957.98	963.22	0.14	963.52	0.000624	4.39	222.47	59.11	0.4
Reach-1	45853	460	957.98	961.45	0.11	961.66	0.000683	3.6	127.83	49.4	0.39
Reach-1	45853	134	957.98	959.91	0.06	960	0.000803	2.42	55.31	44.4	0.38
Reach-1	45861	8721	957.8	975.01	0.25	975.68	0.000359	7.11	2326.89	487.77	0.32
Reach-1	45861	7239	957.8	973.08	0.29	973.9	0.000461	7.51	1453.09	383.88	0.37

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Reach-1	45861	4375	957.8	968.8	0.3	969.6	0.000625	7.18	609.32	69.05	0.43
Reach-1	45861	3336	957.8	967.63	0.24	968.25	0.000561	6.31	528.56	69	0.4
Reach-1	45861	2047	957.8	965.65	0.18	966.08	0.00053	5.22	392.42	68.6	0.38
Reach-1	45861	1761	957.8	965.08	0.16	965.47	0.000536	4.98	353.56	67.35	0.38
Reach-1	45861	1670	957.8	964.89	0.16	965.26	0.000538	4.9	340.79	66.94	0.38
Reach-1	45861	1612	957.8	964.78	0.16	965.14	0.000536	4.84	333.23	66.69	0.38
Reach-1	45861	1422	957.8	964.37	0.15	964.7	0.00054	4.65	306.07	65.8	0.38
Reach-1	45861	976	957.8	963.26	0.13	963.53	0.000572	4.16	234.76	63.38	0.38
Reach-1	45861	460	957.8	961.45	0.12	961.66	0.000846	3.68	124.99	55.53	0.43
Reach-1	45861	134	957.8	959.89	0.09	960.02	0.001319	2.83	47.41	44	0.48
Reach-1	45890 Bridge										
Reach-1	45915	8721	957.8	975.17	0.24	975.8	0.000341	6.97	2403.63	490.99	0.32
Reach-1	45915	7239	957.8	973.12	0.29	973.94	0.000456	7.47	1469.24	387.67	0.36
Reach-1	45915	4375	957.8	968.85	0.29	969.64	0.000614	7.14	612.78	69.06	0.42
Reach-1	45915	3336	957.8	967.66	0.24	968.28	0.000553	6.28	531.09	69	0.4
Reach-1	45915	2047	957.8	965.69	0.17	966.11	0.00052	5.19	394.76	68.68	0.38
Reach-1	45915	1761	957.8	965.12	0.16	965.5	0.000525	4.95	355.87	67.43	0.38
Reach-1	45915	1670	957.8	964.93	0.16	965.29	0.000527	4.87	343.09	67.01	0.38
Reach-1	45915	1612	957.8	964.81	0.16	965.17	0.000525	4.8	335.51	66.77	0.38
Reach-1	45915	1422	957.8	964.4	0.15	964.73	0.000528	4.61	308.32	65.87	0.38
Reach-1	45915	976	957.8	963.3	0.12	963.56	0.000555	4.12	237.06	63.46	0.38
Reach-1	45915	460	957.8	961.51	0.11	961.71	0.000789	3.59	128	55.93	0.42
Reach-1	45915	134	957.8	959.97	0.07	960.08	0.001054	2.63	50.98	44.59	0.43
Reach-1	45918	8721	956.65	974.87	0.35	975.93	0.000494	8.29	1052.38	67.9	0.37
Reach-1	45918	7239	956.65	973.04	0.32	973.98	0.000491	7.8	927.93	67.9	0.37
Reach-1	45918	4375	956.65	968.95	0.26	969.65	0.000516	6.73	650.39	67.9	0.38
Reach-1	45918	3336	956.65	967.75	0.2	968.29	0.00045	5.86	569.32	67.9	0.36
Reach-1	45918	2047	956.65	965.77	0.14	966.11	0.000389	4.71	434.57	67.9	0.33
Reach-1	45918	1761	956.65	965.2	0.13	965.5	0.000386	4.45	395.75	67.9	0.32
Reach-1	45918	1670	956.65	965.01	0.12	965.3	0.000385	4.36	382.82	67.9	0.32
Reach-1	45918	1612	956.65	964.89	0.12	965.18	0.000382	4.3	375.07	67.9	0.32
Reach-1	45918	1422	956.65	964.48	0.11	964.74	0.000379	4.1	347.08	67.9	0.32
Reach-1	45918	976	956.65	963.37	0.09	963.57	0.000388	3.59	271.76	67.9	0.32
Reach-1	45918	460	956.65	961.58	0.07	961.72	0.000434	2.95	156.16	58.32	0.32
Reach-1	45918	134	956.65	960.04	0.03	960.09	0.000294	1.77	75.69	45.59	0.24
Reach-1	45951	8721	958.14	975.73	0.13	976.03	0.000147	5.28	3637.8	442.92	0.24
Reach-1	45951	7239	958.14	973.49	0.21	974.04	0.000266	6.52	2044.12	433.97	0.32
Reach-1	45951	4375	958.14	968.92	0.29	969.69	0.000576	7.17	772.92	302.92	0.44
Reach-1	45951	3336	958.14	967.68	0.26	968.34	0.000599	6.58	552.32	183.19	0.43
Reach-1	45951	2047	958.14	965.68	0.21	966.18	0.000657	5.64	363.04	68.41	0.43
Reach-1	45951	1761	958.14	965.11	0.2	965.57	0.000665	5.42	324.74	65.55	0.43
Reach-1	45951	1670	958.14	964.92	0.19	965.36	0.000667	5.35	312.39	64.6	0.43
Reach-1	45951	1612	958.14	964.81	0.19	965.24	0.000664	5.28	305.12	64.03	0.43
Reach-1	45951	1422	958.14	964.4	0.18	964.8	0.000663	5.09	279.36	61.99	0.42
Reach-1	45951	976	958.14	963.3	0.15	963.62	0.000663	4.55	214.48	56.52	0.41
Reach-1	45951	460	958.14	961.54	0.12	961.76	0.000764	3.75	122.51	48.39	0.42
Reach-1	45951	134	958.14	960.02	0.07	960.12	0.000885	2.53	53	43.07	0.4
Reach-1	45963	8721	956.47	975.52	0.22	976.13	0.000236	6.99	1992.07	143.1	0.3
Reach-1	45963	7239	956.47	973.39	0.25	974.09	0.000299	7.2	1380.54	143.1	0.33
Reach-1	45963	4375	956.47	969.14	0.22	969.71	0.000367	6.39	891.68	143.1	0.34

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Reach-1	45963	3336	956.47	967.92	0.17	968.37	0.00033	5.6	751.77	143.1	0.32
Reach-1	45963	2047	956.47	965.9	0.12	966.2	0.00029	4.5	537.8	116.64	0.29
Reach-1	45963	1761	956.47	965.32	0.11	965.59	0.00028	4.23	483.98	116.14	0.28
Reach-1	45963	1670	956.47	965.13	0.11	965.39	0.000277	4.14	466.12	115.97	0.28
Reach-1	45963	1612	956.47	965.01	0.1	965.26	0.000273	4.07	455.33	115.87	0.27
Reach-1	45963	1422	956.47	964.6	0.09	964.82	0.000261	3.85	417.18	112.96	0.27
Reach-1	45963	976	956.47	963.49	0.07	963.65	0.000222	3.22	324.25	100.22	0.24
Reach-1	45963	460	956.47	961.7	0.04	961.78	0.000165	2.26	204.72	72.86	0.2
Reach-1	45963	134	956.47	960.11	0.01	960.13	0.00007	1.1	122.19	50.45	0.12
Reach-1	46013	8721	957.35	975.36	0.27	976.21	0.00034	7.52	1282.9	90.1	0.33
Reach-1	46013	7239	957.35	973.34	0.26	974.13	0.000362	7.19	1101.36	90.1	0.34
Reach-1	46013	4375	957.35	969.12	0.23	969.75	0.000431	6.36	721.2	90.1	0.36
Reach-1	46013	3336	957.35	967.92	0.18	968.4	0.00039	5.58	612.36	90.1	0.34
Reach-1	46013	2047	957.35	965.9	0.13	966.22	0.000326	4.5	454.94	66.92	0.3
Reach-1	46013	1761	957.35	965.33	0.11	965.61	0.000305	4.22	417.3	64.13	0.29
Reach-1	46013	1670	957.35	965.14	0.11	965.4	0.000298	4.12	405.09	63.51	0.29
Reach-1	46013	1612	957.35	965.02	0.1	965.28	0.000293	4.05	397.77	63.14	0.28
Reach-1	46013	1422	957.35	964.61	0.09	964.84	0.000276	3.82	371.98	61.8	0.27
Reach-1	46013	976	957.35	963.5	0.07	963.66	0.00024	3.21	304.26	60.16	0.25
Reach-1	46013	460	957.35	961.7	0.04	961.79	0.000203	2.32	198.45	57.89	0.22
Reach-1	46013	134	957.35	960.11	0.01	960.14	0.00012	1.24	107.9	55.88	0.16
Reach-1	46016	8721	958.24	976.06	0.1	976.28	0.000108	4.58	4225.08	508.17	0.21
Reach-1	46016	7239	958.24	973.88	0.12	974.18	0.000161	5.02	2974.75	501.65	0.25
Reach-1	46016	4375	958.24	969.21	0.21	969.76	0.000429	6.06	956.67	324.95	0.38
Reach-1	46016	3336	958.24	967.91	0.2	968.41	0.000475	5.69	650.42	180.45	0.38
Reach-1	46016	2047	958.24	965.86	0.16	966.24	0.000524	4.99	410.28	78.91	0.39
Reach-1	46016	1761	958.24	965.27	0.16	965.63	0.000528	4.82	365.56	74.54	0.38
Reach-1	46016	1670	958.24	965.08	0.15	965.43	0.000528	4.75	351.27	73.09	0.38
Reach-1	46016	1612	958.24	964.96	0.15	965.31	0.000525	4.7	342.81	72.22	0.38
Reach-1	46016	1422	958.24	964.55	0.14	964.87	0.00052	4.54	313.42	69.1	0.38
Reach-1	46016	976	958.24	963.43	0.12	963.69	0.000518	4.06	240.48	62.73	0.37
Reach-1	46016	460	958.24	961.64	0.1	961.82	0.000657	3.42	134.52	54.82	0.38
Reach-1	46016	134	958.24	960.07	0.06	960.16	0.000796	2.4	55.87	45.41	0.38
Reach-1	46043	8721	958.25	975.69	0.23	976.45	0.000252	7.08	1438.27	103.3	0.31
Reach-1	46043	7239	958.25	973.61	0.22	974.31	0.000281	6.8	1223.07	103.3	0.32
Reach-1	46043	4375	958.25	969.19	0.21	969.78	0.000389	6.18	766.81	103.3	0.36
Reach-1	46043	3336	958.25	967.96	0.17	968.43	0.000369	5.47	639.47	103.3	0.34
Reach-1	46043	2047	958.25	965.95	0.13	966.26	0.00034	4.49	456.32	71.95	0.31
Reach-1	46043	1761	958.25	965.37	0.11	965.65	0.000327	4.24	415.69	69.59	0.31
Reach-1	46043	1670	958.25	965.18	0.11	965.45	0.000325	4.15	402.4	69.2	0.3
Reach-1	46043	1612	958.25	965.07	0.11	965.33	0.000322	4.09	394.38	68.96	0.3
Reach-1	46043	1422	958.25	964.65	0.1	964.89	0.000314	3.89	365.95	68.1	0.3
Reach-1	46043	976	958.25	963.53	0.08	963.71	0.000299	3.35	291	65.79	0.28
Reach-1	46043	460	958.25	961.73	0.06	961.84	0.00032	2.61	176.03	62.07	0.27
Reach-1	46043	134	958.25	960.13	0.03	960.18	0.000324	1.67	80.43	57.27	0.25
Reach-1	46093	8721	957.51	975.64	0.26	976.49	0.000286	7.59	1377.57	100.1	0.33
Reach-1	46093	7239	957.51	973.56	0.26	974.35	0.000316	7.28	1169.73	100.1	0.34
Reach-1	46093	4375	957.51	969.17	0.24	969.83	0.000423	6.56	730.14	100.1	0.37
Reach-1	46093	3336	957.51	967.94	0.19	968.46	0.000394	5.78	607.52	100.1	0.35
Reach-1	46093	2047	957.51	965.95	0.14	966.29	0.000361	4.67	438.49	67.24	0.32
Reach-1	46093	1761	957.51	965.37	0.12	965.68	0.000352	4.4	400.32	66.14	0.32

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Reach-1	46093	1670	957.51	965.18	0.12	965.47	0.000348	4.31	387.74	65.77	0.31
Reach-1	46093	1612	957.51	965.07	0.12	965.35	0.000345	4.24	380.14	65.55	0.31
Reach-1	46093	1422	957.51	964.66	0.11	964.91	0.000335	4.03	353.2	64.76	0.3
Reach-1	46093	976	957.51	963.54	0.08	963.72	0.000314	3.46	282.11	62.61	0.29
Reach-1	46093	460	957.51	961.75	0.06	961.86	0.000321	2.66	172.93	59.17	0.27
Reach-1	46093	134	957.51	960.15	0.03	960.19	0.00029	1.64	81.83	54.64	0.24
Reach-1	46138	8721	957.32	975.79	0.23	976.52	0.000239	7.03	1549.55	117.2	0.31
Reach-1	46138	7239	957.32	973.7	0.22	974.38	0.000269	6.79	1303.69	117.2	0.32
Reach-1	46138	4375	957.32	969.26	0.21	969.85	0.000381	6.26	783.23	117.2	0.36
Reach-1	46138	3336	957.32	968	0.18	968.48	0.000365	5.57	636.38	117.2	0.34
Reach-1	46138	2047	957.32	965.98	0.13	966.3	0.000341	4.55	451.59	75.34	0.32
Reach-1	46138	1761	957.32	965.39	0.12	965.68	0.000343	4.31	408.52	71.17	0.32
Reach-1	46138	1670	957.32	965.2	0.12	965.48	0.000342	4.23	395.02	69.92	0.31
Reach-1	46138	1612	957.32	965.09	0.11	965.36	0.000339	4.17	386.92	69.55	0.31
Reach-1	46138	1422	957.32	964.67	0.1	964.92	0.000331	3.97	358.33	68.22	0.31
Reach-1	46138	976	957.32	963.55	0.08	963.73	0.000313	3.44	283.59	64.62	0.29
Reach-1	46138	460	957.32	961.76	0.06	961.87	0.000312	2.66	173.21	58.84	0.27
Reach-1	46138	134	957.32	960.17	0.02	960.21	0.00024	1.58	84.58	51.73	0.22
Reach-1	46188	8721	957.08	975.68	0.28	976.58	0.000303	7.8	1369.53	101.3	0.34
Reach-1	46188	7239	957.08	973.6	0.27	974.44	0.000336	7.5	1158.61	101.3	0.35
Reach-1	46188	4375	957.08	969.2	0.25	969.91	0.000453	6.79	712.72	101.3	0.38
Reach-1	46188	3336	957.08	967.97	0.2	968.52	0.000423	5.99	587.97	101.3	0.36
Reach-1	46188	2047	957.08	965.97	0.14	966.33	0.000374	4.82	424.64	63.64	0.33
Reach-1	46188	1761	957.08	965.4	0.13	965.72	0.000361	4.53	388.42	62.49	0.32
Reach-1	46188	1670	957.08	965.21	0.13	965.51	0.000356	4.43	376.55	62.11	0.32
Reach-1	46188	1612	957.08	965.09	0.12	965.39	0.000352	4.36	369.38	61.88	0.31
Reach-1	46188	1422	957.08	964.68	0.11	964.94	0.000339	4.13	343.97	61.05	0.31
Reach-1	46188	976	957.08	963.55	0.09	963.75	0.000309	3.53	276.57	58.8	0.29
Reach-1	46188	460	957.08	961.77	0.05	961.88	0.000282	2.63	174.98	55.22	0.26
Reach-1	46188	134	957.08	960.18	0.02	960.22	0.000184	1.47	90.95	50.57	0.19
Reach-1	46233	8721	957.91	976.58	0.03	976.67	0.000029	2.48	4230.9	309.1	0.11
Reach-1	46233	7239	957.91	974.43	0.03	974.52	0.000033	2.41	3568.06	309.1	0.12
Reach-1	46233	4375	957.91	969.9	0.03	969.97	0.00005	2.25	2166.45	309.1	0.13
Reach-1	46233	3336	957.91	968.51	0.02	968.58	0.000052	2.05	1738.69	309.1	0.13
Reach-1	46233	2047	957.91	966.32	0.02	966.37	0.000061	1.78	1150.27	214.16	0.13
Reach-1	46233	1761	957.91	965.7	0.02	965.75	0.000064	1.72	1022.04	203.45	0.14
Reach-1	46233	1670	957.91	965.5	0.02	965.54	0.000065	1.7	980.74	200.62	0.14
Reach-1	46233	1612	957.91	965.37	0.02	965.42	0.000065	1.69	955.66	198.89	0.14
Reach-1	46233	1422	957.91	964.93	0.02	964.97	0.000067	1.64	868.73	192.74	0.14
Reach-1	46233	976	957.91	963.73	0.02	963.77	0.00007	1.5	648.74	170.84	0.14
Reach-1	46233	460	957.91	961.87	0.01	961.89	0.000086	1.27	363.43	144.39	0.14
Reach-1	46233	134	957.91	960.21	0.01	960.22	0.000139	0.95	140.73	123.85	0.16
Reach-1	46258	8721	957.81	976.25	0.19	976.81	0.00021	6.46	2009.72	181.5	0.29
Reach-1	46258	7239	957.81	974.1	0.2	974.67	0.000251	6.41	1619.22	181.5	0.31
Reach-1	46258	4375	957.81	969.52	0.23	970.15	0.000433	6.4	789.48	176.84	0.38
Reach-1	46258	3336	957.81	968.2	0.2	968.72	0.00044	5.8	590.18	124.47	0.37
Reach-1	46258	2047	957.81	966.11	0.15	966.47	0.000401	4.83	424.08	68.16	0.34
Reach-1	46258	1761	957.81	965.51	0.13	965.84	0.000394	4.58	384.23	66.03	0.33
Reach-1	46258	1670	957.81	965.32	0.13	965.63	0.000391	4.5	371.3	65.32	0.33
Reach-1	46258	1612	957.81	965.2	0.13	965.5	0.000387	4.43	363.48	64.89	0.33
Reach-1	46258	1422	957.81	964.77	0.12	965.05	0.000378	4.23	336.12	63.36	0.32

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Reach-1	46258	976	957.81	963.62	0.09	963.83	0.000358	3.68	265.32	59.66	0.31
Reach-1	46258	460	957.81	961.8	0.07	961.93	0.000372	2.86	160.89	55.5	0.3
Reach-1	46258	134	957.81	960.19	0.03	960.24	0.000357	1.8	74.64	51.03	0.26
Reach-1	46328	8721	957.73	976.16	0.23	976.88	0.000273	6.9	1401.68	96.7	0.31
Reach-1	46328	7239	957.73	974.05	0.22	974.72	0.000296	6.64	1197.83	96.7	0.32
Reach-1	46328	4375	957.73	969.63	0.2	970.19	0.00038	6.01	770.61	96.7	0.35
Reach-1	46328	3336	957.73	968.31	0.17	968.76	0.000365	5.37	643.14	96.7	0.33
Reach-1	46328	2047	957.73	966.19	0.13	966.5	0.000365	4.51	454.16	76.13	0.33
Reach-1	46328	1761	957.73	965.58	0.12	965.87	0.000359	4.3	409.28	72.71	0.32
Reach-1	46328	1670	957.73	965.38	0.12	965.66	0.000356	4.23	394.88	71.58	0.32
Reach-1	46328	1612	957.73	965.26	0.11	965.53	0.000352	4.17	386.18	70.89	0.32
Reach-1	46328	1422	957.73	964.83	0.11	965.08	0.000342	3.99	356.04	68.44	0.31
Reach-1	46328	976	957.73	963.66	0.08	963.85	0.000312	3.48	280.11	61.84	0.29
Reach-1	46328	460	957.73	961.85	0.05	961.95	0.000259	2.6	176.73	53.23	0.25
Reach-1	46328	134	957.73	960.22	0.02	960.26	0.000158	1.43	93.8	48.85	0.18
Reach-1	46373	8721	957.18	975.97	0.31	976.98	0.000333	8.26	1290.57	95.6	0.36
Reach-1	46373	7239	957.18	973.88	0.3	974.81	0.000367	7.93	1090.46	95.6	0.37
Reach-1	46373	4375	957.18	969.5	0.27	970.27	0.00048	7.11	671.72	95.6	0.4
Reach-1	46373	3336	957.18	968.22	0.22	968.82	0.000446	6.26	556.18	83.85	0.37
Reach-1	46373	2047	957.18	966.15	0.16	966.54	0.000397	5.05	405.47	59.08	0.34
Reach-1	46373	1761	957.18	965.56	0.14	965.91	0.00038	4.75	370.97	57.64	0.33
Reach-1	46373	1670	957.18	965.36	0.14	965.69	0.000373	4.64	359.73	57.17	0.33
Reach-1	46373	1612	957.18	965.24	0.13	965.56	0.000368	4.57	352.89	56.87	0.32
Reach-1	46373	1422	957.18	964.81	0.12	965.1	0.000351	4.32	328.91	55.84	0.31
Reach-1	46373	976	957.18	963.66	0.09	963.87	0.000308	3.67	266.21	53.04	0.29
Reach-1	46373	460	957.18	961.86	0.05	961.96	0.000244	2.64	174.39	48.66	0.25
Reach-1	46373	134	957.18	960.24	0.02	960.27	0.000119	1.35	99.02	44.74	0.16
Reach-1	46418	8721	956.82	975.88	0.35	977.04	0.000392	8.71	1121.69	88.36	0.39
Reach-1	46418	7239	956.82	973.79	0.34	974.87	0.000443	8.41	941.45	84.18	0.41
Reach-1	46418	4375	956.82	969.43	0.32	970.33	0.000618	7.63	593.53	75.44	0.45
Reach-1	46418	3336	956.82	968.17	0.27	968.88	0.0006	6.79	499.47	72.9	0.43
Reach-1	46418	2047	956.82	966.1	0.2	966.6	0.000582	5.67	360.8	59.85	0.41
Reach-1	46418	1761	956.82	965.51	0.19	965.96	0.000564	5.39	326.52	57.05	0.4
Reach-1	46418	1670	956.82	965.32	0.18	965.75	0.000556	5.29	315.53	56.12	0.39
Reach-1	46418	1612	956.82	965.2	0.18	965.62	0.000548	5.22	308.91	55.56	0.39
Reach-1	46418	1422	956.82	964.77	0.16	965.15	0.000528	4.99	285.25	53.48	0.38
Reach-1	46418	976	956.82	963.62	0.13	963.91	0.000476	4.31	226.63	49.26	0.35
Reach-1	46418	460	956.82	961.85	0.08	962	0.000384	3.18	144.73	42.86	0.3
Reach-1	46418	134	956.82	960.25	0.02	960.29	0.000183	1.66	80.76	37.1	0.2
Reach-1	46478	8721	957.27	976.61	0.19	977.13	0.000204	6.49	2837.78	415.87	0.29
Reach-1	46478	7239	957.27	974.23	0.25	974.93	0.000307	7.16	1859.64	404.85	0.34
Reach-1	46478	4375	957.27	969.54	0.3	970.38	0.000571	7.38	676.62	135.66	0.43
Reach-1	46478	3336	957.27	968.23	0.26	968.92	0.000576	6.68	521.51	100.45	0.42
Reach-1	46478	2047	957.27	966.14	0.2	966.63	0.000582	5.63	363.62	61.84	0.41
Reach-1	46478	1761	957.27	965.55	0.19	966	0.000576	5.37	327.73	59.51	0.4
Reach-1	46478	1670	957.27	965.35	0.18	965.79	0.000573	5.28	316.16	58.74	0.4
Reach-1	46478	1612	957.27	965.23	0.18	965.66	0.000569	5.21	309.15	58.27	0.4
Reach-1	46478	1422	957.27	964.8	0.17	965.19	0.000563	5.01	284.04	56.55	0.39
Reach-1	46478	976	957.27	963.64	0.14	963.95	0.000538	4.41	221.52	52.02	0.38
Reach-1	46478	460	957.27	961.85	0.09	962.03	0.000511	3.42	134.41	44.94	0.35
Reach-1	46478	134	957.27	960.25	0.03	960.31	0.000295	1.94	69.1	36.23	0.25

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Reach-1	46533	8721	957.25	976.19	0.36	977.34	0.000436	8.63	1053.18	78.73	0.38
Reach-1	46533	7239	957.25	974	0.34	975.06	0.000469	8.29	892.41	68.22	0.39
Reach-1	46533	4375	957.25	969.58	0.29	970.41	0.00055	7.29	602.21	63.57	0.41
Reach-1	46533	3336	957.25	968.31	0.24	968.94	0.000497	6.4	522.05	62.33	0.39
Reach-1	46533	2047	957.25	966.25	0.16	966.67	0.000431	5.16	396.35	59.46	0.35
Reach-1	46533	1761	957.25	965.66	0.15	966.03	0.000418	4.87	361.68	58.18	0.34
Reach-1	46533	1670	957.25	965.47	0.14	965.82	0.000413	4.77	350.34	57.75	0.34
Reach-1	46533	1612	957.25	965.35	0.14	965.69	0.000408	4.69	343.4	57.49	0.34
Reach-1	46533	1422	957.25	964.91	0.13	965.22	0.000397	4.47	318.4	56.53	0.33
Reach-1	46533	976	957.25	963.75	0.1	963.98	0.000366	3.84	254.24	54	0.31
Reach-1	46533	460	957.25	961.93	0.06	962.06	0.000337	2.88	159.55	50.04	0.28
Reach-1	46533	134	957.25	960.27	0.03	960.31	0.000243	1.67	80.1	45.37	0.22
Reach-1	46623	8721	957.24	976.88	0.18	977.42	0.000187	6.36	2560.39	444.31	0.28
Reach-1	46623	7239	957.24	974.62	0.18	975.15	0.000219	6.23	1851.06	246.61	0.29
Reach-1	46623	4375	957.24	969.83	0.23	970.47	0.000405	6.44	728.8	186	0.37
Reach-1	46623	3336	957.24	968.48	0.19	969	0.000396	5.75	591.82	82.28	0.36
Reach-1	46623	2047	957.24	966.37	0.14	966.71	0.000342	4.71	436.59	67.47	0.32
Reach-1	46623	1761	957.24	965.77	0.12	966.08	0.000336	4.45	396.94	65.37	0.31
Reach-1	46623	1670	957.24	965.57	0.12	965.87	0.000333	4.36	384.07	64.67	0.31
Reach-1	46623	1612	957.24	965.45	0.12	965.74	0.00033	4.29	376.18	64.24	0.31
Reach-1	46623	1422	957.24	965.01	0.11	965.27	0.000325	4.09	348.03	62.67	0.3
Reach-1	46623	976	957.24	963.82	0.09	964.01	0.000306	3.54	275.9	58.74	0.29
Reach-1	46623	460	957.24	961.98	0.05	962.09	0.000274	2.66	173.21	52.91	0.26
Reach-1	46623	134	957.24	960.29	0.02	960.33	0.000179	1.51	88.75	46.73	0.19
Reach-1	46663	8721	958.32	976.77	0.22	977.48	0.000228	6.98	1583.56	132.6	0.3
Reach-1	46663	7239	958.32	974.53	0.22	975.21	0.00026	6.78	1293.58	118.7	0.31
Reach-1	46663	4375	958.32	969.89	0.21	970.49	0.00037	6.24	768.69	109.56	0.35
Reach-1	46663	3336	958.32	968.54	0.18	969.01	0.000359	5.57	628.62	96.11	0.34
Reach-1	46663	2047	958.32	966.4	0.13	966.73	0.00035	4.6	445.44	74.18	0.32
Reach-1	46663	1761	958.32	965.8	0.12	966.09	0.000342	4.36	404.03	66.95	0.31
Reach-1	46663	1670	958.32	965.6	0.12	965.88	0.000338	4.27	390.75	66.25	0.31
Reach-1	46663	1612	958.32	965.47	0.11	965.75	0.000335	4.21	382.6	65.82	0.31
Reach-1	46663	1422	958.32	965.03	0.11	965.28	0.000327	4.02	353.59	64.26	0.3
Reach-1	46663	976	958.32	963.83	0.08	964.02	0.000308	3.49	279.34	60.19	0.29
Reach-1	46663	460	958.32	961.99	0.06	962.1	0.000309	2.68	171.65	56.7	0.27
Reach-1	46663	134	958.32	960.3	0.03	960.35	0.00029	1.69	79.48	51.16	0.24
Reach-1	46703	8721	958.88	976.82	0.21	977.49	0.000227	6.74	1941.22	464.94	0.3
Reach-1	46703	7239	958.88	974.52	0.22	975.22	0.000282	6.77	1231.86	195.63	0.32
Reach-1	46703	4375	958.88	969.9	0.22	970.51	0.000424	6.29	711.73	90.92	0.37
Reach-1	46703	3336	958.88	968.54	0.19	969.04	0.00043	5.67	591.79	84.7	0.36
Reach-1	46703	2047	958.88	966.39	0.15	966.75	0.000415	4.81	425.57	69.98	0.34
Reach-1	46703	1761	958.88	965.79	0.13	966.12	0.000394	4.58	384.9	65.55	0.33
Reach-1	46703	1670	958.88	965.59	0.13	965.91	0.000392	4.49	371.9	65.07	0.33
Reach-1	46703	1612	958.88	965.48	0.13	965.78	0.000388	4.42	364.6	64.81	0.33
Reach-1	46703	1422	958.88	965.03	0.12	965.31	0.000386	4.23	335.88	63.74	0.33
Reach-1	46703	976	958.88	963.84	0.1	964.05	0.000389	3.73	261.38	60.88	0.32
Reach-1	46703	460	958.88	961.99	0.07	962.13	0.000456	3.01	152.85	56.47	0.32
Reach-1	46703	134	958.88	960.3	0.05	960.38	0.000733	2.2	60.99	52.69	0.36
Reach-1	46748	8721	958.87	976.88	0.19	977.5	0.000204	6.4	1514.82	120.9	0.28
Reach-1	46748	7239	958.87	974.65	0.19	975.25	0.000235	6.22	1245.29	120.9	0.29

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Reach-1	46748	4375	958.87	970.04	0.18	970.54	0.000334	5.67	778.05	88.83	0.33
Reach-1	46748	3336	958.87	968.66	0.15	969.06	0.000331	5.08	658.23	85.26	0.32
Reach-1	46748	2047	958.87	966.5	0.11	966.78	0.000308	4.25	481.58	75.46	0.3
Reach-1	46748	1761	958.87	965.89	0.1	966.14	0.000291	4.03	436.97	71	0.29
Reach-1	46748	1670	958.87	965.68	0.1	965.93	0.000284	3.95	422.83	69.56	0.28
Reach-1	46748	1612	958.87	965.57	0.1	965.8	0.000281	3.89	414.86	69.35	0.28
Reach-1	46748	1422	958.87	965.12	0.09	965.33	0.000277	3.71	383.76	68.51	0.28
Reach-1	46748	976	958.87	963.91	0.07	964.07	0.000272	3.23	302.4	66.28	0.27
Reach-1	46748	460	958.87	962.05	0.05	962.15	0.000301	2.53	181.76	63.62	0.26
Reach-1	46748	134	958.87	960.36	0.03	960.4	0.000421	1.77	75.84	60.29	0.28
Reach-1	46798	8721	958.78	976.78	0.24	977.56	0.000254	7.16	1373	109.6	0.32
Reach-1	46798	7239	958.78	974.56	0.24	975.3	0.000296	6.99	1129.07	109.6	0.33
Reach-1	46798	4375	958.78	969.96	0.23	970.6	0.000439	6.45	691.91	85.4	0.38
Reach-1	46798	3336	958.78	968.6	0.2	969.12	0.000442	5.81	578.87	80.82	0.37
Reach-1	46798	2047	958.78	966.44	0.16	966.82	0.00046	4.95	413.72	70.87	0.36
Reach-1	46798	1761	958.78	965.84	0.15	966.19	0.000446	4.73	372.01	66.52	0.35
Reach-1	46798	1670	958.78	965.64	0.14	965.97	0.000439	4.65	358.81	65.08	0.35
Reach-1	46798	1612	958.78	965.52	0.14	965.85	0.000432	4.59	351.47	64.3	0.35
Reach-1	46798	1422	958.78	965.07	0.13	965.38	0.000435	4.4	322.84	63.37	0.34
Reach-1	46798	976	958.78	963.87	0.11	964.11	0.000458	3.93	248.28	60.87	0.34
Reach-1	46798	460	958.78	962.02	0.09	962.19	0.000625	3.31	139.03	57.02	0.37
Reach-1	46798	134	958.78	960.34	0.08	960.46	0.001269	2.74	48.84	45.92	0.47
Reach-1	46858	8721	957.65	977.39	0.09	977.63	0.000102	4.34	3930.75	621.28	0.2
Reach-1	46858	7239	957.65	975.1	0.1	975.37	0.000138	4.5	2716.19	440.73	0.22
Reach-1	46858	4375	957.65	970.25	0.15	970.65	0.000345	5.13	1059.1	285.83	0.33
Reach-1	46858	3336	957.65	968.78	0.16	969.16	0.000432	4.98	703.37	183.39	0.35
Reach-1	46858	2047	957.65	966.54	0.13	966.85	0.000338	4.52	453.37	68.63	0.31
Reach-1	46858	1761	957.65	965.93	0.12	966.21	0.000335	4.27	411.99	67.73	0.31
Reach-1	46858	1670	957.65	965.73	0.11	966	0.000334	4.19	398.37	67.43	0.3
Reach-1	46858	1612	957.65	965.61	0.11	965.88	0.00033	4.13	390.6	67.26	0.3
Reach-1	46858	1422	957.65	965.16	0.1	965.4	0.000329	3.95	360.39	66.59	0.3
Reach-1	46858	976	957.65	963.96	0.09	964.14	0.000335	3.47	281.11	64.8	0.29
Reach-1	46858	460	957.65	962.1	0.07	962.23	0.00041	2.81	163.7	61.83	0.3
Reach-1	46858	134	957.65	960.45	0.05	960.52	0.000677	2.08	64.44	56.87	0.34
Reach-1	46903	8721	959.01	976.76	0.36	977.91	0.0004	8.83	1199.52	87	0.39
Reach-1	46903	7239	959.01	974.54	0.36	975.63	0.000457	8.56	1006.14	87	0.4
Reach-1	46903	4375	959.01	969.88	0.35	970.85	0.000676	7.96	608.77	82.51	0.46
Reach-1	46903	3336	959.01	968.52	0.3	969.31	0.000679	7.18	497.27	80.78	0.45
Reach-1	46903	2047	959.01	966.39	0.23	966.95	0.000685	6.04	339.1	55.58	0.43
Reach-1	46903	1761	959.01	965.79	0.22	966.31	0.000687	5.75	306.43	54.6	0.43
Reach-1	46903	1670	959.01	965.6	0.21	966.09	0.000687	5.65	295.72	54.27	0.43
Reach-1	46903	1612	959.01	965.48	0.21	965.96	0.000682	5.56	289.68	54.09	0.42
Reach-1	46903	1422	959.01	965.04	0.2	965.49	0.000686	5.35	265.97	53.36	0.42
Reach-1	46903	976	959.01	963.86	0.17	964.22	0.000726	4.78	204.03	51.41	0.42
Reach-1	46903	460	959.01	962.04	0.14	962.29	0.00102	4.07	113.07	48.4	0.47
Reach-1	46903	134	959.01	960.42	0.16	960.62	0.003243	3.64	36.77	45.73	0.72
Reach-1	46948	8721	958.76	977.13	0.28	977.97	0.000296	7.87	1646.14	136	0.34
Reach-1	46948	7239	958.76	974.83	0.29	975.68	0.000355	7.8	1334.02	136	0.37
Reach-1	46948	4375	958.76	969.93	0.34	970.87	0.000637	7.88	673.25	132.55	0.46
Reach-1	46948	3336	958.76	968.54	0.31	969.34	0.000668	7.24	489.38	105.67	0.45
Reach-1	46948	2047	958.76	966.41	0.24	966.99	0.000702	6.11	336.56	61.39	0.44

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Reach-1	46948	1761	958.76	965.81	0.23	966.34	0.000724	5.85	301.25	57.22	0.44
Reach-1	46948	1670	958.76	965.61	0.22	966.13	0.000732	5.76	290.08	55.87	0.45
Reach-1	46948	1612	958.76	965.5	0.22	966	0.000728	5.68	283.83	55.59	0.44
Reach-1	46948	1422	958.76	965.06	0.21	965.53	0.00074	5.48	259.46	54.49	0.44
Reach-1	46948	976	958.76	963.88	0.18	964.26	0.000802	4.96	196.72	51.56	0.45
Reach-1	46948	460	958.76	962.07	0.15	962.35	0.000989	4.22	109.02	43.56	0.47
Reach-1	46948	134	958.76	960.59	0.08	960.72	0.001135	2.81	47.64	39.62	0.45
Reach-1	46988	8721	957.74	977.23	0.27	977.99	0.000275	7.81	1959.49	170.2	0.33
Reach-1	46988	7239	957.74	974.9	0.29	975.7	0.000337	7.85	1563.42	170.2	0.36
Reach-1	46988	4375	957.74	969.91	0.37	970.92	0.000643	8.25	724.6	163.87	0.46
Reach-1	46988	3336	957.74	968.52	0.33	969.39	0.000665	7.58	509.3	127.98	0.46
Reach-1	46988	2047	957.74	966.42	0.25	967.03	0.000668	6.29	329.6	62.5	0.44
Reach-1	46988	1761	957.74	965.83	0.23	966.38	0.000681	5.96	296.12	52.41	0.44
Reach-1	46988	1670	957.74	965.63	0.22	966.16	0.000683	5.85	285.79	51.92	0.43
Reach-1	46988	1612	957.74	965.52	0.22	966.04	0.000679	5.76	279.94	51.63	0.43
Reach-1	46988	1422	957.74	965.08	0.21	965.55	0.000689	5.53	257.25	50.52	0.43
Reach-1	46988	976	957.74	963.92	0.17	964.29	0.000679	4.87	200.61	47.64	0.42
Reach-1	46988	460	957.74	962.16	0.12	962.38	0.000701	3.82	120.48	43.23	0.4
Reach-1	46988	134	957.74	960.67	0.04	960.75	0.000417	2.18	61.5	35.1	0.29
Reach-1	47033	8721	957.26	977.8	0.09	978.04	0.000097	4.4	4022.8	658.62	0.2
Reach-1	47033	7239	957.26	975.48	0.1	975.76	0.000131	4.6	2728.64	458.41	0.22
Reach-1	47033	4375	957.26	970.64	0.14	971	0.00028	4.95	1144.32	259.91	0.3
Reach-1	47033	3336	957.26	969.12	0.14	969.47	0.000335	4.79	773.5	220.81	0.32
Reach-1	47033	2047	957.26	966.78	0.13	967.09	0.000474	4.44	460.84	98.24	0.36
Reach-1	47033	1761	957.26	966.13	0.13	966.43	0.000491	4.4	399.93	87.73	0.36
Reach-1	47033	1670	957.26	965.92	0.13	966.21	0.000485	4.38	381.39	83.52	0.36
Reach-1	47033	1612	957.26	965.79	0.13	966.08	0.000477	4.34	371.05	81.07	0.36
Reach-1	47033	1422	957.26	965.31	0.12	965.59	0.000447	4.25	334.62	71.79	0.35
Reach-1	47033	976	957.26	964.11	0.1	964.33	0.000353	3.75	260.13	56.3	0.31
Reach-1	47033	460	957.26	962.29	0.06	962.41	0.000306	2.81	163.8	49.85	0.27
Reach-1	47033	134	957.26	960.74	0.02	960.77	0.000157	1.48	90.53	44.33	0.18
Reach-1	47078	8721	958.43	977.7	0.14	978.1	0.000143	5.44	2329.82	184.7	0.24
Reach-1	47078	7239	958.43	975.4	0.14	975.8	0.000173	5.39	1905.62	184.7	0.26
Reach-1	47078	4375	958.43	970.6	0.16	971.04	0.000312	5.43	1019.75	184.7	0.32
Reach-1	47078	3336	958.43	969.09	0.16	969.5	0.000363	5.16	740.47	184.7	0.34
Reach-1	47078	2047	958.43	966.78	0.15	967.12	0.000475	4.71	434.73	83.89	0.36
Reach-1	47078	1761	958.43	966.13	0.14	966.46	0.000483	4.6	382.85	77.54	0.36
Reach-1	47078	1670	958.43	965.92	0.14	966.24	0.000485	4.56	366.41	75.42	0.36
Reach-1	47078	1612	958.43	965.79	0.14	966.11	0.000482	4.51	357.07	74.18	0.36
Reach-1	47078	1422	958.43	965.32	0.13	965.62	0.00048	4.4	322.94	69.49	0.36
Reach-1	47078	976	958.43	964.11	0.11	964.35	0.000436	3.97	245.94	57.52	0.34
Reach-1	47078	460	958.43	962.29	0.08	962.44	0.000432	3.09	148.65	50.94	0.32
Reach-1	47078	134	958.43	960.73	0.03	960.79	0.000342	1.84	72.7	46.36	0.26
Reach-1	47118	8721	958.08	977.64	0.17	978.13	0.000165	6.08	2197.35	169.6	0.26
Reach-1	47118	7239	958.08	975.34	0.17	975.82	0.000194	5.98	1807	169.6	0.28
Reach-1	47118	4375	958.08	970.57	0.18	971.06	0.000315	5.84	997.43	169.6	0.33
Reach-1	47118	3336	958.08	969.06	0.17	969.51	0.000343	5.45	743	169.6	0.33
Reach-1	47118	2047	958.08	966.78	0.14	967.13	0.000398	4.75	430.65	73.54	0.34
Reach-1	47118	1761	958.08	966.15	0.13	966.47	0.000405	4.56	385.86	69.35	0.34
Reach-1	47118	1670	958.08	965.94	0.13	966.25	0.000408	4.5	371.25	68.55	0.34
Reach-1	47118	1612	958.08	965.81	0.13	966.12	0.000406	4.44	362.81	68.08	0.34

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Reach-1	47118	1422	958.08	965.35	0.12	965.64	0.000409	4.28	331.93	66.34	0.34
Reach-1	47118	976	958.08	964.14	0.11	964.37	0.000422	3.84	254.22	61.74	0.33
Reach-1	47118	460	958.08	962.3	0.08	962.45	0.000489	3.13	146.94	54.76	0.34
Reach-1	47118	134	958.08	960.74	0.04	960.8	0.000494	2.03	66.11	48.23	0.31
Reach-1	47168	8721	957.95	977.51	0.23	978.2	0.000227	7.1	1828.37	141.9	0.3
Reach-1	47168	7239	957.95	975.22	0.23	975.89	0.000265	6.97	1502.7	141.9	0.32
Reach-1	47168	4375	957.95	970.47	0.24	971.13	0.000414	6.69	828.49	141.9	0.38
Reach-1	47168	3336	957.95	969	0.21	969.57	0.000432	6.14	624.41	126.23	0.37
Reach-1	47168	2047	957.95	966.75	0.17	967.18	0.00047	5.23	405.59	78.8	0.37
Reach-1	47168	1761	957.95	966.12	0.16	966.52	0.000476	5.02	356.61	76.78	0.37
Reach-1	47168	1670	957.95	965.91	0.16	966.29	0.000478	4.94	340.54	76.11	0.37
Reach-1	47168	1612	957.95	965.79	0.15	966.16	0.000473	4.87	331.6	69.59	0.36
Reach-1	47168	1422	957.95	965.34	0.14	965.68	0.000463	4.68	304.15	57.46	0.36
Reach-1	47168	976	957.95	964.14	0.12	964.4	0.000457	4.12	237.18	54.25	0.35
Reach-1	47168	460	957.95	962.31	0.08	962.47	0.000477	3.23	142.43	49.35	0.34
Reach-1	47168	134	957.95	960.76	0.04	960.82	0.00037	1.93	69.29	43.56	0.27
Reach-1	47213	8721	958.67	977.71	0.18	978.22	0.000188	6.22	2741.3	503.83	0.27
Reach-1	47213	7239	958.67	975.36	0.19	975.91	0.000242	6.34	1837.77	297.15	0.3
Reach-1	47213	4375	958.67	970.48	0.24	971.15	0.000475	6.62	746.02	160.31	0.39
Reach-1	47213	3336	958.67	969.01	0.22	969.6	0.000522	6.14	553.29	97.7	0.4
Reach-1	47213	2047	958.67	966.77	0.18	967.2	0.00051	5.31	385.7	64.71	0.38
Reach-1	47213	1761	958.67	966.14	0.17	966.54	0.000504	5.09	346.08	61.47	0.38
Reach-1	47213	1670	958.67	965.93	0.16	966.32	0.000502	5.01	333.29	60.38	0.38
Reach-1	47213	1612	958.67	965.81	0.16	966.19	0.000496	4.95	325.95	59.75	0.37
Reach-1	47213	1422	958.67	965.34	0.15	965.69	0.000492	4.76	298.66	57.7	0.37
Reach-1	47213	976	958.67	964.15	0.12	964.42	0.000482	4.2	232.18	53.69	0.36
Reach-1	47213	460	958.67	962.32	0.09	962.49	0.000485	3.29	139.69	47.55	0.34
Reach-1	47213	134	958.67	960.78	0.03	960.83	0.000333	1.9	70.55	42.04	0.26
Reach-1	47253	8721	958.4	977.65	0.2	978.26	0.000216	6.61	1864.67	150.8	0.29
Reach-1	47253	7239	958.4	975.33	0.21	975.94	0.000264	6.57	1514.05	150.8	0.32
Reach-1	47253	4375	958.4	970.5	0.25	971.17	0.000492	6.66	785.38	150.8	0.4
Reach-1	47253	3336	958.4	969.02	0.23	969.63	0.00054	6.26	570.54	127.11	0.41
Reach-1	47253	2047	958.4	966.77	0.19	967.24	0.000568	5.48	373.33	64.71	0.4
Reach-1	47253	1761	958.4	966.14	0.18	966.58	0.000561	5.27	333.95	60.76	0.4
Reach-1	47253	1670	958.4	965.93	0.18	966.35	0.000557	5.2	321.34	59.44	0.39
Reach-1	47253	1612	958.4	965.81	0.17	966.22	0.00055	5.13	314.12	58.68	0.39
Reach-1	47253	1422	958.4	965.34	0.16	965.72	0.000546	4.95	287.22	56.37	0.39
Reach-1	47253	976	958.4	964.16	0.13	964.45	0.000513	4.36	223.62	50.82	0.37
Reach-1	47253	460	958.4	962.33	0.09	962.51	0.000501	3.38	135.94	45.25	0.34
Reach-1	47253	134	958.4	960.8	0.03	960.85	0.000323	1.91	70.23	40.45	0.26
Reach-1	47323	8721	958.38	977.66	0.2	978.28	0.000222	6.62	1813.56	148.2	0.3
Reach-1	47323	7239	958.38	975.34	0.21	975.96	0.000274	6.6	1469.32	148.2	0.32
Reach-1	47323	4375	958.38	970.51	0.26	971.21	0.000531	6.76	753.88	148.2	0.41
Reach-1	47323	3336	958.38	969.04	0.25	969.67	0.000619	6.4	538.76	129.67	0.43
Reach-1	47323	2047	958.38	966.78	0.21	967.29	0.000621	5.68	360.67	63.56	0.42
Reach-1	47323	1761	958.38	966.16	0.2	966.62	0.000614	5.47	322.07	59.48	0.41
Reach-1	47323	1670	958.38	965.95	0.19	966.4	0.00061	5.39	309.73	58.12	0.41
Reach-1	47323	1612	958.38	965.83	0.19	966.27	0.000603	5.33	302.68	57.32	0.41
Reach-1	47323	1422	958.38	965.36	0.18	965.77	0.000591	5.14	276.53	54.36	0.4
Reach-1	47323	976	958.38	964.17	0.15	964.49	0.000568	4.54	214.88	49.75	0.39
Reach-1	47323	460	958.38	962.35	0.1	962.55	0.000572	3.56	129.3	44.18	0.37

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Reach-1	47323	134	958.38	960.82	0.04	960.88	0.000395	2.05	65.25	39.28	0.28
Reach-1	47383	8721	959.17	977.67	0.21	978.3	0.000219	6.78	2113.62	266.91	0.3
Reach-1	47383	7239	959.17	975.31	0.23	976	0.000281	6.91	1536.41	222.1	0.33
Reach-1	47383	4375	959.17	970.52	0.26	971.25	0.000495	6.91	692.99	129.69	0.41
Reach-1	47383	3336	959.17	969.09	0.23	969.71	0.000517	6.3	538.18	82.91	0.4
Reach-1	47383	2047	959.17	966.87	0.19	967.32	0.000557	5.42	377.37	66	0.4
Reach-1	47383	1761	959.17	966.24	0.18	966.66	0.000576	5.24	336.35	63.8	0.4
Reach-1	47383	1670	959.17	966.02	0.18	966.44	0.000584	5.17	322.87	63.08	0.4
Reach-1	47383	1612	959.17	965.9	0.18	966.3	0.000585	5.12	315.02	62.65	0.4
Reach-1	47383	1422	959.17	965.42	0.17	965.81	0.000608	4.98	285.49	61.02	0.41
Reach-1	47383	976	959.17	964.2	0.15	964.52	0.000679	4.57	213.51	56.85	0.42
Reach-1	47383	460	959.17	962.36	0.14	962.61	0.001001	4.01	114.78	50.57	0.47
Reach-1	47383	134	959.17	960.79	0.13	960.97	0.00234	3.38	39.61	43.23	0.62
Reach-1	47428	8721	960	977.52	0.26	978.38	0.000279	7.55	1330.98	105.9	0.33
Reach-1	47428	7239	960	975.22	0.26	976.06	0.000331	7.4	1087.51	105.9	0.35
Reach-1	47428	4375	960	970.53	0.27	971.27	0.00051	6.93	646.71	84.74	0.41
Reach-1	47428	3336	960	969.12	0.23	969.73	0.000528	6.29	533.64	75.3	0.4
Reach-1	47428	2047	960	966.89	0.19	967.35	0.000594	5.46	374.88	68.01	0.41
Reach-1	47428	1761	960	966.26	0.19	966.69	0.000629	5.3	332.41	66.22	0.42
Reach-1	47428	1670	960	966.04	0.19	966.47	0.000644	5.25	318.36	65.62	0.42
Reach-1	47428	1612	960	965.92	0.18	966.34	0.000649	5.2	310.16	65.26	0.42
Reach-1	47428	1422	960	965.44	0.18	965.84	0.000694	5.09	279.2	63.9	0.43
Reach-1	47428	976	960	964.22	0.18	964.57	0.000862	4.8	203.27	60.44	0.46
Reach-1	47428	460	960	962.34	0.22	962.71	0.002051	4.83	95.19	54.62	0.65
Reach-1	47428	134	960	961.09	0.27	961.4	0.007171	4.48	29.88	49.58	1.02
Reach-1	47468	8721	959.62	977.65	0.24	978.4	0.000252	7.27	1864.01	263.84	0.32
Reach-1	47468	7239	959.62	975.26	0.26	976.07	0.000325	7.4	1306.59	200.31	0.35
Reach-1	47468	4375	959.62	970.53	0.28	971.31	0.000523	7.1	647.26	93.75	0.42
Reach-1	47468	3336	959.62	969.13	0.24	969.77	0.000525	6.43	531.81	74.5	0.41
Reach-1	47468	2047	959.62	966.91	0.19	967.38	0.000557	5.5	374.51	67.1	0.4
Reach-1	47468	1761	959.62	966.28	0.19	966.71	0.000592	5.31	332.68	64.99	0.41
Reach-1	47468	1670	959.62	966.06	0.18	966.49	0.000607	5.25	318.86	64.28	0.41
Reach-1	47468	1612	959.62	965.94	0.18	966.35	0.000612	5.19	310.78	63.86	0.41
Reach-1	47468	1422	959.62	965.46	0.18	965.86	0.000654	5.06	281.06	62.29	0.42
Reach-1	47468	976	959.62	964.27	0.16	964.61	0.000762	4.68	208.7	58.81	0.44
Reach-1	47468	460	959.62	962.51	0.16	962.78	0.001224	4.19	109.86	52.93	0.51
Reach-1	47468	134	959.62	961.41	0.07	961.5	0.000934	2.47	54.33	47.7	0.41
Reach-1	47523	8721	959.77	977.75	0.21	978.42	0.000221	6.7	1516.12	120.1	0.3
Reach-1	47523	7239	959.77	975.44	0.21	976.1	0.000263	6.59	1188.88	120.1	0.31
Reach-1	47523	4375	959.77	970.77	0.21	971.36	0.000399	6.14	732.27	97.48	0.36
Reach-1	47523	3336	959.77	969.33	0.18	969.81	0.000406	5.58	606.08	83.78	0.36
Reach-1	47523	2047	959.77	967.05	0.15	967.42	0.000456	4.84	423.38	76.78	0.36
Reach-1	47523	1761	959.77	966.41	0.15	966.75	0.000497	4.7	374.62	74.8	0.37
Reach-1	47523	1670	959.77	966.19	0.15	966.53	0.000514	4.66	358.46	74.13	0.37
Reach-1	47523	1612	959.77	966.06	0.15	966.39	0.000521	4.62	348.93	73.77	0.37
Reach-1	47523	1422	959.77	965.58	0.14	965.9	0.000563	4.53	313.93	72.64	0.38
Reach-1	47523	976	959.77	964.37	0.14	964.66	0.000726	4.29	227.35	69.78	0.42
Reach-1	47523	460	959.77	962.57	0.18	962.87	0.001854	4.35	105.85	65.54	0.6
Reach-1	47523	134	959.77	961.42	0.18	961.63	0.004184	3.75	35.72	51.41	0.79
Reach-1	47563	8721	960.13	977.74	0.21	978.44	0.000221	6.79	1501.34	127	0.3

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Reach-1	47563	7239	960.13	975.43	0.22	976.12	0.000268	6.73	1131.71	127	0.32
Reach-1	47563	4375	960.13	970.77	0.22	971.38	0.000414	6.29	712.78	91.08	0.37
Reach-1	47563	3336	960.13	969.32	0.19	969.84	0.00044	5.75	586.7	86.12	0.37
Reach-1	47563	2047	960.13	967.04	0.17	967.45	0.000566	5.13	399.11	78.27	0.4
Reach-1	47563	1761	960.13	966.4	0.17	966.79	0.000616	5.04	349.52	75.16	0.41
Reach-1	47563	1670	960.13	966.18	0.17	966.57	0.000636	5.01	333.27	74.09	0.42
Reach-1	47563	1612	960.13	966.05	0.17	966.43	0.000645	4.98	323.75	73.46	0.42
Reach-1	47563	1422	960.13	965.57	0.17	965.95	0.000699	4.92	289.16	71.11	0.43
Reach-1	47563	976	960.13	964.36	0.17	964.71	0.000892	4.72	206.64	65.17	0.47
Reach-1	47563	460	960.13	962.64	0.19	962.95	0.001729	4.52	101.67	56.71	0.6
Reach-1	47563	134	960.13	961.63	0.1	961.75	0.001702	2.86	46.85	51.75	0.53
Reach-1	47566	8721	960.2	977.62	0.27	978.49	0.000302	7.57	1285.61	119.14	0.34
Reach-1	47566	7239	960.2	975.32	0.28	976.17	0.000368	7.48	1035.64	105.49	0.37
Reach-1	47566	4375	960.2	970.62	0.31	971.44	0.000648	7.29	615.39	87.33	0.45
Reach-1	47566	3336	960.2	969.18	0.28	969.9	0.000734	6.79	494.28	80.92	0.47
Reach-1	47566	2047	960.2	966.89	0.28	967.52	0.000983	6.34	322.83	68.08	0.51
Reach-1	47566	1761	960.2	966.24	0.28	966.86	0.001078	6.29	279.96	64.03	0.53
Reach-1	47566	1670	960.2	966.03	0.28	966.64	0.001116	6.28	266.1	62.66	0.54
Reach-1	47566	1612	960.2	965.9	0.28	966.5	0.001131	6.25	258.11	61.86	0.54
Reach-1	47566	1422	960.2	965.42	0.28	966.02	0.001225	6.2	229.18	58.86	0.55
Reach-1	47566	976	960.2	964.22	0.28	964.77	0.001501	5.99	162.94	51.35	0.59
Reach-1	47566	460	960.2	962.49	0.34	963.04	0.003462	5.91	77.83	48.53	0.82
Reach-1	47566	134	960.2	961.54	0.21	961.8	0.004582	4.09	32.78	44.53	0.84
Reach-1	47603	8721	960.17	977.21	0.55	978.69	0.001125	9.77	896.07	98.39	0.53
Reach-1	47603	7239	960.17	974.95	0.48	976.36	0.000823	9.52	760.69	54	0.45
Reach-1	47603	4375	960.17	970.46	0.42	971.57	0.000924	8.44	518.19	54	0.48
Reach-1	47603	3336	960.17	969.1	0.34	969.98	0.000848	7.5	444.88	54	0.46
Reach-1	47603	2047	960.17	966.94	0.26	967.55	0.000807	6.24	328.27	54	0.45
Reach-1	47603	1761	960.17	966.35	0.24	966.9	0.000819	5.94	296.42	54	0.45
Reach-1	47603	1670	960.17	966.15	0.23	966.68	0.000827	5.85	285.5	54	0.45
Reach-1	47603	1612	960.17	966.03	0.23	966.55	0.000828	5.78	279.01	54	0.45
Reach-1	47603	1422	960.17	965.59	0.22	966.07	0.000854	5.58	254.92	54	0.45
Reach-1	47603	976	960.17	964.45	0.19	964.84	0.000961	5.05	193.38	54	0.47
Reach-1	47603	460	960.17	962.85	0.17	963.13	0.001425	4.3	107.04	54	0.54
Reach-1	47603	134	960.17	961.79	0.08	961.9	0.001325	2.65	50.54	51.37	0.47
Reach-1	47630 Bridge										
Reach-1	47658	8721	960	979.22	0.34	980.18	0.000613	7.91	1264.45	214.2	0.4
Reach-1	47658	7239	960	977.39	0.33	978.34	0.000577	7.81	935.56	87.7	0.38
Reach-1	47658	4375	960	972.86	0.23	973.51	0.000427	6.48	674.79	54	0.32
Reach-1	47658	3336	960	969.29	0.29	970.03	0.00067	6.92	481.85	54	0.41
Reach-1	47658	2047	960	967.11	0.2	967.6	0.000589	5.62	364.18	54	0.38
Reach-1	47658	1761	960	966.52	0.18	966.95	0.000578	5.3	332.26	54	0.38
Reach-1	47658	1670	960	966.32	0.18	966.73	0.000576	5.2	321.36	54	0.38
Reach-1	47658	1612	960	966.19	0.17	966.6	0.000572	5.12	314.83	54	0.37
Reach-1	47658	1422	960	965.75	0.16	966.12	0.000569	4.89	290.82	54	0.37
Reach-1	47658	976	960	964.62	0.13	964.9	0.000561	4.25	229.68	54	0.36
Reach-1	47658	460	960	963.05	0.08	963.21	0.000538	3.17	145.06	54	0.34
Reach-1	47658	134	960	961.91	0.03	961.95	0.000273	1.61	83.42	54	0.23
Reach-1	47718	8721	960.33	979.64	0.18	980.23	0.000177	6.27	1616.38	120.2	0.27
Reach-1	47718	7239	960.33	977.88	0.16	978.4	0.00018	5.87	1404.49	120.2	0.27

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Reach-1	47718	4375	960.33	973.12	0.15	973.55	0.000246	5.3	878.53	101.89	0.29
Reach-1	47718	3336	960.33	969.44	0.25	970.08	0.000657	6.41	527.77	88.63	0.45
Reach-1	47718	2047	960.33	967.08	0.28	967.68	0.001108	6.23	328.36	78.81	0.54
Reach-1	47718	1761	960.33	966.44	0.29	967.06	0.001286	6.29	279.86	74.03	0.57
Reach-1	47718	1670	960.33	966.22	0.3	966.85	0.001364	6.33	263.96	72.4	0.58
Reach-1	47718	1612	960.33	966.09	0.3	966.72	0.001407	6.33	254.64	71.42	0.59
Reach-1	47718	1422	960.33	965.62	0.32	966.26	0.001633	6.43	221.25	67.8	0.63
Reach-1	47718	976	960.33	964.36	0.42	965.11	0.003001	6.94	140.59	61.04	0.81
Reach-1	47718	460	960.33	963.01	0.47	963.75	0.00536	6.86	67.02	46.31	1.01
Reach-1	47718	134	960.33	961.99	0.32	962.4	0.006775	5.09	26.31	34.34	1.03
Reach-1	47773	8721	961.13	979.7	0.16	980.24	0.000161	6.04	1680.3	121.5	0.26
Reach-1	47773	7239	961.13	977.93	0.15	978.41	0.000163	5.65	1465.63	121.2	0.26
Reach-1	47773	4375	961.13	973.17	0.14	973.57	0.000225	5.12	916.78	107.34	0.28
Reach-1	47773	3336	961.13	969.53	0.23	970.12	0.000599	6.19	549.31	94.55	0.43
Reach-1	47773	2047	961.13	967.19	0.26	967.74	0.001016	5.99	341.72	83.26	0.52
Reach-1	47773	1761	961.13	966.55	0.27	967.12	0.001191	6.06	290.48	78.38	0.55
Reach-1	47773	1670	961.13	966.34	0.28	966.92	0.001267	6.1	273.69	76.62	0.57
Reach-1	47773	1612	961.13	966.21	0.28	966.79	0.00131	6.11	263.79	75.57	0.58
Reach-1	47773	1422	961.13	965.76	0.29	966.35	0.00149	6.17	230.65	71.91	0.61
Reach-1	47773	976	961.13	964.66	0.32	965.26	0.002123	6.22	156.81	63.02	0.7
Reach-1	47773	460	961.13	963.58	0.23	963.96	0.002163	4.93	93.34	54.22	0.66
Reach-1	47773	134	961.13	962.46	0.15	962.65	0.002898	3.56	37.61	44.49	0.68
Reach-1	47818	8721	960.92	979.69	0.17	980.26	0.000169	6.14	1634.82	125.72	0.27
Reach-1	47818	7239	960.92	977.92	0.15	978.42	0.000173	5.75	1415.46	122.62	0.27
Reach-1	47818	4375	960.92	973.16	0.15	973.59	0.000242	5.24	879.43	102.35	0.29
Reach-1	47818	3336	960.92	969.53	0.25	970.16	0.000665	6.38	529.49	90.22	0.45
Reach-1	47818	2047	960.92	967.21	0.27	967.8	0.001057	6.19	330.93	79.9	0.53
Reach-1	47818	1761	960.92	966.59	0.29	967.19	0.001254	6.24	282.28	75.86	0.57
Reach-1	47818	1670	960.92	966.37	0.29	966.98	0.001315	6.27	266.4	73.65	0.58
Reach-1	47818	1612	960.92	966.25	0.29	966.86	0.001346	6.27	257.1	72.32	0.59
Reach-1	47818	1422	960.92	965.8	0.3	966.42	0.001471	6.29	226.16	67.72	0.61
Reach-1	47818	976	960.92	964.8	0.29	965.36	0.001718	5.98	163.11	59.23	0.64
Reach-1	47818	460	960.92	963.75	0.18	964.05	0.001464	4.42	104.09	53.11	0.56
Reach-1	47818	134	960.92	962.63	0.09	962.75	0.001311	2.77	48.32	45.97	0.48
Reach-1	47868	8721	961.14	979.45	0.28	980.37	0.000276	7.89	1362.06	107.2	0.34
Reach-1	47868	7239	961.14	977.71	0.25	978.53	0.000279	7.38	1175.72	107.2	0.33
Reach-1	47868	4375	961.14	973	0.23	973.68	0.00037	6.63	721.78	86.64	0.36
Reach-1	47868	3336	961.14	969.34	0.38	970.3	0.000935	7.9	432.07	71.25	0.54
Reach-1	47868	2047	961.14	967.12	0.36	967.92	0.001267	7.21	284.28	61.94	0.59
Reach-1	47868	1761	961.14	966.53	0.36	967.31	0.001411	7.08	248.71	59.48	0.61
Reach-1	47868	1670	961.14	966.33	0.36	967.1	0.001476	7.05	236.88	58.65	0.62
Reach-1	47868	1612	961.14	966.21	0.36	966.97	0.001504	7.01	229.86	58.23	0.62
Reach-1	47868	1422	961.14	965.79	0.36	966.53	0.001628	6.91	205.86	56.78	0.64
Reach-1	47868	976	961.14	964.84	0.33	965.47	0.001867	6.36	153.42	53.46	0.66
Reach-1	47868	460	961.14	963.81	0.19	964.13	0.001556	4.6	99.97	49.86	0.57
Reach-1	47868	134	961.14	962.69	0.09	962.82	0.0015	2.88	46.45	45.97	0.51
Reach-1	47923	8721	961.19	979.7	0.21	980.41	0.000209	6.9	1526.5	112.4	0.29
Reach-1	47923	7239	961.19	977.94	0.19	978.56	0.00021	6.43	1329.29	109.73	0.29
Reach-1	47923	4375	961.19	973.21	0.17	973.71	0.000276	5.75	843.36	98.02	0.31
Reach-1	47923	3336	961.19	969.68	0.27	970.38	0.000649	6.71	517.63	86.7	0.45
Reach-1	47923	2047	961.19	967.43	0.25	968.01	0.000875	6.12	334.66	69.27	0.49

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Reach-1	47923	1761	961.19	966.85	0.25	967.4	0.00093	5.97	295.1	66.46	0.5
Reach-1	47923	1670	961.19	966.65	0.25	967.2	0.000951	5.92	282.18	65.51	0.5
Reach-1	47923	1612	961.19	966.53	0.24	967.07	0.000961	5.87	274.39	64.94	0.5
Reach-1	47923	1422	961.19	966.12	0.24	966.63	0.001001	5.73	248.18	62.96	0.51
Reach-1	47923	976	961.19	965.16	0.2	965.57	0.001018	5.13	190.09	57.75	0.5
Reach-1	47923	460	961.19	964	0.11	964.21	0.0008	3.66	125.75	53.52	0.42
Reach-1	47923	134	961.19	962.8	0.05	962.87	0.00057	2.09	64.11	49.65	0.32
Reach-1	47988	8721	961.41	979.65	0.25	980.45	0.000238	7.49	1508.56	110.32	0.32
Reach-1	47988	7239	961.41	977.9	0.22	978.6	0.000238	6.98	1317.83	107.8	0.31
Reach-1	47988	4375	961.41	973.18	0.2	973.75	0.000306	6.22	831.6	96.57	0.33
Reach-1	47988	3336	961.41	969.66	0.3	970.45	0.000689	7.19	510.55	86.21	0.47
Reach-1	47988	2047	961.41	967.44	0.27	968.08	0.000892	6.43	326.32	79.66	0.5
Reach-1	47988	1761	961.41	966.87	0.27	967.47	0.000987	6.25	282.67	67.06	0.52
Reach-1	47988	1670	961.41	966.67	0.27	967.27	0.001022	6.19	270.25	63.04	0.52
Reach-1	47988	1612	961.41	966.56	0.27	967.14	0.001038	6.14	262.82	62.65	0.52
Reach-1	47988	1422	961.41	966.15	0.26	966.71	0.001107	5.98	237.64	61.29	0.53
Reach-1	47988	976	961.41	965.19	0.23	965.65	0.00121	5.4	180.61	58.1	0.54
Reach-1	47988	460	961.41	964.03	0.14	964.28	0.001077	3.99	115.4	54.22	0.48
Reach-1	47988	134	961.41	962.83	0.07	962.93	0.001108	2.54	52.7	50.21	0.44
Reach-1	48023	8721	961.96	979.63	0.26	980.47	0.000259	7.57	1414.91	111.17	0.33
Reach-1	48023	7239	961.96	977.88	0.23	978.62	0.000262	7.07	1225.81	105.04	0.32
Reach-1	48023	4375	961.96	973.16	0.21	973.77	0.000353	6.37	764.89	90.17	0.35
Reach-1	48023	3336	961.96	969.65	0.34	970.51	0.000853	7.5	467.49	79.23	0.51
Reach-1	48023	2047	961.96	967.41	0.33	968.15	0.001189	6.91	298	70.72	0.57
Reach-1	48023	1761	961.96	966.83	0.33	967.55	0.001347	6.79	259.27	63.32	0.59
Reach-1	48023	1670	961.96	966.64	0.33	967.35	0.001406	6.76	246.97	62.69	0.6
Reach-1	48023	1612	961.96	966.52	0.33	967.22	0.001439	6.73	239.52	62.37	0.61
Reach-1	48023	1422	961.96	966.11	0.33	966.79	0.00158	6.64	214.16	61.28	0.63
Reach-1	48023	976	961.96	965.14	0.32	965.75	0.001983	6.24	156.32	58.72	0.67
Reach-1	48023	460	961.96	963.98	0.25	964.39	0.002565	5.13	89.71	55.62	0.71
Reach-1	48023	134	961.96	962.85	0.27	963.16	0.007085	4.47	29.99	49.49	1.01
Reach-1	48078	8721	961.64	979.53	0.31	980.54	0.000328	8.31	1309.7	110.51	0.36
Reach-1	48078	7239	961.64	977.79	0.29	978.69	0.000334	7.79	1122.93	104.08	0.36
Reach-1	48078	4375	961.64	973.07	0.27	973.84	0.00046	7.09	673.18	86.66	0.39
Reach-1	48078	3336	961.64	969.54	0.43	970.63	0.001135	8.39	402.95	67.14	0.57
Reach-1	48078	2047	961.64	967.37	0.4	968.27	0.001459	7.61	269.05	57.61	0.62
Reach-1	48078	1761	961.64	966.8	0.4	967.66	0.0016	7.45	236.5	56.49	0.64
Reach-1	48078	1670	961.64	966.62	0.39	967.47	0.001644	7.38	226.43	56.13	0.65
Reach-1	48078	1612	961.64	966.51	0.39	967.34	0.001672	7.33	220.03	55.91	0.65
Reach-1	48078	1422	961.64	966.12	0.39	966.92	0.001792	7.17	198.31	55.14	0.67
Reach-1	48078	976	961.64	965.21	0.35	965.88	0.002049	6.54	149.13	53.35	0.69
Reach-1	48078	460	961.64	964.12	0.23	964.51	0.002077	4.99	92.21	50.97	0.65
Reach-1	48078	134	961.64	963.2	0.09	963.33	0.001362	2.83	47.31	44.86	0.49
Reach-1	48128	8721	961.12	979.5	0.34	980.58	0.000351	8.6	1286.4	112.23	0.37
Reach-1	48128	7239	961.12	977.76	0.31	978.72	0.000359	8.08	1096.52	106.04	0.37
Reach-1	48128	4375	961.12	973.04	0.29	973.89	0.000501	7.4	639.1	84.64	0.41
Reach-1	48128	3336	961.12	969.54	0.47	970.72	0.001219	8.71	384.67	61.59	0.59
Reach-1	48128	2047	961.12	967.41	0.42	968.36	0.001488	7.81	262.11	54.7	0.63
Reach-1	48128	1761	961.12	966.86	0.4	967.75	0.001569	7.58	232.31	53.07	0.64
Reach-1	48128	1670	961.12	966.69	0.4	967.56	0.001588	7.48	223.19	52.57	0.64
Reach-1	48128	1612	961.12	966.58	0.39	967.43	0.001599	7.41	217.41	52.24	0.64

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Reach-1	48128	1422	961.12	966.2	0.38	967	0.00164	7.18	198.05	51.14	0.64
Reach-1	48128	976	961.12	965.37	0.3	965.97	0.001567	6.24	156.37	48.69	0.61
Reach-1	48128	460	961.12	964.3	0.16	964.59	0.001118	4.34	106.11	44.97	0.5
Reach-1	48128	134	961.12	963.3	0.04	963.37	0.000386	2.06	65.16	38.32	0.28
Reach-1	48178	8721	960.97	979.82	0.25	980.62	0.000257	7.37	1456.44	131.57	0.32
Reach-1	48178	7239	960.97	978.03	0.23	978.76	0.000269	6.97	1224.44	128.42	0.32
Reach-1	48178	4375	960.97	973.29	0.22	973.93	0.000389	6.43	708.73	89.87	0.36
Reach-1	48178	3336	960.97	969.93	0.35	970.8	0.000893	7.51	444.66	69.12	0.52
Reach-1	48178	2047	960.97	967.74	0.3	968.45	0.001015	6.74	303.51	60.12	0.53
Reach-1	48178	1761	960.97	967.19	0.29	967.84	0.001042	6.51	270.63	57.82	0.53
Reach-1	48178	1670	960.97	967.01	0.28	967.65	0.001045	6.41	260.49	57.09	0.53
Reach-1	48178	1612	960.97	966.9	0.28	967.52	0.001047	6.34	254.06	56.63	0.53
Reach-1	48178	1422	960.97	966.51	0.27	967.09	0.001049	6.11	232.68	55.05	0.52
Reach-1	48178	976	960.97	965.62	0.21	966.05	0.000959	5.27	185.14	51.36	0.49
Reach-1	48178	460	960.97	964.44	0.11	964.64	0.000641	3.61	127.49	46.51	0.38
Reach-1	48178	134	960.97	963.34	0.03	963.38	0.00024	1.71	78.52	42.64	0.22
Reach-1	48228	8721	960.95	979.71	0.3	980.69	0.000307	8.19	1394.08	117.82	0.35
Reach-1	48228	7239	960.95	977.95	0.28	978.82	0.000313	7.7	1188.7	114.81	0.35
Reach-1	48228	4375	960.95	973.23	0.26	973.98	0.00042	6.98	689.35	89.98	0.38
Reach-1	48228	3336	960.95	969.92	0.37	970.87	0.000868	7.83	433.64	64.44	0.51
Reach-1	48228	2047	960.95	967.79	0.3	968.5	0.000972	6.75	304.38	58.96	0.52
Reach-1	48228	1761	960.95	967.25	0.29	967.9	0.00102	6.48	272.37	58.01	0.52
Reach-1	48228	1670	960.95	967.07	0.28	967.7	0.001034	6.38	262.25	57.71	0.52
Reach-1	48228	1612	960.95	966.96	0.28	967.58	0.001043	6.31	255.76	57.51	0.52
Reach-1	48228	1422	960.95	966.58	0.27	967.15	0.001081	6.08	233.82	56.84	0.53
Reach-1	48228	976	960.95	965.66	0.22	966.1	0.001065	5.33	183.09	53.83	0.51
Reach-1	48228	460	960.95	964.46	0.12	964.69	0.000813	3.79	121.27	49.21	0.43
Reach-1	48228	134	960.95	963.36	0.03	963.41	0.00035	1.9	70.64	43.4	0.26
Reach-1	48273	8721	961.36	979.79	0.28	980.71	0.000293	7.88	1383.77	121.18	0.35
Reach-1	48273	7239	961.36	978.01	0.26	978.84	0.000307	7.45	1170.94	117.78	0.35
Reach-1	48273	4375	961.36	973.26	0.26	974	0.000455	6.95	660.33	86.21	0.39
Reach-1	48273	3336	961.36	969.9	0.42	970.94	0.001115	8.18	409.44	67.87	0.58
Reach-1	48273	2047	961.36	967.72	0.4	968.61	0.001464	7.58	270.21	59.66	0.63
Reach-1	48273	1761	961.36	967.16	0.39	968.02	0.00158	7.41	237.59	57.57	0.64
Reach-1	48273	1670	961.36	966.99	0.39	967.82	0.001615	7.34	227.48	56.91	0.65
Reach-1	48273	1612	961.36	966.87	0.39	967.7	0.001638	7.29	221.04	56.48	0.65
Reach-1	48273	1422	961.36	966.49	0.38	967.28	0.001725	7.13	199.55	55.03	0.66
Reach-1	48273	976	961.36	965.58	0.33	966.23	0.001816	6.44	151.59	50.83	0.66
Reach-1	48273	460	961.36	964.42	0.2	964.77	0.001457	4.76	96.74	43.53	0.56
Reach-1	48273	134	961.36	963.36	0.07	963.46	0.000824	2.56	52.4	39.57	0.39
Reach-1	48328	8721	962.04	979.62	0.36	980.8	0.000379	8.96	1228.77	104.43	0.39
Reach-1	48328	7239	962.04	977.87	0.34	978.93	0.000392	8.44	1048.52	100.89	0.39
Reach-1	48328	4375	962.04	973.15	0.33	974.08	0.000567	7.8	608.86	76.91	0.44
Reach-1	48328	3336	962.04	969.78	0.53	971.09	0.001399	9.22	369.62	64.94	0.64
Reach-1	48328	2047	962.04	967.65	0.52	968.78	0.002056	8.54	239.77	56.65	0.73
Reach-1	48328	1761	962.04	967.08	0.53	968.19	0.002329	8.46	208.17	55.06	0.77
Reach-1	48328	1670	962.04	966.9	0.53	968	0.002423	8.42	198.4	54.56	0.78
Reach-1	48328	1612	962.04	966.79	0.53	967.88	0.002487	8.39	192.17	54.24	0.79
Reach-1	48328	1422	962.04	965.47	1.1	967.53	0.006889	11.54	123.22	46.88	1.25
Reach-1	48328	976	962.04	964.73	1.07	966.57	0.008621	10.9	89.51	44.17	1.35
Reach-1	48328	460	962.04	963.82	0.84	965.07	0.01069	8.97	51.27	40.17	1.4

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Reach-1	48328	134	962.04	963	0.57	963.67	0.014581	6.58	20.37	32.29	1.46
Reach-1	48378	8721	962.5	979.77	0.33	980.83	0.000372	8.42	1235.25	108.36	0.38
Reach-1	48378	7239	962.5	977.99	0.31	978.96	0.000395	7.99	1044.81	105.22	0.38
Reach-1	48378	4375	962.5	973.23	0.32	974.12	0.000629	7.58	600.52	78.63	0.45
Reach-1	48378	3336	962.5	969.81	0.58	971.19	0.001817	9.44	354.99	66.54	0.71
Reach-1	48378	2047	962.5	967.55	0.71	969.01	0.003378	9.7	210.96	59.67	0.91
Reach-1	48378	1761	962.5	966.94	0.8	968.51	0.004313	10.05	175.3	56.87	1.01
Reach-1	48378	1670	962.5	966.82	0.78	968.34	0.004346	9.9	168.71	56.34	1.01
Reach-1	48378	1612	962.5	966.75	0.77	968.24	0.004373	9.81	164.39	55.99	1.01
Reach-1	48378	1422	962.5	966.49	0.73	967.88	0.004462	9.47	150.11	54.81	1.01
Reach-1	48378	976	962.5	965.75	0.65	966.94	0.004515	8.75	111.59	46.52	1
Reach-1	48378	460	962.5	964.73	0.49	965.49	0.005273	7.02	65.57	43.3	1
Reach-1	48378	134	962.5	963.84	0.29	964.19	0.006711	4.74	28.29	40.88	1
Reach-1	48423	8721	962.07	979.68	0.38	980.9	0.000423	9.03	1160.55	102.3	0.4
Reach-1	48423	7239	962.07	977.91	0.35	979.02	0.000444	8.54	982.86	98.73	0.4
Reach-1	48423	4375	962.07	973.19	0.35	974.18	0.000673	7.98	571.22	72.64	0.46
Reach-1	48423	3336	962.07	969.85	0.59	971.28	0.001696	9.58	350.76	61.49	0.69
Reach-1	48423	2047	962.07	968.08	0.5	969.16	0.001988	8.37	244.7	57.87	0.72
Reach-1	48423	1761	962.07	967.75	0.44	968.69	0.00184	7.79	225.93	56.21	0.69
Reach-1	48423	1670	962.07	967.62	0.42	968.53	0.001807	7.63	218.93	55.57	0.68
Reach-1	48423	1612	962.07	967.53	0.42	968.41	0.0018	7.54	213.77	55.09	0.67
Reach-1	48423	1422	962.07	967.27	0.38	968.06	0.001697	7.12	199.6	53.76	0.65
Reach-1	48423	976	962.07	966.54	0.28	967.11	0.001373	6.02	162.04	48.12	0.58
Reach-1	48423	460	962.07	965.35	0.15	965.63	0.000942	4.21	109.26	42.26	0.46
Reach-1	48423	134	962.07	964.2	0.04	964.27	0.000448	2.14	62.5	38.66	0.3
Reach-1	48483	8721	961.7	979.79	0.36	980.93	0.000399	8.77	1191.1	101.61	0.39
Reach-1	48483	7239	961.7	978.01	0.33	979.05	0.000419	8.29	1014.1	98.16	0.39
Reach-1	48483	4375	961.7	973.29	0.34	974.22	0.000645	7.79	587.81	77.77	0.45
Reach-1	48483	3336	961.7	970.07	0.54	971.39	0.001557	9.21	364.83	63.78	0.66
Reach-1	48483	2047	961.7	968.29	0.46	969.29	0.001799	8.02	255.09	59.46	0.68
Reach-1	48483	1761	961.7	967.92	0.41	968.81	0.001721	7.55	233.15	57.78	0.66
Reach-1	48483	1670	961.7	967.79	0.4	968.64	0.001703	7.41	225.5	57.18	0.66
Reach-1	48483	1612	961.7	967.69	0.39	968.52	0.001703	7.33	220.01	56.75	0.66
Reach-1	48483	1422	961.7	967.41	0.36	968.16	0.001641	6.96	204.28	55.49	0.64
Reach-1	48483	976	961.7	966.63	0.28	967.19	0.00151	6	162.57	52.26	0.6
Reach-1	48483	460	961.7	965.4	0.16	965.7	0.001123	4.39	104.72	43.44	0.5
Reach-1	48483	134	961.7	964.21	0.06	964.3	0.000686	2.41	55.51	39.61	0.36
Reach-1	48528	8721	960.68	979.83	0.34	980.95	0.000333	8.67	1216.34	95.89	0.37
Reach-1	48528	7239	960.68	978.1	0.3	979.08	0.000335	8.08	1053.31	92.23	0.37
Reach-1	48528	4375	960.68	973.47	0.27	974.26	0.000432	7.19	654.69	77.45	0.39
Reach-1	48528	3336	960.68	970.58	0.34	971.48	0.000743	7.62	448.24	66.07	0.49
Reach-1	48528	2047	960.68	968.81	0.24	969.39	0.000677	6.1	336.64	59.91	0.44
Reach-1	48528	1761	960.68	968.4	0.21	968.89	0.000638	5.65	312.34	58.48	0.43
Reach-1	48528	1670	960.68	968.25	0.2	968.72	0.000625	5.5	303.97	57.98	0.42
Reach-1	48528	1612	960.68	968.15	0.19	968.61	0.000617	5.41	298.2	57.63	0.42
Reach-1	48528	1422	960.68	967.84	0.17	968.24	0.000578	5.07	280.42	56.55	0.4
Reach-1	48528	976	960.68	966.99	0.12	967.26	0.000465	4.18	233.5	53.18	0.35
Reach-1	48528	460	960.68	965.62	0.06	965.74	0.000281	2.79	164.64	47.34	0.26
Reach-1	48528	134	960.68	964.29	0.01	964.32	0.000087	1.27	105.7	41.78	0.14
Reach-1	48568	8721	961.51	980.07	0.28	980.98	0.00028	7.87	1399.99	127.46	0.34

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Reach-1	48568	7239	961.51	978.27	0.26	979.11	0.000293	7.45	1174.69	123.6	0.34
Reach-1	48568	4375	961.51	973.59	0.24	974.29	0.000402	6.75	705.43	87.05	0.38
Reach-1	48568	3336	961.51	970.69	0.32	971.52	0.00075	7.33	471.02	74.59	0.49
Reach-1	48568	2047	961.51	968.84	0.24	969.42	0.000737	6.09	340.64	66.66	0.46
Reach-1	48568	1761	961.51	968.42	0.21	968.92	0.000699	5.69	312.83	64.85	0.44
Reach-1	48568	1670	961.51	968.27	0.21	968.75	0.000689	5.55	303.34	64.21	0.44
Reach-1	48568	1612	961.51	968.17	0.2	968.64	0.000684	5.47	296.82	63.78	0.44
Reach-1	48568	1422	961.51	967.85	0.18	968.27	0.000656	5.17	276.73	62.41	0.42
Reach-1	48568	976	961.51	966.99	0.14	967.28	0.000585	4.35	224.29	58.69	0.39
Reach-1	48568	460	961.51	965.61	0.08	965.76	0.00043	3.1	148.53	51.04	0.32
Reach-1	48568	134	961.51	964.29	0.02	964.33	0.000177	1.55	86.3	43.11	0.19
Reach-1	48633	8721	961.68	980.32	0.21	981.01	0.000237	6.8	1529.72	135.89	0.3
Reach-1	48633	7239	961.68	978.52	0.2	979.15	0.000251	6.45	1288.54	130.78	0.3
Reach-1	48633	4375	961.68	973.77	0.2	974.33	0.000377	6	761.13	93.29	0.35
Reach-1	48633	3336	961.68	970.89	0.28	971.58	0.000729	6.67	507.1	83.88	0.46
Reach-1	48633	2047	961.68	968.94	0.24	969.48	0.000877	5.86	349.41	77.49	0.48
Reach-1	48633	1761	961.68	968.49	0.22	968.98	0.000896	5.6	314.69	75.31	0.48
Reach-1	48633	1670	961.68	968.33	0.22	968.8	0.000896	5.51	302.91	74.15	0.48
Reach-1	48633	1612	961.68	968.22	0.22	968.69	0.000899	5.47	294.97	73.35	0.48
Reach-1	48633	1422	961.68	967.88	0.2	968.31	0.000891	5.26	270.39	70.85	0.47
Reach-1	48633	976	961.68	967	0.17	967.33	0.000846	4.63	210.67	64.35	0.45
Reach-1	48633	460	961.68	965.61	0.11	965.81	0.000785	3.58	128.37	54.83	0.41
Reach-1	48633	134	961.68	964.29	0.05	964.36	0.000503	2.13	62.9	42.56	0.31
Reach-1	48668	8721	963.33	980.23	0.27	981.07	0.000298	7.54	1373	116.89	0.34
Reach-1	48668	7239	963.33	978.43	0.25	979.2	0.000319	7.17	1166.87	112.38	0.35
Reach-1	48668	4375	963.33	973.67	0.27	974.39	0.000533	6.89	673.91	91.58	0.42
Reach-1	48668	3336	963.33	970.71	0.42	971.71	0.001213	8.06	422.93	79.1	0.59
Reach-1	48668	2047	963.33	968.76	0.4	969.62	0.001689	7.44	275.99	71.8	0.66
Reach-1	48668	1761	963.33	968.31	0.39	969.12	0.001847	7.22	244.09	70.11	0.68
Reach-1	48668	1670	963.33	968.15	0.39	968.95	0.001929	7.17	232.97	69.51	0.69
Reach-1	48668	1612	963.33	968.04	0.39	968.84	0.002002	7.15	225.36	69.1	0.7
Reach-1	48668	1422	963.33	967.69	0.39	968.46	0.002111	7.05	201.82	65.77	0.71
Reach-1	48668	976	963.33	966.81	0.36	967.49	0.002304	6.6	147.81	56.82	0.72
Reach-1	48668	460	963.33	965.36	0.4	965.99	0.004396	6.38	72.07	47.8	0.92
Reach-1	48668	134	963.33	964.38	0.29	964.73	0.006907	4.73	28.33	41.71	1.01
Reach-1	48733	8721	962.15	980.56	0.17	981.12	0.000178	6.15	1796.52	152.26	0.27
Reach-1	48733	7239	962.15	978.74	0.16	979.24	0.000189	5.85	1523.65	146.59	0.28
Reach-1	48733	4375	962.15	973.98	0.17	974.45	0.000297	5.55	873.8	122.09	0.32
Reach-1	48733	3336	962.15	971.23	0.23	971.81	0.000581	6.12	566.3	101.71	0.43
Reach-1	48733	2047	962.15	969.27	0.2	969.73	0.000714	5.42	381.05	87.63	0.45
Reach-1	48733	1761	962.15	968.81	0.19	969.23	0.000732	5.18	341.68	84.51	0.45
Reach-1	48733	1670	962.15	968.66	0.19	969.06	0.000741	5.1	328.58	83.44	0.45
Reach-1	48733	1612	962.15	968.55	0.18	968.95	0.000748	5.05	319.92	82.73	0.45
Reach-1	48733	1422	962.15	968.21	0.17	968.58	0.000771	4.87	292.1	80.4	0.45
Reach-1	48733	976	962.15	967.31	0.15	967.61	0.000817	4.39	222.07	73.61	0.45
Reach-1	48733	460	962.15	965.94	0.11	966.14	0.000871	3.55	129.73	62.39	0.43
Reach-1	48733	134	962.15	964.76	0.04	964.83	0.000412	2.03	65.9	41.7	0.29
Reach-1	48768	8721	962.58	980.55	0.17	981.13	0.000175	6.24	1751.97	168.12	0.27
Reach-1	48768	7239	962.58	978.73	0.16	979.25	0.000183	5.91	1463.53	148.48	0.27
Reach-1	48768	4375	962.58	974.01	0.15	974.46	0.000258	5.4	873.04	108.64	0.3
Reach-1	48768	3336	962.58	971.33	0.19	971.84	0.000441	5.71	600.46	94.68	0.38

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Reach-1	48768	2047	962.58	969.4	0.15	969.76	0.000475	4.81	427.25	84.62	0.37
Reach-1	48768	1761	962.58	968.94	0.14	969.26	0.00047	4.53	389.14	82.24	0.36
Reach-1	48768	1670	962.58	968.79	0.13	969.09	0.000468	4.44	376.4	81.42	0.36
Reach-1	48768	1612	962.58	968.68	0.13	968.98	0.000468	4.38	368	80.89	0.36
Reach-1	48768	1422	962.58	968.34	0.12	968.61	0.000463	4.17	340.75	79.11	0.35
Reach-1	48768	976	962.58	967.44	0.1	967.64	0.000436	3.6	270.84	75.03	0.33
Reach-1	48768	460	962.58	966.06	0.06	966.17	0.000391	2.68	171.72	68.92	0.3
Reach-1	48768	134	962.58	964.81	0.02	964.84	0.000255	1.5	89.09	62.09	0.22
Reach-1	48828	8721	962.38	980.33	0.28	981.24	0.000296	7.75	1330.66	138.87	0.35
Reach-1	48828	7239	962.38	978.53	0.26	979.36	0.000314	7.34	1102.58	114.41	0.35
Reach-1	48828	4375	962.38	973.84	0.26	974.56	0.000472	6.82	666.35	83.18	0.4
Reach-1	48828	3336	962.38	971.12	0.35	971.98	0.000917	7.48	449.94	75.41	0.52
Reach-1	48828	2047	962.38	969.23	0.3	969.89	0.00109	6.54	312.96	69.31	0.54
Reach-1	48828	1761	962.38	968.79	0.28	969.39	0.001098	6.23	282.74	67.59	0.54
Reach-1	48828	1670	962.38	968.64	0.27	969.22	0.001102	6.13	272.58	67.03	0.54
Reach-1	48828	1612	962.38	968.54	0.27	969.11	0.001106	6.06	265.84	66.65	0.54
Reach-1	48828	1422	962.38	968.21	0.25	968.73	0.001114	5.83	244.08	65.42	0.53
Reach-1	48828	976	962.38	967.33	0.21	967.74	0.001162	5.19	187.91	62.13	0.53
Reach-1	48828	460	962.38	965.98	0.17	966.26	0.001454	4.27	107.74	57.12	0.55
Reach-1	48828	134	962.38	964.75	0.14	964.92	0.002859	3.33	40.21	51.85	0.67
Reach-1	48868	8721	963.04	980.38	0.27	981.26	0.00029	7.62	1369.87	140.41	0.34
Reach-1	48868	7239	963.04	978.57	0.25	979.37	0.000311	7.25	1134.31	119.48	0.35
Reach-1	48868	4375	963.04	973.86	0.26	974.58	0.000494	6.86	666.4	87.96	0.41
Reach-1	48868	3336	963.04	971.13	0.37	972.04	0.001017	7.65	439.72	78.02	0.55
Reach-1	48868	2047	963.04	969.24	0.32	969.96	0.001183	6.81	300.52	66.95	0.57
Reach-1	48868	1761	963.04	968.8	0.3	969.45	0.001172	6.48	271.75	64.76	0.56
Reach-1	48868	1670	963.04	968.65	0.29	969.28	0.00117	6.37	262.13	64.07	0.56
Reach-1	48868	1612	963.04	968.55	0.29	969.17	0.001171	6.3	255.78	63.61	0.55
Reach-1	48868	1422	963.04	968.22	0.27	968.79	0.001163	6.04	235.31	62.11	0.55
Reach-1	48868	976	963.04	967.36	0.22	967.8	0.001149	5.33	183.17	58.11	0.53
Reach-1	48868	460	963.04	966.05	0.15	966.31	0.001161	4.15	110.9	52.07	0.5
Reach-1	48868	134	963.04	964.9	0.07	964.99	0.000917	2.47	54.21	46.78	0.4
Reach-1	48928	8721	962.05	980.08	0.42	981.42	0.000444	9.59	1196.55	120.45	0.43
Reach-1	48928	7239	962.05	978.31	0.39	979.51	0.000464	9.05	1001.2	100.52	0.43
Reach-1	48928	4375	962.05	973.64	0.39	974.73	0.000708	8.5	581.52	80.33	0.49
Reach-1	48928	3336	962.05	970.88	0.54	972.24	0.001389	9.4	375.76	69.05	0.65
Reach-1	48928	2047	962.05	969.13	0.43	970.12	0.00153	7.98	261.5	61.28	0.65
Reach-1	48928	1761	962.05	968.72	0.4	969.6	0.00154	7.53	236.7	59.46	0.64
Reach-1	48928	1670	962.05	968.58	0.39	969.43	0.00155	7.39	228.33	58.83	0.64
Reach-1	48928	1612	962.05	968.48	0.38	969.31	0.001561	7.3	222.77	58.41	0.64
Reach-1	48928	1422	962.05	968.17	0.36	968.93	0.001586	6.98	204.86	57.04	0.64
Reach-1	48928	976	962.05	967.34	0.29	967.92	0.00152	6.12	159.54	50.82	0.61
Reach-1	48928	460	962.05	966.08	0.17	966.4	0.001124	4.51	102.03	40.69	0.5
Reach-1	48928	134	962.05	964.95	0.05	965.03	0.000465	2.25	59.65	35.23	0.3
Reach-1	48978	8721	962.65	980.23	0.38	981.45	0.00042	9.1	1202.52	113.77	0.41
Reach-1	48978	7239	962.65	978.42	0.36	979.55	0.000454	8.69	1004.25	104.86	0.42
Reach-1	48978	4375	962.65	973.68	0.39	974.76	0.000762	8.4	562.55	81.61	0.51
Reach-1	48978	3336	962.65	970.93	0.58	972.34	0.001648	9.54	356.46	68.09	0.7
Reach-1	48978	2047	962.65	969.13	0.51	970.24	0.002035	8.46	241.98	59.26	0.73
Reach-1	48978	1761	962.65	968.71	0.48	969.73	0.002078	8.09	217.64	57.21	0.73
Reach-1	48978	1670	962.65	968.57	0.47	969.56	0.002085	7.97	209.5	56.51	0.73

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Reach-1	48978	1612	962.65	968.47	0.46	969.44	0.002094	7.9	204.12	56.04	0.73
Reach-1	48978	1422	962.65	968.17	0.44	969.06	0.0021	7.6	186.99	54.52	0.72
Reach-1	48978	976	962.65	967.32	0.38	968.05	0.002185	6.85	142.57	50.36	0.72
Reach-1	48978	460	962.65	966.04	0.29	966.53	0.002504	5.59	82.35	44.1	0.72
Reach-1	48978	134	962.65	964.91	0.14	965.11	0.002013	3.6	37.26	32.94	0.6
Reach-1	49028	8721	962.95	980.41	0.33	981.48	0.000371	8.44	1203.76	107.08	0.39
Reach-1	49028	7239	962.95	978.6	0.32	979.58	0.000401	8.05	1016.57	100.08	0.39
Reach-1	49028	4375	962.95	973.88	0.34	974.82	0.000682	7.77	587.66	81.79	0.48
Reach-1	49028	3336	962.95	971.27	0.49	972.45	0.001417	8.71	387.19	71.67	0.64
Reach-1	49028	2047	962.95	969.41	0.43	970.36	0.001711	7.82	261.81	63.26	0.67
Reach-1	49028	1761	962.95	968.97	0.41	969.85	0.001774	7.51	234.5	61.26	0.68
Reach-1	49028	1670	962.95	968.82	0.4	969.68	0.001792	7.41	225.36	60.57	0.68
Reach-1	49028	1612	962.95	968.72	0.4	969.56	0.001813	7.36	219.17	60.1	0.68
Reach-1	49028	1422	962.95	968.38	0.39	969.17	0.001881	7.15	198.76	58.53	0.68
Reach-1	49028	976	962.95	967.49	0.35	968.16	0.002109	6.57	148.59	54.47	0.7
Reach-1	49028	460	962.95	966.17	0.31	966.68	0.003002	5.69	80.89	48.39	0.78
Reach-1	49028	134	962.95	964.99	0.19	965.26	0.003064	4.15	32.32	31.65	0.72
Reach-1	49078	8721	963.05	980.13	0.47	981.63	0.000524	10.08	1075.66	101.09	0.46
Reach-1	49078	7239	963.05	978.35	0.45	979.73	0.000565	9.61	902.02	93.6	0.47
Reach-1	49078	4375	963.05	973.65	0.48	974.97	0.000948	9.28	509.11	73.89	0.56
Reach-1	49078	3336	963.05	971	0.69	972.68	0.001975	10.42	327.8	62.74	0.76
Reach-1	49078	2047	963.05	969.29	0.58	970.57	0.002278	9.06	226.83	55.57	0.78
Reach-1	49078	1761	963.05	968.89	0.54	970.04	0.002305	8.62	204.63	53.87	0.77
Reach-1	49078	1670	963.05	968.75	0.53	969.86	0.002324	8.48	197.15	53.28	0.77
Reach-1	49078	1612	963.05	968.65	0.52	969.75	0.002348	8.4	192.04	52.88	0.77
Reach-1	49078	1422	963.05	968.33	0.5	969.35	0.002429	8.12	175.17	51.52	0.78
Reach-1	49078	976	963.05	967.5	0.43	968.32	0.00254	7.3	133.79	48.03	0.77
Reach-1	49078	460	963.05	966.3	0.31	966.82	0.002732	5.79	79.45	43.01	0.75
Reach-1	49078	134	963.05	965.17	0.16	965.4	0.002499	3.84	34.89	32.91	0.66
Reach-1	49133	8721	963.15	980.07	0.82	981.71	0.000939	10.56	993.08	95.02	0.49
Reach-1	49133	7239	963.15	978.28	0.79	979.81	0.00103	10.13	829.66	87.83	0.5
Reach-1	49133	4375	963.15	973.57	0.9	975.11	0.001873	10.03	460.41	68.87	0.63
Reach-1	49133	3336	963.15	970.85	1.41	972.97	0.004443	11.7	287.93	57.93	0.9
Reach-1	49133	2047	963.15	969.19	1.23	970.86	0.00523	10.39	197.18	51.24	0.93
Reach-1	49133	1761	963.15	968.81	1.14	970.33	0.005263	9.88	178.26	49.71	0.92
Reach-1	49133	1670	963.15	968.68	1.11	970.15	0.005259	9.72	171.83	49.11	0.92
Reach-1	49133	1612	963.15	968.59	1.1	970.03	0.005278	9.63	167.43	48.69	0.91
Reach-1	49133	1422	963.15	968.29	1.04	969.63	0.005327	9.3	152.96	47.28	0.91
Reach-1	49133	976	963.15	967.52	0.88	968.58	0.005354	8.28	117.85	43.68	0.89
Reach-1	49133	460	963.15	966.43	0.57	967.05	0.004874	6.28	73.29	38.68	0.8
Reach-1	49133	134	963.15	965.34	0.27	965.58	0.003931	3.93	34.09	31.15	0.66
Reach-1	49188	8721	963.05	980.18	0.78	981.77	0.000899	10.34	993.88	92.67	0.48
Reach-1	49188	7239	963.05	978.41	0.75	979.88	0.000975	9.88	835.64	86.01	0.49
Reach-1	49188	4375	963.05	973.84	0.8	975.23	0.001618	9.5	481.95	68.83	0.58
Reach-1	49188	3336	963.05	971.73	0.94	973.21	0.002539	9.79	344.93	60.88	0.69
Reach-1	49188	2047	963.05	970.06	0.73	971.11	0.002695	8.22	248.88	54.63	0.68
Reach-1	49188	1761	963.05	969.63	0.67	970.58	0.002644	7.8	225.73	53.01	0.67
Reach-1	49188	1670	963.05	969.49	0.65	970.4	0.002629	7.66	218.02	52.46	0.66
Reach-1	49188	1612	963.05	969.39	0.64	970.28	0.002621	7.57	213.01	52.1	0.66
Reach-1	49188	1422	963.05	969.06	0.6	969.88	0.002593	7.25	196.13	50.87	0.65
Reach-1	49188	976	963.05	968.19	0.49	968.82	0.00253	6.37	153.11	47.58	0.63

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Reach-1	49188	460	963.05	966.88	0.33	967.25	0.002423	4.89	94.11	42.67	0.58
Reach-1	49188	134	963.05	965.59	0.16	965.74	0.001993	3.09	43.38	34.16	0.48
Reach-1	49233	8721	965.25	980.21	0.8	981.81	0.000941	10.37	977.14	91.6	0.49
Reach-1	49233	7239	965.25	978.44	0.77	979.93	0.001039	9.95	820.34	85.3	0.5
Reach-1	49233	4375	965.25	973.85	0.87	975.34	0.00189	9.82	466.77	69	0.63
Reach-1	49233	3336	965.25	969.71	3.15	973.91	0.014488	16.45	203.57	58.17	1.53
Reach-1	49233	2047	965.25	968.6	2.73	971.87	0.017338	14.5	141.14	54.59	1.59
Reach-1	49233	1761	965.25	968.32	2.61	971.35	0.018193	13.96	126.14	53.69	1.61
Reach-1	49233	1670	965.25	968.23	2.56	971.18	0.018472	13.76	121.33	53.4	1.61
Reach-1	49233	1612	965.25	968.17	2.54	971.06	0.018699	13.64	118.15	53.21	1.61
Reach-1	49233	1422	965.25	967.97	2.45	970.69	0.019573	13.23	107.48	52.56	1.63
Reach-1	49233	976	965.25	967.46	2.2	969.71	0.022409	12.03	81.14	50.91	1.68
Reach-1	49233	460	965.25	966.78	1.7	968.25	0.028218	9.74	47.23	48.71	1.74
Reach-1	49233	134	965.25	966.17	1.02	966.88	0.032796	6.75	19.84	39.82	1.69
Reach-1	49293	8721	966.65	979.92	1.1	982.04	0.001439	11.97	863.97	90.8	0.6
Reach-1	49293	7239	966.65	978.11	1.12	980.18	0.001706	11.76	706.11	84.1	0.63
Reach-1	49293	4375	966.65	973.19	1.8	976	0.005076	13.5	337.38	65.82	0.98
Reach-1	49293	3336	966.65	972.21	1.63	974.6	0.005516	12.44	274.17	62.15	0.99
Reach-1	49293	2047	966.65	970.85	1.32	972.6	0.006209	10.61	193.43	57.12	1
Reach-1	49293	1761	966.65	970.51	1.24	972.1	0.006444	10.11	174.35	55.87	1
Reach-1	49293	1670	966.65	970.39	1.22	971.94	0.006614	9.97	167.49	55.41	1.01
Reach-1	49293	1612	966.65	970.32	1.2	971.83	0.006666	9.86	163.57	55.15	1.01
Reach-1	49293	1422	966.65	970.07	1.14	971.47	0.006809	9.49	149.8	54.21	1.01
Reach-1	49293	976	966.65	969.41	0.99	970.53	0.007284	8.51	114.74	51.75	1.01
Reach-1	49293	460	966.65	968.47	0.73	969.18	0.008431	6.79	67.78	48.27	1.01
Reach-1	49293	134	966.65	967.64	0.44	967.97	0.010888	4.61	29.07	45.19	1.01
Reach-1	49333	8721	966.74	980.71	0.74	982.15	0.000982	9.76	989.53	100.86	0.49
Reach-1	49333	7239	966.74	978.91	0.74	980.3	0.001161	9.56	814.46	93.51	0.52
Reach-1	49333	4375	966.74	974.9	0.84	976.27	0.0021	9.39	473.05	77.18	0.64
Reach-1	49333	3336	966.74	973.63	0.8	974.86	0.002473	8.87	377.99	72.61	0.67
Reach-1	49333	2047	966.74	971.84	0.75	972.85	0.003226	8.09	253.03	66.25	0.73
Reach-1	49333	1761	966.74	971.39	0.73	972.35	0.003475	7.87	223.65	64.67	0.75
Reach-1	49333	1670	966.74	971.25	0.72	972.19	0.003535	7.77	214.8	64.19	0.75
Reach-1	49333	1612	966.74	971.16	0.71	972.08	0.003587	7.72	208.89	63.86	0.75
Reach-1	49333	1422	966.74	970.85	0.69	971.72	0.003772	7.51	189.39	62.77	0.76
Reach-1	49333	976	966.74	970.03	0.66	970.79	0.004604	7	139.36	59.89	0.81
Reach-1	49333	460	966.74	968.93	0.6	969.51	0.007151	6.1	75.41	56	0.93
Reach-1	49333	134	966.74	968.09	0.37	968.38	0.008897	4.3	31.14	46.22	0.92
Reach-1	49378	8721	965.54	980.49	0.93	982.31	0.001219	11.04	914.25	96.3	0.55
Reach-1	49378	7239	965.54	978.71	0.94	980.47	0.001429	10.8	749.07	88.72	0.58
Reach-1	49378	4375	965.54	974.77	1.02	976.46	0.002443	10.46	432.83	72	0.7
Reach-1	49378	3336	965.54	973.59	0.93	975.04	0.002664	9.65	350.97	67	0.71
Reach-1	49378	2047	965.54	971.93	0.78	973.01	0.003122	8.35	245.14	59.91	0.73
Reach-1	49378	1761	965.54	971.51	0.73	972.5	0.00317	7.98	220.57	58.15	0.72
Reach-1	49378	1670	965.54	971.39	0.7	972.34	0.003129	7.81	213.69	57.64	0.72
Reach-1	49378	1612	965.54	971.31	0.69	972.23	0.003106	7.71	209.14	57.3	0.71
Reach-1	49378	1422	965.54	971.05	0.63	971.88	0.00301	7.32	194.17	56.18	0.69
Reach-1	49378	976	965.54	970.37	0.48	970.97	0.00266	6.21	157.17	53.31	0.64
Reach-1	49378	460	965.54	969.39	0.25	969.68	0.0019	4.3	106.87	49.14	0.51
Reach-1	49378	134	965.54	968.41	0.08	968.49	0.000851	2.19	61.09	42.56	0.32

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Reach-1	49433	8721	965.24	980.27	0.74	982.5	0.001075	12.06	779.86	83.87	0.62
Reach-1	49433	7239	965.24	978.5	0.76	980.67	0.001295	11.86	637.58	76.78	0.66
Reach-1	49433	4375	965.24	974.52	0.92	976.77	0.002609	12.03	363.71	61.01	0.87
Reach-1	49433	3336	965.24	973.37	0.85	975.35	0.00278	11.28	295.79	57.35	0.88
Reach-1	49433	2047	965.24	971.83	0.68	973.29	0.002821	9.71	210.9	52.42	0.85
Reach-1	49433	1761	965.24	971.45	0.63	972.76	0.00279	9.21	191.28	51.21	0.84
Reach-1	49433	1670	965.24	971.34	0.6	972.6	0.002735	8.99	185.82	50.87	0.83
Reach-1	49433	1612	965.24	971.27	0.59	972.49	0.002704	8.85	182.18	50.64	0.82
Reach-1	49433	1422	965.24	971.03	0.53	972.11	0.002585	8.36	170.06	49.87	0.8
Reach-1	49433	976	965.24	970.4	0.39	971.16	0.002228	7.01	139.21	47.86	0.72
Reach-1	49433	460	965.24	969.43	0.21	969.8	0.001631	4.88	94.32	44.72	0.59
Reach-1	49433	134	965.24	968.44	0.06	968.53	0.00059	2.44	54.96	34.39	0.34
Reach-1	49488	8721	966.14	980.15	1.32	982.66	0.001784	13.08	802.8	86.12	0.66
Reach-1	49488	7239	966.14	978.39	1.35	980.85	0.002138	12.88	655.98	80.31	0.71
Reach-1	49488	4375	966.14	974.53	1.57	977.02	0.003971	12.82	370.44	67.58	0.89
Reach-1	49488	3336	966.14	973.44	1.43	975.59	0.004366	11.87	298.62	63.98	0.91
Reach-1	49488	2047	966.14	971.92	1.2	973.55	0.005108	10.27	205.67	58.99	0.93
Reach-1	49488	1761	966.14	971.53	1.15	973.04	0.005492	9.89	182.41	57.68	0.94
Reach-1	49488	1670	966.14	971.41	1.13	972.87	0.005558	9.72	175.66	57.29	0.95
Reach-1	49488	1612	966.14	971.33	1.11	972.76	0.005612	9.61	171.23	57.04	0.95
Reach-1	49488	1422	966.14	971.05	1.08	972.39	0.00596	9.31	155.19	56.1	0.96
Reach-1	49488	976	966.14	970.4	0.9	971.45	0.006215	8.22	119.67	52.67	0.94
Reach-1	49488	460	966.14	969.39	0.64	970.04	0.006333	6.49	70.9	43.65	0.9
Reach-1	49488	134	966.14	968.4	0.26	968.64	0.003697	3.9	34.4	30.4	0.65
Reach-1	49538	8721	967.04	980.04	1.48	982.84	0.002025	13.82	755.94	81.03	0.71
Reach-1	49538	7239	967.04	974.52	4.72	981.96	0.01211	22.19	357.75	64.53	1.56
Reach-1	49538	4375	967.04	972.9	3.53	977.99	0.012199	18.26	255.81	61.51	1.49
Reach-1	49538	3336	967.04	972.24	2.95	976.31	0.011867	16.28	215.96	60.29	1.43
Reach-1	49538	2047	967.04	971.29	2.13	973.98	0.011228	13.2	159.94	56.96	1.33
Reach-1	49538	1761	967.04	971.04	1.92	973.41	0.011043	12.38	145.99	56.09	1.3
Reach-1	49538	1670	967.04	970.95	1.86	973.23	0.011048	12.12	141.11	55.79	1.3
Reach-1	49538	1612	967.04	970.92	1.79	973.09	0.010738	11.85	139.22	55.67	1.28
Reach-1	49538	1422	967.04	970.72	1.67	972.7	0.010856	11.31	128.1	54.97	1.27
Reach-1	49538	976	967.04	970.92	0.66	971.71	0.00396	7.19	138.95	55.65	0.77
Reach-1	49538	460	967.04	969.83	0.5	970.34	0.005086	5.75	80.3	51.84	0.8
Reach-1	49538	134	967.04	968.62	0.5	969.02	0.010215	5.11	26.2	33.21	1.01
Reach-1	49588	8721	967.04	976.33	4.77	984.36	0.010519	22.86	402.75	62.74	1.47
Reach-1	49588	7239	967.04	975.5	4.35	982.56	0.010776	21.4	351.72	60.08	1.46
Reach-1	49588	4375	967.04	973.71	3.32	978.59	0.011212	17.75	249.14	54.37	1.41
Reach-1	49588	3336	967.04	972.98	2.81	976.9	0.011138	15.9	210.41	52.04	1.37
Reach-1	49588	2047	967.04	971.97	1.99	974.53	0.01008	12.84	159.47	48.82	1.25
Reach-1	49588	1761	967.04	971.7	1.78	973.94	0.009657	12.03	146.38	47.96	1.21
Reach-1	49588	1670	967.04	971.63	1.68	973.74	0.00928	11.66	143.21	47.75	1.19
Reach-1	49588	1612	967.04	971.92	1.28	973.55	0.006561	10.27	156.92	48.65	1.01
Reach-1	49588	1422	967.04	971.35	1.52	973.21	0.009043	10.95	129.91	46.85	1.16
Reach-1	49588	976	967.04	970.78	1.19	972.15	0.008453	9.4	103.86	45.04	1.09
Reach-1	49588	460	967.04	970	0.66	970.68	0.006518	6.61	69.63	42.55	0.91
Reach-1	49588	134	967.04	969.12	0.26	969.35	0.004058	3.86	34.71	33.45	0.67
Reach-1	49633	8721	967.04	977.45	4.25	984.84	0.008218	22.06	429.24	59.5	1.33
Reach-1	49633	7239	967.04	976.5	3.9	983.04	0.008473	20.71	373.63	57.21	1.32
Reach-1	49633	4375	967.04	974.43	3.04	979.07	0.009052	17.34	260.57	52.27	1.3

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Reach-1	49633	3336	967.04	973.59	2.61	977.37	0.009156	15.64	217.49	49.95	1.27
Reach-1	49633	2047	967.04	972.43	1.9	974.95	0.008783	12.76	161.38	46.55	1.19
Reach-1	49633	1761	967.04	972.14	1.7	974.35	0.008428	11.92	148.33	45.72	1.15
Reach-1	49633	1670	967.04	972.07	1.6	974.14	0.008111	11.55	145.11	45.52	1.13
Reach-1	49633	1612	967.04	972.02	1.56	974.01	0.007983	11.34	142.58	45.35	1.11
Reach-1	49633	1422	967.04	971.96	1.26	973.57	0.006566	10.18	140.05	45.19	1.01
Reach-1	49633	976	967.04	971.23	1.08	972.5	0.00707	9.06	107.77	43.02	1.01
Reach-1	49633	460	967.04	970.27	0.65	970.96	0.005825	6.67	68.96	37.96	0.87
Reach-1	49633	134	967.04	969.29	0.26	969.52	0.003729	3.89	34.42	30.64	0.65
Reach-1	49673	8721	966.84	980.15	2.77	985.29	0.004237	18.52	529.3	58.99	0.97
Reach-1	49673	7239	966.84	978.83	2.59	983.48	0.004486	17.54	453.42	55.74	0.98
Reach-1	49673	4375	966.84	975.99	2.12	979.45	0.005131	15.03	305.04	48.76	0.99
Reach-1	49673	3336	966.84	974.82	1.89	977.74	0.005443	13.75	249.77	45.89	0.99
Reach-1	49673	2047	966.84	973.09	1.55	975.27	0.006025	11.86	174.24	41.64	1
Reach-1	49673	1761	966.84	972.64	1.47	974.65	0.006303	11.38	155.5	40.52	1
Reach-1	49673	1670	966.84	972.49	1.44	974.44	0.006368	11.2	149.73	40.17	1.01
Reach-1	49673	1612	966.84	972.41	1.41	974.3	0.006352	11.04	146.46	39.97	1
Reach-1	49673	1422	966.84	972.15	1.29	973.85	0.006196	10.46	136.19	39.33	0.98
Reach-1	49673	976	966.84	971.67	0.86	972.74	0.004682	8.32	117.3	38.13	0.84
Reach-1	49673	460	966.84	970.63	0.46	971.16	0.003434	5.81	79.21	35.59	0.69
Reach-1	49673	134	966.84	969.46	0.19	969.64	0.002326	3.4	39.46	30.15	0.52
Reach-1	49733	8721	968.28	983.98	0.9	985.75	0.001246	10.69	815.57	73.52	0.53
Reach-1	49733	7239	968.28	982.29	0.86	983.92	0.001379	10.23	707.6	70.12	0.54
Reach-1	49733	4375	968.28	978.47	0.82	979.84	0.001912	9.4	465.32	62.64	0.6
Reach-1	49733	3336	968.28	976.82	0.82	978.11	0.002322	9.11	366.33	59.59	0.64
Reach-1	49733	2047	968.28	974.44	0.87	975.65	0.003517	8.81	232.37	53.55	0.74
Reach-1	49733	1761	968.28	973.84	0.89	975.04	0.004038	8.76	200.97	51.85	0.78
Reach-1	49733	1670	968.28	973.64	0.91	974.83	0.004276	8.78	190.3	51.26	0.8
Reach-1	49733	1612	968.28	973.49	0.92	974.7	0.004488	8.81	182.91	50.85	0.82
Reach-1	49733	1422	968.28	972.94	1.04	974.24	0.005758	9.17	155.02	49.26	0.91
Reach-1	49733	976	968.28	972.03	1.04	973.22	0.00746	8.76	111.45	46.67	1
Reach-1	49733	460	968.28	971.02	0.77	971.78	0.008671	7	65.72	43.79	1.01
Reach-1	49733	134	968.28	970.14	0.46	970.48	0.011087	4.74	28.27	41.28	1.01
Reach-1	49763 Bridge										
Reach-1	49798	8721	969.13	984.72	0.83	986.45	0.001013	10.55	826.74	91.82	0.5
Reach-1	49798	7239	969.13	982.81	0.81	984.42	0.001147	10.17	712.1	84.97	0.52
Reach-1	49798	4375	969.13	978.73	0.79	980.09	0.001711	9.37	466.96	70.34	0.59
Reach-1	49798	3336	969.13	977.04	0.82	978.33	0.002245	9.12	365.79	64.3	0.65
Reach-1	49798	2047	969.13	974.65	0.91	975.91	0.003729	9.02	226.88	55.72	0.79
Reach-1	49798	1761	969.13	974.1	0.93	975.34	0.004212	8.95	196.79	53.75	0.82
Reach-1	49798	1670	969.13	973.94	0.92	975.16	0.004298	8.85	188.62	53.2	0.83
Reach-1	49798	1612	969.13	973.82	0.93	975.04	0.00444	8.85	182.21	52.77	0.84
Reach-1	49798	1422	969.13	973.47	0.91	974.64	0.004733	8.67	164.04	51.52	0.86
Reach-1	49798	976	969.13	972.73	0.77	973.65	0.004899	7.72	126.48	48.84	0.84
Reach-1	49798	460	969.13	971.63	0.56	972.21	0.005411	6.11	75.3	44.92	0.83
Reach-1	49798	134	969.13	970.69	0.29	970.92	0.00551	3.9	34.32	41.05	0.75
Reach-1	49800	8721	968	984.91	0.73	986.47	0.000797	10.03	869.54	96.36	0.46
Reach-1	49800	7239	968	983.04	0.68	984.44	0.000854	9.51	761.54	90.14	0.46
Reach-1	49800	4375	968	979.08	0.58	980.13	0.00103	8.22	532.29	76.92	0.48
Reach-1	49800	3336	968	977.49	0.52	978.38	0.001125	7.57	440.5	71.63	0.48

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Reach-1	49800	2047	968	975.32	0.43	975.97	0.001295	6.5	315.02	64.39	0.49
Reach-1	49800	1761	968	974.82	0.4	975.41	0.001319	6.15	286.23	62.73	0.49
Reach-1	49800	1670	968	974.67	0.38	975.23	0.001318	6.02	277.31	62.22	0.48
Reach-1	49800	1612	968	974.56	0.38	975.11	0.001325	5.95	271.08	61.86	0.48
Reach-1	49800	1422	968	974.21	0.35	974.71	0.001331	5.66	251.12	60.71	0.48
Reach-1	49800	976	968	973.34	0.28	973.71	0.001283	4.85	201.12	57.81	0.45
Reach-1	49800	460	968	972.07	0.16	972.26	0.0011	3.53	130.45	53.57	0.4
Reach-1	49800	134	968	970.89	0.06	970.94	0.000654	1.93	69.39	48.09	0.28
Reach-1	49850	8721	967	985.74	0.4	986.57	0.000423	7.46	1312.18	108.15	0.33
Reach-1	49850	7239	967	983.76	0.38	984.54	0.000465	7.15	1105.65	101.03	0.34
Reach-1	49850	4375	967	979.59	0.34	980.21	0.000588	6.32	715.62	85.99	0.36
Reach-1	49850	3336	967	977.94	0.31	978.47	0.000649	5.85	578.21	80.02	0.37
Reach-1	49850	2047	967	975.65	0.26	976.05	0.000757	5.05	404.99	71.78	0.37
Reach-1	49850	1761	967	975.13	0.24	975.48	0.000747	4.79	367.62	69.88	0.37
Reach-1	49850	1670	967	974.96	0.23	975.3	0.000738	4.69	356.11	69.28	0.36
Reach-1	49850	1612	967	974.85	0.22	975.18	0.000734	4.63	348.29	68.88	0.36
Reach-1	49850	1422	967	974.48	0.21	974.78	0.000711	4.4	323.27	67.55	0.35
Reach-1	49850	976	967	973.55	0.15	973.77	0.000624	3.72	262.29	64.22	0.32
Reach-1	49850	460	967	972.2	0.08	972.31	0.000442	2.57	178.84	59.34	0.26
Reach-1	49850	134	967	970.94	0.02	970.96	0.000184	1.26	106.63	54.15	0.16
Reach-1	49900	8721	966.5	985.9	0.33	986.61	0.000342	6.87	1452.54	119.36	0.3
Reach-1	49900	7239	966.5	983.92	0.32	984.57	0.000372	6.57	1224.35	111.05	0.31
Reach-1	49900	4375	966.5	979.74	0.27	980.24	0.00045	5.74	796.42	93.49	0.32
Reach-1	49900	3336	966.5	978.07	0.24	978.5	0.000483	5.27	646.78	86.52	0.32
Reach-1	49900	2047	966.5	975.78	0.19	976.09	0.000529	4.46	459.41	76.9	0.32
Reach-1	49900	1761	966.5	975.25	0.18	975.52	0.000521	4.2	418.91	74.66	0.31
Reach-1	49900	1670	966.5	975.08	0.17	975.34	0.000514	4.11	406.38	73.95	0.31
Reach-1	49900	1612	966.5	974.96	0.17	975.22	0.000511	4.05	397.91	73.47	0.31
Reach-1	49900	1422	966.5	974.59	0.15	974.82	0.000489	3.84	370.69	71.9	0.3
Reach-1	49900	976	966.5	973.64	0.11	973.8	0.00041	3.21	304.42	67.92	0.27
Reach-1	49900	460	966.5	972.25	0.05	972.33	0.000258	2.15	214.31	62.11	0.2
Reach-1	49900	134	966.5	970.95	0.01	970.97	0.000085	0.98	137.11	56.51	0.11
Reach-1	49950	8721	967	985.77	0.45	986.69	0.000467	7.91	1301.75	112.72	0.35
Reach-1	49950	7239	967	983.8	0.43	984.66	0.000516	7.6	1087.33	104.33	0.36
Reach-1	49950	4375	967	979.63	0.38	980.33	0.000654	6.75	689.75	86.65	0.38
Reach-1	49950	3336	967	977.98	0.35	978.59	0.000719	6.25	552.72	79.65	0.39
Reach-1	49950	2047	967	975.72	0.29	976.17	0.000826	5.37	383.13	70.03	0.39
Reach-1	49950	1761	967	975.19	0.27	975.59	0.000842	5.09	346.83	67.8	0.39
Reach-1	49950	1670	967	975.02	0.26	975.41	0.000839	4.98	335.64	67.09	0.39
Reach-1	49950	1612	967	974.91	0.25	975.29	0.000838	4.92	328.05	66.61	0.39
Reach-1	49950	1422	967	974.54	0.23	974.88	0.000826	4.68	303.75	65.04	0.38
Reach-1	49950	976	967	973.61	0.18	973.85	0.000735	3.99	244.77	61.07	0.35
Reach-1	49950	460	967	972.24	0.1	972.36	0.000525	2.78	165.18	55.26	0.28
Reach-1	49950	134	967	970.96	0.03	970.99	0.000217	1.37	97.89	49.47	0.17
Reach-1	50000	8721	967.5	985.87	0.42	986.72	0.00045	7.69	1395.13	129.27	0.34
Reach-1	50000	7239	967.5	983.87	0.42	984.69	0.00051	7.47	1147.84	118.33	0.36
Reach-1	50000	4375	967.5	979.66	0.39	980.36	0.000696	6.8	698.46	95.29	0.39
Reach-1	50000	3336	967.5	978	0.37	978.63	0.000797	6.38	548.15	86.22	0.41
Reach-1	50000	2047	967.5	975.73	0.32	976.22	0.000996	5.63	366.34	73.77	0.43
Reach-1	50000	1761	967.5	975.2	0.31	975.65	0.001044	5.38	328.19	70.88	0.43
Reach-1	50000	1670	967.5	975.04	0.3	975.47	0.001055	5.28	316.48	69.97	0.43

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Reach-1	50000	1612	967.5	974.92	0.29	975.35	0.001068	5.23	308.55	69.35	0.43
Reach-1	50000	1422	967.5	974.55	0.28	974.95	0.001088	5.02	283.22	67.32	0.43
Reach-1	50000	976	967.5	973.61	0.22	973.91	0.001028	4.39	222.34	62.17	0.41
Reach-1	50000	460	967.5	972.24	0.14	972.4	0.000853	3.24	141.85	54.62	0.35
Reach-1	50000	134	967.5	970.96	0.04	971.01	0.00041	1.72	77.92	45.04	0.23
Reach-1	50050	8721	967	986.03	0.35	986.76	0.000367	6.97	1550.16	197.59	0.31
Reach-1	50050	7239	967	984.05	0.34	984.73	0.000406	6.7	1221.99	121.37	0.32
Reach-1	50050	4375	967	979.86	0.3	980.41	0.000524	5.97	768.87	97.23	0.34
Reach-1	50050	3336	967	978.2	0.28	978.68	0.000584	5.55	614.81	88.64	0.35
Reach-1	50050	2047	967	975.92	0.23	976.28	0.000691	4.81	425.86	76.81	0.36
Reach-1	50050	1761	967	975.38	0.22	975.71	0.000686	4.57	385.5	74.04	0.35
Reach-1	50050	1670	967	975.21	0.21	975.53	0.000679	4.48	373.03	73.16	0.35
Reach-1	50050	1612	967	975.1	0.2	975.4	0.000675	4.42	364.63	72.57	0.35
Reach-1	50050	1422	967	974.72	0.19	975	0.000653	4.21	337.7	70.62	0.34
Reach-1	50050	976	967	973.76	0.14	973.96	0.00057	3.59	272.1	65.63	0.31
Reach-1	50050	460	967	972.34	0.08	972.43	0.000395	2.5	183.86	58.25	0.25
Reach-1	50050	134	967	971	0.02	971.02	0.000153	1.21	110.54	51.31	0.15
Reach-1	50100	8721	966	986.28	0.24	986.79	0.000241	5.87	1836.66	195.35	0.25
Reach-1	50100	7239	966	984.28	0.23	984.76	0.000266	5.66	1466.81	155.31	0.26
Reach-1	50100	4375	966	980.07	0.2	980.44	0.000317	4.92	932.16	108.3	0.27
Reach-1	50100	3336	966	978.4	0.18	978.72	0.000336	4.5	758.98	99.58	0.27
Reach-1	50100	2047	966	976.1	0.14	976.32	0.000356	3.78	543.12	87.89	0.26
Reach-1	50100	1761	966	975.55	0.12	975.75	0.000349	3.55	495.98	85.12	0.26
Reach-1	50100	1670	966	975.38	0.12	975.57	0.000344	3.47	481.27	84.24	0.25
Reach-1	50100	1612	966	975.26	0.12	975.44	0.000341	3.42	471.41	83.64	0.25
Reach-1	50100	1422	966	974.88	0.11	975.04	0.000327	3.24	439.56	81.69	0.25
Reach-1	50100	976	966	973.87	0.08	973.99	0.000273	2.71	360.14	76.59	0.22
Reach-1	50100	460	966	972.4	0.04	972.45	0.000171	1.82	252.67	69.1	0.17
Reach-1	50100	134	966	971.02	0.01	971.03	0.000055	0.83	162.31	62.11	0.09
Reach-1	50150	8721	966	986.16	0.34	986.87	0.000335	6.94	1588.38	201.59	0.3
Reach-1	50150	7239	966	984.16	0.33	984.84	0.000372	6.72	1220.58	140.55	0.31
Reach-1	50150	4375	966	980	0.27	980.5	0.000418	5.72	801.63	88.74	0.31
Reach-1	50150	3336	966	978.35	0.23	978.77	0.00043	5.18	660.28	82.84	0.3
Reach-1	50150	2047	966	976.08	0.17	976.36	0.00043	4.27	481.16	74.69	0.29
Reach-1	50150	1761	966	975.54	0.16	975.78	0.00042	3.99	441.47	72.76	0.28
Reach-1	50150	1670	966	975.37	0.15	975.6	0.000414	3.9	429.02	72.14	0.28
Reach-1	50150	1612	966	975.25	0.15	975.48	0.000411	3.83	420.65	71.72	0.28
Reach-1	50150	1422	966	974.87	0.13	975.07	0.000394	3.61	393.54	70.36	0.27
Reach-1	50150	976	966	973.87	0.1	974.01	0.000325	3	325.21	66.79	0.24
Reach-1	50150	460	966	972.4	0.05	972.46	0.0002	1.99	230.9	61.52	0.18
Reach-1	50150	134	966	971.03	0.01	971.04	0.000063	0.89	149.91	56.61	0.1
Reach-1	50200	8721	966	986.1	0.38	986.92	0.000381	7.39	1502.12	244.51	0.32
Reach-1	50200	7239	966	984.13	0.36	984.88	0.000406	7.02	1172.77	113.56	0.32
Reach-1	50200	4375	966	979.98	0.29	980.54	0.000461	6.02	763.91	84.85	0.32
Reach-1	50200	3336	966	978.34	0.26	978.8	0.000471	5.45	629.61	78.99	0.32
Reach-1	50200	2047	966	976.07	0.19	976.38	0.000466	4.48	459.34	70.87	0.3
Reach-1	50200	1761	966	975.54	0.17	975.81	0.000453	4.18	421.97	68.96	0.29
Reach-1	50200	1670	966	975.36	0.16	975.62	0.000447	4.07	410.25	68.35	0.29
Reach-1	50200	1612	966	975.25	0.16	975.5	0.000444	4.01	402.37	67.94	0.29
Reach-1	50200	1422	966	974.87	0.14	975.09	0.000425	3.77	376.84	66.58	0.28
Reach-1	50200	976	966	973.88	0.1	974.03	0.000345	3.12	312.46	63.03	0.25

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Reach-1	50200	460	966	972.4	0.05	972.47	0.000206	2.06	223.5	57.77	0.18
Reach-1	50200	134	966	971.04	0.01	971.05	0.000061	0.91	147.97	52.89	0.1
Reach-1	50250	8721	965	986.15	0.4	986.94	0.000396	7.57	1750.93	244.35	0.32
Reach-1	50250	7239	965	984.06	0.43	984.94	0.000488	7.7	1244.22	241.2	0.35
Reach-1	50250	4375	965	979.92	0.36	980.6	0.000554	6.63	706.72	81.74	0.35
Reach-1	50250	3336	965	978.3	0.31	978.85	0.000557	5.98	580.01	74.42	0.34
Reach-1	50250	2047	965	976.06	0.22	976.43	0.000527	4.85	424.73	64.33	0.32
Reach-1	50250	1761	965	975.53	0.2	975.85	0.000505	4.51	391.23	61.94	0.31
Reach-1	50250	1670	965	975.36	0.19	975.66	0.000495	4.39	380.79	61.18	0.3
Reach-1	50250	1612	965	975.25	0.18	975.54	0.00049	4.32	373.78	60.66	0.3
Reach-1	50250	1422	965	974.87	0.16	975.13	0.000465	4.05	351.18	59.08	0.29
Reach-1	50250	976	965	973.88	0.11	974.05	0.000365	3.32	294.39	55.61	0.25
Reach-1	50250	460	965	972.4	0.05	972.48	0.000197	2.13	216.15	50.44	0.18
Reach-1	50250	134	965	971.05	0.01	971.06	0.000048	0.89	150.85	45.67	0.09
Reach-1	50300	8721	965.22	986.18	0.38	986.96	0.00038	7.32	1565.1	203.91	0.32
Reach-1	50300	7239	965.22	984.2	0.37	984.97	0.000428	7.14	1183.44	152.96	0.33
Reach-1	50300	4375	965.22	980.05	0.31	980.63	0.000492	6.14	744.71	82.68	0.33
Reach-1	50300	3336	965.22	978.41	0.27	978.89	0.000508	5.57	612.94	77.35	0.33
Reach-1	50300	2047	965.22	976.13	0.2	976.46	0.000517	4.61	445.09	69.96	0.32
Reach-1	50300	1761	965.22	975.59	0.18	975.88	0.000509	4.32	407.68	68.2	0.31
Reach-1	50300	1670	965.22	975.41	0.18	975.69	0.000503	4.22	395.92	67.64	0.31
Reach-1	50300	1612	965.22	975.3	0.17	975.56	0.000499	4.16	388.01	67.26	0.3
Reach-1	50300	1422	965.22	974.91	0.16	975.15	0.000478	3.92	362.35	65.86	0.29
Reach-1	50300	976	965.22	973.9	0.11	974.06	0.000387	3.27	298.1	60.89	0.26
Reach-1	50300	460	965.22	972.41	0.05	972.48	0.000221	2.16	212.79	53.57	0.19
Reach-1	50300	134	965.22	971.05	0.01	971.07	0.000056	0.93	144.81	46.93	0.09
Reach-1	50350	8721	966.76	986.49	0.26	987.01	0.000257	6.06	2054.06	256.04	0.26
Reach-1	50350	7239	966.76	984.47	0.27	985.01	0.000306	6.07	1538.81	252.84	0.28
Reach-1	50350	4375	966.76	980.22	0.24	980.67	0.000384	5.4	851.4	100.55	0.3
Reach-1	50350	3336	966.76	978.54	0.21	978.92	0.000408	4.94	694.07	90.58	0.3
Reach-1	50350	2047	966.76	976.21	0.17	976.48	0.000444	4.18	492.39	82.22	0.29
Reach-1	50350	1761	966.76	975.66	0.16	975.9	0.000448	3.94	447.46	80.24	0.29
Reach-1	50350	1670	966.76	975.48	0.15	975.71	0.000447	3.86	433.31	79.61	0.29
Reach-1	50350	1612	966.76	975.36	0.15	975.59	0.000448	3.81	423.82	79.18	0.29
Reach-1	50350	1422	966.76	974.97	0.14	975.17	0.000445	3.62	392.93	77.7	0.28
Reach-1	50350	976	966.76	973.93	0.1	974.08	0.00039	3.09	315.48	71.69	0.26
Reach-1	50350	460	966.76	972.42	0.05	972.49	0.000265	2.15	213.64	62.91	0.21
Reach-1	50350	134	966.76	971.06	0.01	971.08	0.000089	1	133.78	55.06	0.11
Reach-1	50400	8721	966	986.48	0.27	987.03	0.000267	6.25	1975.96	237.41	0.27
Reach-1	50400	7239	966	984.46	0.28	985.03	0.000311	6.21	1506.57	229.62	0.28
Reach-1	50400	4375	966	980.24	0.24	980.69	0.000366	5.42	856.92	98.78	0.29
Reach-1	50400	3336	966	978.57	0.21	978.94	0.000374	4.91	701.82	88.23	0.28
Reach-1	50400	2047	966	976.25	0.15	976.5	0.000372	4.04	509.93	77.92	0.27
Reach-1	50400	1761	966	975.71	0.14	975.93	0.000361	3.77	468.35	75.73	0.26
Reach-1	50400	1670	966	975.53	0.13	975.74	0.000357	3.67	454.93	75	0.26
Reach-1	50400	1612	966	975.41	0.13	975.61	0.000355	3.62	445.95	74.52	0.26
Reach-1	50400	1422	966	975.01	0.12	975.2	0.000344	3.41	416.76	72.92	0.25
Reach-1	50400	976	966	973.96	0.09	974.09	0.000292	2.86	341.78	69.52	0.23
Reach-1	50400	460	966	972.44	0.04	972.5	0.000189	1.92	239.61	64.62	0.18
Reach-1	50400	134	966	971.07	0.01	971.08	0.000062	0.87	154.26	60.23	0.1

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Reach-1	50450	8721	966.48	986.47	0.29	987.05	0.000295	6.43	1847.23	305.64	0.28
Reach-1	50450	7239	966.48	984.46	0.29	985.05	0.00034	6.32	1423.71	166.96	0.29
Reach-1	50450	4375	966.48	980.24	0.26	980.73	0.000431	5.64	826.58	99.1	0.31
Reach-1	50450	3336	966.48	978.56	0.24	978.98	0.000465	5.2	666.64	91.39	0.31
Reach-1	50450	2047	966.48	976.24	0.19	976.54	0.000515	4.42	466.77	80.72	0.31
Reach-1	50450	1761	966.48	975.7	0.17	975.97	0.000517	4.17	423.76	78.23	0.31
Reach-1	50450	1670	966.48	975.52	0.17	975.78	0.000515	4.08	409.91	77.42	0.31
Reach-1	50450	1612	966.48	975.4	0.17	975.65	0.000515	4.03	400.65	76.87	0.31
Reach-1	50450	1422	966.48	975	0.15	975.23	0.000511	3.84	370.6	75.05	0.3
Reach-1	50450	976	966.48	973.95	0.12	974.12	0.000481	3.32	294.14	70.21	0.29
Reach-1	50450	460	966.48	972.44	0.07	972.53	0.000373	2.38	193.37	63.28	0.24
Reach-1	50450	134	966.48	971.07	0.02	971.09	0.00016	1.2	112.04	55.04	0.15
Reach-1	50500	8721	966.2	986.55	0.26	987.07	0.000259	6.15	2130.64	394.04	0.26
Reach-1	50500	7239	966.2	984.51	0.27	985.06	0.000306	6.14	1535.63	221.4	0.28
Reach-1	50500	4375	966.2	980.31	0.24	980.75	0.000368	5.39	884.89	107.41	0.29
Reach-1	50500	3336	966.2	978.63	0.21	979	0.000388	4.93	714.39	97.16	0.29
Reach-1	50500	2047	966.2	976.3	0.16	976.57	0.000408	4.13	501.95	84.66	0.28
Reach-1	50500	1761	966.2	975.76	0.15	975.99	0.000403	3.88	456.92	81.11	0.28
Reach-1	50500	1670	966.2	975.58	0.14	975.8	0.0004	3.79	442.52	79.94	0.28
Reach-1	50500	1612	966.2	975.46	0.14	975.68	0.0004	3.74	432.95	79.15	0.27
Reach-1	50500	1422	966.2	975.06	0.13	975.26	0.000395	3.54	402.01	76.56	0.27
Reach-1	50500	976	966.2	974	0.1	974.14	0.000351	3.01	324.09	70.63	0.25
Reach-1	50500	460	966.2	972.48	0.05	972.54	0.000227	2.06	222.81	62.18	0.19
Reach-1	50500	134	966.2	971.08	0.01	971.1	0.000073	0.95	141.44	54.45	0.1
Reach-1	50550	8721	966.5	986.74	0.35	987.1	0.00034	5.34	2589.99	461.5	0.23
Reach-1	50550	7239	966.5	984.63	0.41	985.09	0.00046	5.68	1636.9	357.27	0.26
Reach-1	50550	4375	966.5	980.38	0.37	980.77	0.000583	5.1	921.63	110.16	0.28
Reach-1	50550	3336	966.5	978.7	0.33	979.03	0.000623	4.69	743.53	101.58	0.28
Reach-1	50550	2047	966.5	976.36	0.26	976.6	0.000673	3.97	520.09	88.28	0.28
Reach-1	50550	1761	966.5	975.81	0.24	976.03	0.000669	3.74	472.92	84.35	0.27
Reach-1	50550	1670	966.5	975.63	0.23	975.84	0.000667	3.65	457.86	83.05	0.27
Reach-1	50550	1612	966.5	975.51	0.23	975.71	0.000668	3.6	447.87	82.18	0.27
Reach-1	50550	1422	966.5	975.11	0.21	975.29	0.00066	3.42	415.58	79.27	0.26
Reach-1	50550	976	966.5	974.04	0.16	974.17	0.000556	2.91	335.16	71.56	0.24
Reach-1	50550	460	966.5	972.5	0.08	972.56	0.000335	1.97	233.37	61.47	0.18
Reach-1	50550	134	966.5	971.09	0.02	971.1	0.0001	0.88	151.76	54.2	0.09
Reach-1	50600	8721	966.5	986.91	0.24	987.14	0.000251	4.42	3330.07	484	0.19
Reach-1	50600	7239	966.5	984.81	0.31	985.13	0.000368	4.89	2314.81	479.81	0.23
Reach-1	50600	4375	966.5	980.44	0.36	980.81	0.000612	4.96	944.4	116.42	0.28
Reach-1	50600	3336	966.5	978.75	0.33	979.08	0.000672	4.6	757.18	106.28	0.28
Reach-1	50600	2047	966.5	976.4	0.27	976.64	0.000779	3.97	520.94	94.41	0.29
Reach-1	50600	1761	966.5	975.85	0.25	976.07	0.000795	3.76	469.86	91.29	0.28
Reach-1	50600	1670	966.5	975.67	0.25	975.88	0.0008	3.69	453.48	89.96	0.28
Reach-1	50600	1612	966.5	975.55	0.24	975.75	0.000806	3.65	442.61	89.07	0.28
Reach-1	50600	1422	966.5	975.14	0.23	975.33	0.000822	3.49	407.43	86.09	0.28
Reach-1	50600	976	966.5	974.07	0.18	974.21	0.000777	3.06	319.17	78.21	0.27
Reach-1	50600	460	966.5	972.52	0.11	972.6	0.000599	2.23	206.64	66.86	0.22
Reach-1	50600	134	966.5	971.1	0.03	971.12	0.000255	1.12	119.3	56.5	0.14
Reach-1	50650	8721	967.5	986.86	0.32	987.18	0.000306	5.17	2948.59	511.5	0.22
Reach-1	50650	7239	967.5	984.76	0.39	985.18	0.00042	5.57	1915.43	425.69	0.25
Reach-1	50650	4375	967.5	980.43	0.39	980.86	0.000589	5.3	932.3	133.23	0.28

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Reach-1	50650	3336	967.5	978.76	0.35	979.12	0.000615	4.86	730.7	112.04	0.28
Reach-1	50650	2047	967.5	976.44	0.26	976.69	0.000599	3.99	519.77	81.18	0.26
Reach-1	50650	1761	967.5	975.89	0.23	976.1	0.00058	3.72	476.02	77.23	0.25
Reach-1	50650	1670	967.5	975.71	0.22	975.91	0.000572	3.63	462.12	75.94	0.25
Reach-1	50650	1612	967.5	975.58	0.21	975.78	0.000568	3.57	452.91	75.06	0.25
Reach-1	50650	1422	967.5	975.19	0.19	975.36	0.000547	3.36	423.83	72.24	0.24
Reach-1	50650	976	967.5	974.12	0.14	974.24	0.000459	2.8	349.07	67.72	0.22
Reach-1	50650	460	967.5	972.55	0.07	972.61	0.000282	1.86	247.68	62.12	0.16
Reach-1	50650	134	967.5	971.11	0.02	971.12	0.000087	0.83	161.84	56.95	0.09
Reach-1	50700	8721	968.5	986.86	0.36	987.2	0.000373	5.35	2646.72	427.41	0.23
Reach-1	50700	7239	968.5	984.77	0.43	985.21	0.000514	5.74	1771.99	368.76	0.27
Reach-1	50700	4375	968.5	980.43	0.47	980.91	0.000813	5.68	868.3	147.88	0.32
Reach-1	50700	3336	968.5	978.76	0.43	979.18	0.000886	5.26	678.68	100.21	0.32
Reach-1	50700	2047	968.5	976.42	0.36	976.75	0.001036	4.58	457.76	88.82	0.33
Reach-1	50700	1761	968.5	975.87	0.34	976.16	0.001063	4.35	409.42	85	0.33
Reach-1	50700	1670	968.5	975.69	0.33	975.97	0.00107	4.27	394.21	82.55	0.33
Reach-1	50700	1612	968.5	975.57	0.32	975.84	0.001078	4.22	384.24	80.9	0.33
Reach-1	50700	1422	968.5	975.17	0.3	975.42	0.001092	4.03	353.37	75.57	0.32
Reach-1	50700	976	968.5	974.1	0.25	974.29	0.001103	3.54	275.77	70.5	0.32
Reach-1	50700	460	968.5	972.54	0.17	972.65	0.001122	2.72	169.35	65.73	0.3
Reach-1	50700	134	968.5	971.11	0.05	971.14	0.000364	1.43	93.55	40.42	0.17
Reach-1	50750	8721	968.5	987	0.26	987.23	0.000256	4.67	3595.9	640.28	0.2
Reach-1	50750	7239	968.5	984.89	0.35	985.24	0.000391	5.29	2251.54	633.93	0.24
Reach-1	50750	4375	968.5	980.47	0.45	980.95	0.000696	5.61	857.99	161.41	0.3
Reach-1	50750	3336	968.5	978.82	0.39	979.22	0.000717	5.09	679.27	87.85	0.3
Reach-1	50750	2047	968.5	976.52	0.3	976.8	0.000734	4.23	487.89	78.12	0.29
Reach-1	50750	1761	968.5	975.97	0.27	976.21	0.000724	3.97	445.53	75.79	0.28
Reach-1	50750	1670	968.5	975.79	0.26	976.02	0.00072	3.88	431.85	75.03	0.28
Reach-1	50750	1612	968.5	975.67	0.25	975.89	0.000718	3.82	422.76	74.51	0.28
Reach-1	50750	1422	968.5	975.27	0.23	975.47	0.000705	3.61	393.65	72.85	0.27
Reach-1	50750	976	968.5	974.19	0.18	974.34	0.000636	3.07	317.43	68.79	0.25
Reach-1	50750	460	968.5	972.62	0.1	972.69	0.000466	2.15	213.58	63.09	0.21
Reach-1	50750	134	968.5	971.13	0.03	971.15	0.000214	1.08	123.72	57.71	0.13
Reach-1	50800	8721	967.5	987.01	0.26	987.24	0.000266	4.61	3341.96	586.16	0.2
Reach-1	50800	7239	967.5	984.95	0.32	985.26	0.000376	5.02	2147.24	530.03	0.23
Reach-1	50800	4375	967.5	980.56	0.41	980.99	0.000672	5.33	980.78	237.86	0.29
Reach-1	50800	3336	967.5	978.89	0.37	979.26	0.000728	4.93	712.12	104.04	0.29
Reach-1	50800	2047	967.5	976.57	0.29	976.83	0.000777	4.16	498.09	84.38	0.29
Reach-1	50800	1761	967.5	976.01	0.27	976.25	0.000776	3.92	452.21	81.24	0.28
Reach-1	50800	1670	967.5	975.83	0.26	976.06	0.000774	3.83	437.47	80.2	0.28
Reach-1	50800	1612	967.5	975.71	0.25	975.93	0.000775	3.78	427.7	79.51	0.28
Reach-1	50800	1422	967.5	975.31	0.23	975.51	0.00077	3.59	396.54	77.26	0.28
Reach-1	50800	976	967.5	974.23	0.19	974.37	0.000737	3.09	315.41	72.81	0.26
Reach-1	50800	460	967.5	972.64	0.11	972.72	0.000622	2.25	204.35	67.32	0.23
Reach-1	50800	134	967.5	971.14	0.03	971.16	0.000199	1.19	112.45	40.07	0.13
Reach-1	50850	8721	966.5	987.07	0.22	987.26	0.000209	4.25	3713.6	599.75	0.18
Reach-1	50850	7239	966.5	985.05	0.26	985.28	0.000282	4.55	2516.47	582.88	0.21
Reach-1	50850	4375	966.5	980.74	0.3	981.03	0.000459	4.65	1309.18	233.23	0.25
Reach-1	50850	3336	966.5	978.98	0.32	979.3	0.000582	4.66	903.27	227.59	0.27
Reach-1	50850	2047	966.5	976.61	0.28	976.88	0.00067	4.1	510.04	89.05	0.28
Reach-1	50850	1761	966.5	976.06	0.25	976.29	0.000661	3.85	461.95	83.33	0.27

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Reach-1	50850	1670	966.5	975.87	0.24	976.09	0.000657	3.77	446.8	81.45	0.27
Reach-1	50850	1612	966.5	975.75	0.24	975.96	0.000656	3.71	436.87	80.19	0.27
Reach-1	50850	1422	966.5	975.35	0.22	975.54	0.000644	3.51	405.6	76.08	0.26
Reach-1	50850	976	966.5	974.27	0.16	974.4	0.000571	2.98	327.73	68.83	0.24
Reach-1	50850	460	966.5	972.67	0.08	972.74	0.000372	2.05	224.65	60.43	0.19
Reach-1	50850	134	966.5	971.15	0.02	971.17	0.000127	0.96	139.13	52.03	0.1
Reach-1	50900	8721	967.5	987.08	0.22	987.27	0.000218	4.22	3784.56	669.11	0.18
Reach-1	50900	7239	967.5	985.04	0.28	985.3	0.000313	4.64	2474.9	619.45	0.21
Reach-1	50900	4375	967.5	980.73	0.33	981.07	0.000529	4.82	1129.25	236.33	0.26
Reach-1	50900	3336	967.5	979.01	0.32	979.33	0.000603	4.58	783.36	119.15	0.27
Reach-1	50900	2047	967.5	976.67	0.25	976.91	0.000646	3.87	536.66	93.02	0.27
Reach-1	50900	1761	967.5	976.11	0.23	976.32	0.000644	3.65	486.05	86.96	0.26
Reach-1	50900	1670	967.5	975.93	0.22	976.12	0.000643	3.57	470.1	85.26	0.26
Reach-1	50900	1612	967.5	975.8	0.22	975.99	0.000644	3.52	459.59	84.41	0.26
Reach-1	50900	1422	967.5	975.4	0.2	975.57	0.000639	3.34	426.07	81.64	0.25
Reach-1	50900	976	967.5	974.31	0.16	974.43	0.000598	2.87	340.31	76.23	0.24
Reach-1	50900	460	967.5	972.7	0.09	972.76	0.000484	2.07	222.71	70.01	0.2
Reach-1	50900	134	967.5	971.16	0.03	971.18	0.000285	1.12	119.87	64.07	0.14
Reach-1	50950	8721	968.5	987.08	0.22	987.27	0.000211	4.23	3983.95	715	0.18
Reach-1	50950	7239	968.5	985.04	0.29	985.32	0.000319	4.77	2553.24	647.5	0.22
Reach-1	50950	4375	968.5	980.74	0.34	981.09	0.000534	4.92	1068.11	198.75	0.27
Reach-1	50950	3336	968.5	979.04	0.32	979.36	0.000597	4.63	781.72	135.11	0.27
Reach-1	50950	2047	968.5	976.71	0.26	976.95	0.000644	3.92	527.79	87.78	0.27
Reach-1	50950	1761	968.5	976.15	0.23	976.36	0.000645	3.69	479.07	85.11	0.27
Reach-1	50950	1670	968.5	975.96	0.23	976.16	0.000646	3.62	463.32	84.24	0.27
Reach-1	50950	1612	968.5	975.84	0.22	976.04	0.000647	3.57	452.89	83.65	0.26
Reach-1	50950	1422	968.5	975.43	0.21	975.61	0.000646	3.39	419.4	81.74	0.26
Reach-1	50950	976	968.5	974.34	0.16	974.47	0.000617	2.93	332.69	76.58	0.25
Reach-1	50950	460	968.5	972.72	0.1	972.79	0.000505	2.14	215.18	68.97	0.21
Reach-1	50950	134	968.5	971.17	0.03	971.2	0.000288	1.17	114.4	59.86	0.15
Reach-1	51000	8721	967.2	987.12	0.18	987.28	0.000169	3.85	4248.14	778.5	0.16
Reach-1	51000	7239	967.2	985.11	0.22	985.34	0.000242	4.24	2695.09	711.62	0.19
Reach-1	51000	4375	967.2	980.86	0.25	981.13	0.000376	4.24	1278.93	266.73	0.23
Reach-1	51000	3336	967.2	979.15	0.24	979.4	0.000418	3.99	894.14	137.82	0.23
Reach-1	51000	2047	967.2	976.81	0.18	976.98	0.000429	3.33	621.34	97.5	0.22
Reach-1	51000	1761	967.2	976.24	0.16	976.39	0.000425	3.13	566.51	94.79	0.22
Reach-1	51000	1670	967.2	976.05	0.16	976.2	0.000423	3.06	548.74	93.9	0.22
Reach-1	51000	1612	967.2	975.93	0.15	976.07	0.000422	3.01	536.98	93.31	0.22
Reach-1	51000	1422	967.2	975.52	0.14	975.64	0.000416	2.85	499.1	91.36	0.21
Reach-1	51000	976	967.2	974.41	0.11	974.5	0.000387	2.44	400.71	86.1	0.2
Reach-1	51000	460	967.2	972.76	0.06	972.81	0.000292	1.73	265.56	77.44	0.16
Reach-1	51000	134	967.2	971.19	0.02	971.2	0.000118	0.87	153.94	64.3	0.1
Reach-1	51050	8721	965.5	987.1	0.22	987.31	0.00021	4.26	3718.36	665	0.18
Reach-1	51050	7239	965.5	985.08	0.28	985.37	0.000303	4.7	2375.86	665	0.21
Reach-1	51050	4375	965.5	980.86	0.29	981.16	0.00043	4.51	1161.94	228.97	0.24
Reach-1	51050	3336	965.5	979.15	0.26	979.43	0.000469	4.21	848.78	139.36	0.24
Reach-1	51050	2047	965.5	976.82	0.2	977.01	0.000478	3.5	592.03	94.48	0.23
Reach-1	51050	1761	965.5	976.25	0.18	976.42	0.000471	3.29	539.3	90.86	0.23
Reach-1	51050	1670	965.5	976.06	0.18	976.22	0.000469	3.21	522.33	89.66	0.23
Reach-1	51050	1612	965.5	975.94	0.17	976.09	0.000468	3.17	511.16	88.91	0.23
Reach-1	51050	1422	965.5	975.53	0.16	975.67	0.00046	3	475.22	86.62	0.22

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Reach-1	51050	976	965.5	974.42	0.12	974.52	0.000418	2.55	382.73	80.39	0.21
Reach-1	51050	460	965.5	972.78	0.06	972.83	0.000287	1.78	258.62	70.55	0.16
Reach-1	51050	134	965.5	971.2	0.02	971.21	0.000095	0.85	157.52	57.05	0.09
Reach-1	51100	8721	967.5	987.15	0.2	987.32	0.000193	4.07	4258.65	773	0.17
Reach-1	51100	7239	967.5	985.1	0.28	985.39	0.000311	4.74	2680.05	773	0.22
Reach-1	51100	4375	967.5	980.85	0.32	981.18	0.000485	4.74	1070.25	190.52	0.25
Reach-1	51100	3336	967.5	979.16	0.29	979.45	0.000525	4.4	804.72	123.42	0.26
Reach-1	51100	2047	967.5	976.83	0.22	977.04	0.000545	3.68	564.83	92.88	0.25
Reach-1	51100	1761	967.5	976.26	0.2	976.45	0.000542	3.46	513.03	89.66	0.25
Reach-1	51100	1670	967.5	976.07	0.2	976.25	0.00054	3.39	496.3	88.6	0.24
Reach-1	51100	1612	967.5	975.95	0.19	976.12	0.00054	3.34	485.29	87.89	0.24
Reach-1	51100	1422	967.5	975.54	0.18	975.7	0.000535	3.17	449.85	85.58	0.24
Reach-1	51100	976	967.5	974.43	0.14	974.55	0.000507	2.72	358.63	79.3	0.23
Reach-1	51100	460	967.5	972.79	0.08	972.85	0.000378	1.95	236.31	69.77	0.19
Reach-1	51100	134	967.5	971.21	0.02	971.22	0.000175	1.01	133.2	60.1	0.12
Reach-1	51150	8721	967.5	987.14	0.22	987.34	0.000213	4.3	4019.42	712	0.18
Reach-1	51150	7239	967.5	985.11	0.31	985.42	0.000334	4.96	2573.08	712	0.22
Reach-1	51150	4375	967.5	980.84	0.35	981.21	0.000522	4.99	1032.8	187.9	0.26
Reach-1	51150	3336	967.5	979.16	0.32	979.49	0.000557	4.62	769.36	126.24	0.27
Reach-1	51150	2047	967.5	976.84	0.24	977.06	0.000553	3.81	543	83.86	0.25
Reach-1	51150	1761	967.5	976.27	0.21	976.47	0.000541	3.56	496.36	80.87	0.25
Reach-1	51150	1670	967.5	976.09	0.2	976.27	0.000537	3.48	481.31	79.88	0.24
Reach-1	51150	1612	967.5	975.96	0.2	976.14	0.000535	3.43	471.41	79.22	0.24
Reach-1	51150	1422	967.5	975.55	0.18	975.72	0.000522	3.24	439.55	77.07	0.24
Reach-1	51150	976	967.5	974.45	0.14	974.56	0.000447	2.73	357.6	71.22	0.21
Reach-1	51150	460	967.5	972.81	0.07	972.86	0.000289	1.86	247.48	63.67	0.17
Reach-1	51150	134	967.5	971.22	0.02	971.23	0.00011	0.89	150.99	57.82	0.1
Reach-1	51200	8721	968.5	987.22	0.12	987.35	0.000119	3.21	4669.03	766	0.14
Reach-1	51200	7239	968.5	985.28	0.15	985.45	0.000162	3.46	3178.97	766	0.15
Reach-1	51200	4375	968.5	981.1	0.14	981.25	0.000205	3.16	1493.87	194.21	0.17
Reach-1	51200	3336	968.5	979.4	0.12	979.52	0.000211	2.88	1206.19	154.98	0.16
Reach-1	51200	2047	968.5	977.01	0.09	977.09	0.000209	2.37	869.95	125.09	0.15
Reach-1	51200	1761	968.5	976.42	0.08	976.5	0.000205	2.22	797.26	123.37	0.15
Reach-1	51200	1670	968.5	976.23	0.08	976.3	0.000203	2.16	773.44	122.8	0.15
Reach-1	51200	1612	968.5	976.1	0.08	976.17	0.000203	2.13	757.7	122.43	0.15
Reach-1	51200	1422	968.5	975.68	0.07	975.74	0.000198	2.01	706.37	121.19	0.15
Reach-1	51200	976	968.5	974.54	0.05	974.59	0.000187	1.71	570.11	118.39	0.14
Reach-1	51200	460	968.5	972.84	0.03	972.87	0.000164	1.24	371.72	115.39	0.12
Reach-1	51200	134	968.5	971.23	0.01	971.24	0.000128	0.71	188.08	112.54	0.1
Reach-1	51250	8721	968.5	987.21	0.2	987.37	0.000192	4.07	4370.33	729	0.17
Reach-1	51250	7239	968.5	985.23	0.28	985.48	0.000299	4.69	2927.55	729	0.21
Reach-1	51250	4375	968.5	980.97	0.35	981.33	0.00053	5.02	1078.24	202.06	0.27
Reach-1	51250	3336	968.5	979.26	0.33	979.61	0.000594	4.75	773.62	155.47	0.27
Reach-1	51250	2047	968.5	976.91	0.26	977.16	0.000607	3.96	524.15	82.73	0.26
Reach-1	51250	1761	968.5	976.34	0.23	976.56	0.0006	3.72	477.48	80.18	0.26
Reach-1	51250	1670	968.5	976.15	0.22	976.36	0.000597	3.63	462.37	79.33	0.26
Reach-1	51250	1612	968.5	976.03	0.22	976.23	0.000596	3.58	452.42	78.77	0.26
Reach-1	51250	1422	968.5	975.61	0.2	975.79	0.000587	3.39	420.3	76.93	0.25
Reach-1	51250	976	968.5	974.5	0.16	974.63	0.000555	2.9	336.93	72.38	0.24
Reach-1	51250	460	968.5	972.82	0.09	972.89	0.000442	2.08	221.03	66.36	0.2
Reach-1	51250	134	968.5	971.23	0.03	971.25	0.00025	1.12	120.07	60.64	0.14

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Reach-1	51300	8721	968.5	987.21	0.21	987.37	0.000217	4.13	4278.36	740	0.18
Reach-1	51300	7239	968.5	985.26	0.28	985.5	0.000327	4.66	2894.85	641.25	0.21
Reach-1	51300	4375	968.5	981.01	0.37	981.36	0.000602	5.04	1174.99	257.25	0.27
Reach-1	51300	3336	968.5	979.29	0.37	979.64	0.00072	4.89	807.89	175.79	0.29
Reach-1	51300	2047	968.5	976.92	0.32	977.21	0.00086	4.32	491.35	106.85	0.3
Reach-1	51300	1761	968.5	976.34	0.3	976.61	0.000881	4.11	434.76	90.32	0.3
Reach-1	51300	1670	968.5	976.16	0.29	976.41	0.000886	4.03	418.18	84.87	0.3
Reach-1	51300	1612	968.5	976.03	0.28	976.28	0.000891	3.98	407.74	81.25	0.3
Reach-1	51300	1422	968.5	975.62	0.27	975.84	0.000902	3.8	375.05	77.99	0.3
Reach-1	51300	976	968.5	974.5	0.22	974.67	0.000944	3.35	291.49	72.37	0.29
Reach-1	51300	460	968.5	972.82	0.16	972.93	0.001019	2.63	174.88	66.55	0.29
Reach-1	51300	134	968.5	971.24	0.06	971.27	0.000437	1.52	88.06	40.08	0.18
Reach-1	51350	8721	968.5	987.19	0.27	987.41	0.000265	4.68	3932.55	732	0.2
Reach-1	51350	7239	968.5	985.24	0.33	985.53	0.000369	5.08	2644.13	514.26	0.23
Reach-1	51350	4375	968.5	980.99	0.44	981.42	0.000696	5.56	1054.09	214.31	0.3
Reach-1	51350	3336	968.5	979.28	0.43	979.7	0.000821	5.37	745.6	162.13	0.32
Reach-1	51350	2047	968.5	976.92	0.37	977.26	0.00096	4.71	456.15	94.41	0.33
Reach-1	51350	1761	968.5	976.35	0.35	976.66	0.000978	4.47	404.87	86.19	0.33
Reach-1	51350	1670	968.5	976.17	0.34	976.46	0.000984	4.39	388.89	83.46	0.32
Reach-1	51350	1612	968.5	976.04	0.33	976.33	0.000989	4.33	378.56	81.65	0.32
Reach-1	51350	1422	968.5	975.63	0.31	975.9	0.000998	4.13	346.33	75.72	0.32
Reach-1	51350	976	968.5	974.52	0.25	974.72	0.000969	3.61	270.3	63.15	0.31
Reach-1	51350	460	968.5	972.86	0.15	972.97	0.000765	2.65	173.28	54.11	0.26
Reach-1	51350	134	968.5	971.26	0.05	971.29	0.000425	1.45	92.4	46.56	0.18
Reach-1	51400	8721	968.5	987.18	0.27	987.42	0.000279	4.68	3586.42	633	0.2
Reach-1	51400	7239	968.5	985.25	0.31	985.54	0.000366	4.93	2520.65	466.79	0.23
Reach-1	51400	4375	968.5	981.08	0.38	981.46	0.000617	5.11	1083.56	223.56	0.28
Reach-1	51400	3336	968.5	979.41	0.35	979.75	0.000686	4.79	796.43	139.71	0.29
Reach-1	51400	2047	968.5	977.04	0.3	977.31	0.0008	4.19	508.18	100.41	0.29
Reach-1	51400	1761	968.5	976.47	0.28	976.71	0.000819	3.98	452.5	93.37	0.29
Reach-1	51400	1670	968.5	976.28	0.27	976.51	0.000826	3.91	434.91	91.04	0.29
Reach-1	51400	1612	968.5	976.15	0.27	976.38	0.000832	3.87	423.48	89.48	0.29
Reach-1	51400	1422	968.5	975.74	0.25	975.95	0.000845	3.7	387.34	84.39	0.29
Reach-1	51400	976	968.5	974.61	0.21	974.77	0.000882	3.26	299.31	73.88	0.29
Reach-1	51400	460	968.5	972.91	0.15	973.01	0.000952	2.57	179.11	67.4	0.28
Reach-1	51400	134	968.5	971.28	0.08	971.32	0.000634	1.75	76.76	37.21	0.21
Reach-1	51450	8721	968	987.23	0.23	987.44	0.000221	4.37	3738.37	567.54	0.19
Reach-1	51450	7239	968	985.31	0.27	985.56	0.000289	4.62	2719.94	492.83	0.21
Reach-1	51450	4375	968	981.17	0.3	981.48	0.000442	4.64	1212.38	215.84	0.24
Reach-1	51450	3336	968	979.52	0.27	979.79	0.00047	4.3	914.8	157.73	0.24
Reach-1	51450	2047	968	977.15	0.22	977.36	0.000497	3.67	592.32	114.78	0.24
Reach-1	51450	1761	968	976.57	0.2	976.76	0.000492	3.45	528.92	104.28	0.24
Reach-1	51450	1670	968	976.38	0.19	976.56	0.000489	3.38	509.22	100.79	0.23
Reach-1	51450	1612	968	976.25	0.19	976.42	0.000488	3.33	496.51	98.47	0.23
Reach-1	51450	1422	968	975.84	0.17	975.99	0.000478	3.15	457.4	90.97	0.23
Reach-1	51450	976	968	974.7	0.13	974.81	0.000446	2.68	364.49	74.45	0.21
Reach-1	51450	460	968	972.98	0.07	973.04	0.000331	1.89	243.17	67.35	0.18
Reach-1	51450	134	968	971.32	0.02	971.33	0.000164	0.98	136.59	60.43	0.11
Reach-1	51500	8721	969.5	987.29	0.19	987.45	0.000204	3.96	4134.98	580	0.17
Reach-1	51500	7239	969.5	985.36	0.25	985.58	0.000302	4.43	3015.83	580	0.21

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Reach-1	51500	4375	969.5	981.12	0.42	981.54	0.000701	5.34	954.9	241.41	0.3
Reach-1	51500	3336	969.5	979.48	0.38	979.85	0.000767	4.96	707.14	100.59	0.3
Reach-1	51500	2047	969.5	977.13	0.32	977.41	0.000883	4.28	485.61	88.32	0.31
Reach-1	51500	1761	969.5	976.55	0.3	976.81	0.000915	4.08	435.6	85.31	0.31
Reach-1	51500	1670	969.5	976.36	0.29	976.61	0.000927	4.01	419.36	84.31	0.31
Reach-1	51500	1612	969.5	976.24	0.29	976.48	0.000938	3.97	408.68	83.64	0.31
Reach-1	51500	1422	969.5	975.82	0.27	976.05	0.000963	3.81	374.69	81.49	0.31
Reach-1	51500	976	969.5	974.68	0.24	974.86	0.001092	3.43	284.17	76.64	0.31
Reach-1	51500	460	969.5	972.96	0.2	973.09	0.001509	2.91	158.14	70.22	0.34
Reach-1	51500	134	969.5	971.3	0.11	971.36	0.001122	1.98	67.54	42.75	0.28
Reach-1	51600	8721	969.5	987.35	0.16	987.48	0.000169	3.61	4306.79	500	0.16
Reach-1	51600	7239	969.5	985.46	0.19	985.61	0.000227	3.86	3361.51	500	0.18
Reach-1	51600	4375	969.5	981.3	0.33	981.62	0.000548	4.78	1372.3	409.03	0.26
Reach-1	51600	3336	969.5	979.59	0.35	979.93	0.000696	4.77	816.98	212.74	0.29
Reach-1	51600	2047	969.5	977.22	0.31	977.5	0.000839	4.22	498.41	105.99	0.3
Reach-1	51600	1761	969.5	976.65	0.28	976.9	0.000863	4.01	443.87	87.18	0.3
Reach-1	51600	1670	969.5	976.46	0.28	976.7	0.000872	3.94	427.45	85.58	0.3
Reach-1	51600	1612	969.5	976.34	0.27	976.57	0.000879	3.89	416.73	84.51	0.3
Reach-1	51600	1422	969.5	975.93	0.26	976.14	0.000895	3.73	382.85	81.36	0.3
Reach-1	51600	976	969.5	974.79	0.22	974.97	0.000983	3.32	293.61	76.47	0.3
Reach-1	51600	460	969.5	973.12	0.17	973.23	0.001189	2.7	170.39	70.47	0.31
Reach-1	51600	134	969.5	971.41	0.08	971.46	0.000824	1.81	74.24	42.71	0.24
Reach-1	51650	8721	969.5	987.37	0.16	987.48	0.000151	3.58	4347.96	470	0.15
Reach-1	51650	7239	969.5	985.49	0.18	985.63	0.000194	3.75	3464.71	470	0.17
Reach-1	51650	4375	969.5	981.38	0.28	981.65	0.00042	4.47	1547.68	435.4	0.24
Reach-1	51650	3336	969.5	979.65	0.31	979.96	0.000548	4.56	913.8	287.27	0.26
Reach-1	51650	2047	969.5	977.31	0.25	977.54	0.000586	3.89	538.51	87.99	0.26
Reach-1	51650	1761	969.5	976.74	0.22	976.95	0.00058	3.65	489.17	84.78	0.25
Reach-1	51650	1670	969.5	976.55	0.22	976.75	0.000577	3.57	473.19	83.71	0.25
Reach-1	51650	1612	969.5	976.42	0.21	976.62	0.000576	3.52	462.74	83.01	0.25
Reach-1	51650	1422	969.5	976.02	0.19	976.19	0.000566	3.33	429.31	80.71	0.25
Reach-1	51650	976	969.5	974.89	0.15	975.02	0.000553	2.85	342.03	74.64	0.23
Reach-1	51650	460	969.5	973.2	0.09	973.27	0.000471	2.08	220.64	69.12	0.21
Reach-1	51650	134	969.5	971.46	0.04	971.49	0.00041	1.27	105.49	63.45	0.17
Reach-1	51700	8721	969	987.37	0.17	987.5	0.000161	3.7	4103.58	430	0.16
Reach-1	51700	7239	969	985.5	0.18	985.64	0.000201	3.83	3298.1	430	0.17
Reach-1	51700	4375	969	981.42	0.26	981.67	0.000392	4.34	1573.64	389.69	0.23
Reach-1	51700	3336	969	979.72	0.29	980	0.000502	4.4	986.71	275.77	0.25
Reach-1	51700	2047	969	977.35	0.24	977.57	0.000563	3.84	544.76	87.77	0.25
Reach-1	51700	1761	969	976.77	0.22	976.97	0.000555	3.6	495.49	84.56	0.25
Reach-1	51700	1670	969	976.58	0.21	976.78	0.000551	3.52	479.54	83.49	0.25
Reach-1	51700	1612	969	976.46	0.2	976.64	0.00055	3.47	469.1	82.78	0.25
Reach-1	51700	1422	969	976.05	0.19	976.22	0.000538	3.28	435.71	80.48	0.24
Reach-1	51700	976	969	974.92	0.15	975.04	0.000516	2.8	348.59	74.26	0.23
Reach-1	51700	460	969	973.23	0.08	973.29	0.000405	2.01	228.74	67.28	0.19
Reach-1	51700	134	969	971.49	0.03	971.51	0.00029	1.15	116.2	62.2	0.15
Reach-1	51750	8721	968.5	987.28	0.28	987.55	0.000271	4.82	2926.04	360	0.21
Reach-1	51750	7239	968.5	985.39	0.31	985.71	0.00034	4.99	2246.27	360	0.23
Reach-1	51750	4375	968.5	981.37	0.34	981.72	0.000498	4.9	1063.91	198.37	0.26
Reach-1	51750	3336	968.5	979.72	0.3	980.03	0.000526	4.53	789.32	116.03	0.26
Reach-1	51750	2047	968.5	977.38	0.23	977.6	0.000527	3.74	560.37	90.76	0.25

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Reach-1	51750	1761	968.5	976.81	0.21	977	0.00052	3.51	509.34	87.58	0.24
Reach-1	51750	1670	968.5	976.62	0.2	976.8	0.000517	3.44	492.8	86.52	0.24
Reach-1	51750	1612	968.5	976.49	0.19	976.67	0.000516	3.39	481.97	85.82	0.24
Reach-1	51750	1422	968.5	976.08	0.18	976.24	0.000506	3.2	447.27	83.54	0.24
Reach-1	51750	976	968.5	974.95	0.14	975.07	0.000493	2.74	356.57	77.25	0.22
Reach-1	51750	460	968.5	973.26	0.08	973.32	0.00038	1.97	233.25	68.08	0.19
Reach-1	51750	134	968.5	971.51	0.03	971.53	0.000226	1.09	122.38	58.84	0.13
Reach-1	51800	8721	968.5	987.24	0.37	987.59	0.000357	5.52	2661.37	370	0.23
Reach-1	51800	7239	968.5	985.33	0.43	985.76	0.000465	5.83	1954.12	370	0.26
Reach-1	51800	4375	968.5	981.3	0.45	981.8	0.00067	5.72	859.57	215.09	0.3
Reach-1	51800	3336	968.5	979.69	0.38	980.09	0.000661	5.12	692.54	88.98	0.29
Reach-1	51800	2047	968.5	977.37	0.28	977.64	0.000638	4.19	499.47	77.62	0.27
Reach-1	51800	1761	968.5	976.8	0.25	977.04	0.00062	3.92	456.26	74.84	0.26
Reach-1	51800	1670	968.5	976.62	0.24	976.84	0.000613	3.82	442.25	73.92	0.26
Reach-1	51800	1612	968.5	976.49	0.24	976.71	0.000609	3.76	433.08	73.31	0.26
Reach-1	51800	1422	968.5	976.09	0.21	976.29	0.000586	3.54	404.43	71.37	0.25
Reach-1	51800	976	968.5	974.97	0.16	975.11	0.000545	2.98	327.36	65.89	0.24
Reach-1	51800	460	968.5	973.27	0.09	973.34	0.000387	2.08	220.91	59.51	0.19
Reach-1	51800	134	968.5	971.52	0.03	971.54	0.000197	1.09	122.45	52.93	0.13
Reach-1	51850	8721	967.5	987.2	0.41	987.62	0.00039	5.82	2445.16	380	0.25
Reach-1	51850	7239	967.5	985.31	0.45	985.8	0.000485	6.01	1771.17	325.86	0.27
Reach-1	51850	4375	967.5	981.4	0.4	981.83	0.000574	5.38	878.59	95.82	0.28
Reach-1	51850	3336	967.5	979.77	0.34	980.12	0.000565	4.83	728.18	88.73	0.27
Reach-1	51850	2047	967.5	977.44	0.24	977.67	0.000529	3.92	533.42	78.6	0.25
Reach-1	51850	1761	967.5	976.87	0.22	977.07	0.000509	3.65	489.23	76.12	0.24
Reach-1	51850	1670	967.5	976.68	0.21	976.87	0.000501	3.56	474.86	75.29	0.24
Reach-1	51850	1612	967.5	976.55	0.2	976.74	0.000497	3.5	465.45	74.75	0.24
Reach-1	51850	1422	967.5	976.15	0.18	976.32	0.000475	3.28	435.89	73.01	0.23
Reach-1	51850	976	967.5	975.01	0.14	975.13	0.000433	2.75	355.36	68.04	0.21
Reach-1	51850	460	967.5	973.3	0.07	973.36	0.000292	1.88	244.33	61.92	0.17
Reach-1	51850	134	967.5	971.54	0.02	971.55	0.000133	0.95	140.68	55.61	0.11
Reach-1	51900	8721	967.5	987.28	0.34	987.65	0.000318	5.34	2572.39	375	0.22
Reach-1	51900	7239	967.5	985.41	0.37	985.83	0.000391	5.49	1868.82	368.98	0.24
Reach-1	51900	4375	967.5	981.53	0.31	981.87	0.000422	4.75	985.98	100.96	0.24
Reach-1	51900	3336	967.5	979.88	0.26	980.15	0.000408	4.23	825.4	94.21	0.23
Reach-1	51900	2047	967.5	977.52	0.18	977.7	0.000368	3.39	614.32	84.52	0.21
Reach-1	51900	1761	967.5	976.94	0.16	977.09	0.00035	3.14	566.14	82.15	0.2
Reach-1	51900	1670	967.5	976.75	0.15	976.89	0.000344	3.06	550.43	81.37	0.2
Reach-1	51900	1612	967.5	976.62	0.15	976.76	0.00034	3.01	540.14	80.85	0.2
Reach-1	51900	1422	967.5	976.22	0.13	976.34	0.000321	2.81	507.66	79.18	0.19
Reach-1	51900	976	967.5	975.06	0.1	975.14	0.000283	2.33	418.67	74.8	0.17
Reach-1	51900	460	967.5	973.33	0.05	973.36	0.000186	1.57	293.25	69.75	0.13
Reach-1	51900	134	967.5	971.55	0.01	971.56	0.000077	0.77	174.69	63.74	0.08
Reach-1	51948	8721	969.8	987.65	0.09	987.69	0.000112	2.54	9365.99	2574.57	0.12
Reach-1	51948	7239	969.8	985.71	0.23	985.88	0.000355	4.09	4606.38	2244.65	0.21
Reach-1	51948	4375	969.8	981.43	0.52	981.95	0.000999	5.83	750.55	83.81	0.34
Reach-1	51948	3336	969.8	979.78	0.47	980.24	0.00103	5.41	616.51	79.43	0.34
Reach-1	51948	2047	969.8	977.43	0.37	977.77	0.001029	4.67	438.28	71.32	0.33
Reach-1	51948	1761	969.8	976.86	0.34	977.17	0.001018	4.43	397.87	69.95	0.33
Reach-1	51948	1670	969.8	976.67	0.33	976.96	0.001014	4.34	384.63	69.5	0.33
Reach-1	51948	1612	969.8	976.55	0.33	976.83	0.001012	4.29	375.92	69.19	0.32

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Reach-1	51948	1422	969.8	976.15	0.3	976.4	0.000992	4.08	348.39	68.24	0.32
Reach-1	51948	976	969.8	975	0.25	975.2	0.000998	3.59	271.8	65.49	0.31
Reach-1	51948	460	969.8	973.29	0.18	973.41	0.001052	2.81	163.52	60	0.3
Reach-1	51948	134	969.8	971.52	0.12	971.59	0.001624	2.08	64.44	52.25	0.33
Reach-1	51973 Bridge										
Reach-1	52000	8721	969.7	987.69	0.08	987.72	0.0001	2.41	10084.87	2575.08	0.11
Reach-1	52000	7239	969.7	985.84	0.19	985.95	0.000275	3.68	5537.68	2302.98	0.17
Reach-1	52000	4375	969.7	982.02	0.53	982.54	0.000991	5.95	918.5	288.71	0.33
Reach-1	52000	3336	969.7	979.75	0.61	980.34	0.001392	6.15	542.04	71	0.39
Reach-1	52000	2047	969.7	978.1	0.4	978.46	0.00109	4.81	425.24	69.26	0.34
Reach-1	52000	1761	969.7	977.5	0.37	977.83	0.001081	4.58	384.34	67.18	0.34
Reach-1	52000	1670	969.7	977.31	0.36	977.62	0.001074	4.5	371.27	66.5	0.34
Reach-1	52000	1612	969.7	977.17	0.35	977.48	0.001072	4.45	362.62	66.04	0.33
Reach-1	52000	1422	969.7	976.76	0.32	977.04	0.001048	4.24	335.31	64.59	0.33
Reach-1	52000	976	969.7	975.56	0.27	975.78	0.001038	3.75	260.56	60.44	0.32
Reach-1	52000	460	969.7	973.76	0.19	973.89	0.001051	2.92	157.43	54.2	0.3
Reach-1	52000	134	969.7	971.93	0.12	971.99	0.001503	2.1	63.74	47.82	0.32
Reach-1	52023	8721	968.5	987.53	0.27	987.8	0.00028	4.68	3211.84	630	0.2
Reach-1	52023	7239	968.5	985.67	0.33	986.04	0.000388	5.08	2055.47	555.85	0.24
Reach-1	52023	4375	968.5	982.29	0.26	982.58	0.000404	4.34	1053.34	114.32	0.23
Reach-1	52023	3336	968.5	980.13	0.26	980.39	0.000494	4.15	820.3	100.78	0.25
Reach-1	52023	2047	968.5	978.34	0.16	978.49	0.000379	3.19	646.58	93.76	0.21
Reach-1	52023	1761	968.5	977.72	0.15	977.86	0.000372	3	589.44	91.45	0.2
Reach-1	52023	1670	968.5	977.52	0.14	977.65	0.000368	2.94	571.03	90.69	0.2
Reach-1	52023	1612	968.5	977.38	0.14	977.51	0.000367	2.89	558.88	90.19	0.2
Reach-1	52023	1422	968.5	976.95	0.13	977.07	0.000357	2.74	520.11	88.56	0.2
Reach-1	52023	976	968.5	975.72	0.1	975.8	0.000339	2.36	414.08	83.24	0.19
Reach-1	52023	460	968.5	973.87	0.06	973.91	0.000252	1.7	270.8	71.68	0.15
Reach-1	52023	134	968.5	971.99	0.02	972.01	0.000127	0.91	147.37	59.99	0.1
Reach-1	52073	7180	969.2	987.57	0.24	987.81	0.000236	4.51	2614.37	340	0.19
Reach-1	52073	5960	969.2	985.79	0.27	986.06	0.00029	4.64	2006.34	340	0.21
Reach-1	52073	3602	969.2	982.34	0.24	982.6	0.000334	4.22	989.05	152.7	0.21
Reach-1	52073	2746	969.2	980.18	0.23	980.42	0.000386	3.97	747.83	100.41	0.22
Reach-1	52073	1686	969.2	978.37	0.14	978.51	0.000293	3.03	579.65	85.98	0.19
Reach-1	52073	1450	969.2	977.75	0.13	977.88	0.000284	2.83	527.95	81.77	0.18
Reach-1	52073	1375	969.2	977.55	0.12	977.67	0.000281	2.76	511.48	80.76	0.18
Reach-1	52073	1328	969.2	977.42	0.12	977.53	0.000279	2.72	500.64	80.08	0.18
Reach-1	52073	1171	969.2	976.98	0.11	977.08	0.000268	2.56	466.27	77.91	0.17
Reach-1	52073	804	969.2	975.75	0.08	975.82	0.000251	2.16	374.02	71.74	0.16
Reach-1	52073	379	969.2	973.89	0.05	973.93	0.000195	1.52	248.6	63.67	0.14
Reach-1	52073	110	969.2	972	0.02	972.01	0.000106	0.81	135.12	56.81	0.09
Reach-1	52148.*	7180	968.53	987.72	0.14	987.84	0.000136	3.35	4377.1	860	0.14
Reach-1	52148.*	5960	968.53	985.9	0.18	986.08	0.000204	3.8	2861.4	770.35	0.17
Reach-1	52148.*	3602	968.53	982.44	0.17	982.63	0.000254	3.55	1134.05	141.09	0.18
Reach-1	52148.*	2746	968.53	980.27	0.17	980.45	0.000311	3.42	853.67	118.28	0.2
Reach-1	52148.*	1686	968.53	978.42	0.11	978.53	0.000253	2.66	649.39	103.69	0.17
Reach-1	52148.*	1450	968.53	977.8	0.1	977.9	0.000252	2.5	586.39	97.94	0.17
Reach-1	52148.*	1375	968.53	977.59	0.1	977.69	0.000252	2.45	566.64	95.58	0.17
Reach-1	52148.*	1328	968.53	977.46	0.1	977.55	0.000251	2.42	553.77	94.06	0.17
Reach-1	52148.*	1171	968.53	977.01	0.09	977.1	0.000244	2.29	513.05	89.16	0.16

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Reach-1	52148.*	804	968.53	975.78	0.07	975.84	0.000224	1.96	409.83	79.83	0.15
Reach-1	52148.*	379	968.53	973.91	0.04	973.94	0.00017	1.41	269.24	70.64	0.13
Reach-1	52148.*	110	968.53	972.01	0.01	972.02	0.000094	0.76	143.92	61.3	0.09
Reach-1	52200	7180	969	987.52	0.36	987.94	0.000343	5.46	1579.29	120	0.23
Reach-1	52200	5960	969	985.78	0.33	986.16	0.000349	5.13	1371.26	118.37	0.23
Reach-1	52200	3602	969	982.41	0.23	982.66	0.00031	4.11	981.91	109.18	0.21
Reach-1	52200	2746	969	980.25	0.22	980.48	0.000354	3.87	766.38	93.26	0.21
Reach-1	52200	1686	969	978.42	0.13	978.55	0.000268	2.94	601.4	86.53	0.18
Reach-1	52200	1450	969	977.8	0.12	977.91	0.000259	2.75	548.49	84.03	0.17
Reach-1	52200	1375	969	977.6	0.11	977.71	0.000256	2.68	531.5	83.04	0.17
Reach-1	52200	1328	969	977.46	0.11	977.57	0.000254	2.64	520.32	82.39	0.17
Reach-1	52200	1171	969	977.03	0.1	977.12	0.000243	2.48	485.05	80.29	0.17
Reach-1	52200	804	969	975.79	0.08	975.86	0.000223	2.08	389.66	74.33	0.15
Reach-1	52200	379	969	973.92	0.04	973.96	0.000181	1.47	258.56	66.3	0.13
Reach-1	52200	110	969	972.02	0.02	972.03	0.000112	0.8	136.94	61.55	0.09
Reach-1	52243	7180	968.6	987.74	0.24	987.97	0.000228	4.52	2719.06	362	0.19
Reach-1	52243	5960	968.6	985.9	0.28	986.18	0.000288	4.71	2052.42	362	0.21
Reach-1	52243	3602	968.6	982.4	0.26	982.68	0.000343	4.36	949.46	157.56	0.22
Reach-1	52243	2746	968.6	980.25	0.24	980.5	0.000386	4.08	722.69	91.8	0.22
Reach-1	52243	1686	968.6	978.42	0.15	978.56	0.000286	3.08	568.49	78.22	0.19
Reach-1	52243	1450	968.6	977.8	0.13	977.93	0.000274	2.87	521.11	75.55	0.18
Reach-1	52243	1375	968.6	977.6	0.12	977.72	0.000269	2.79	505.87	74.84	0.18
Reach-1	52243	1328	968.6	977.46	0.12	977.58	0.000267	2.75	495.83	74.37	0.18
Reach-1	52243	1171	968.6	977.04	0.11	977.14	0.000253	2.57	464.7	72.89	0.17
Reach-1	52243	804	968.6	975.81	0.08	975.88	0.000227	2.15	377.54	68.57	0.16
Reach-1	52243	379	968.6	973.93	0.04	973.97	0.000174	1.49	255.08	62.31	0.13
Reach-1	52243	110	968.6	972.03	0.01	972.04	0.00009	0.78	141.51	56.91	0.09
Reach-1	52273.*	7180	968.55	987.92	0.09	987.99	0.000095	2.72	5646.85	1085.4	0.12
Reach-1	52273.*	5960	968.55	986.09	0.13	986.2	0.000148	3.13	3754.81	978.45	0.15
Reach-1	52273.*	3602	968.55	982.54	0.16	982.7	0.000245	3.33	1289.59	359.95	0.18
Reach-1	52273.*	2746	968.55	980.35	0.17	980.52	0.000327	3.3	852.76	130.5	0.2
Reach-1	52273.*	1686	968.55	978.47	0.11	978.57	0.000273	2.61	646.02	94.82	0.18
Reach-1	52273.*	1450	968.55	977.84	0.1	977.94	0.000259	2.47	587.99	90.57	0.17
Reach-1	52273.*	1375	968.55	977.64	0.1	977.73	0.000255	2.41	569.53	89.32	0.17
Reach-1	52273.*	1328	968.55	977.5	0.1	977.59	0.000253	2.38	557.4	88.67	0.17
Reach-1	52273.*	1171	968.55	977.07	0.09	977.14	0.000241	2.26	519.26	86.6	0.16
Reach-1	52273.*	804	968.55	975.82	0.07	975.88	0.000216	1.94	415.11	80.68	0.15
Reach-1	52273.*	379	968.55	973.94	0.04	973.97	0.000166	1.39	272.17	71.75	0.13
Reach-1	52273.*	110	968.55	972.04	0.01	972.05	0.000097	0.76	143.93	62.67	0.09
Reach-1	52350	7180	969	987.7	0.34	988.1	0.000339	5.33	1612.32	124.11	0.23
Reach-1	52350	5960	969	985.93	0.32	986.29	0.000347	5.01	1397.32	118.8	0.23
Reach-1	52350	3602	969	982.51	0.22	982.75	0.000318	4.04	1005.62	110.18	0.21
Reach-1	52350	2746	969	980.34	0.22	980.56	0.000384	3.88	772.17	105.12	0.22
Reach-1	52350	1686	969	978.47	0.14	978.61	0.000304	3.02	581.83	92.5	0.19
Reach-1	52350	1450	969	977.84	0.13	977.97	0.00029	2.83	527.56	82.5	0.18
Reach-1	52350	1375	969	977.64	0.12	977.76	0.000285	2.76	510.92	80.3	0.18
Reach-1	52350	1328	969	977.5	0.12	977.62	0.000282	2.72	500.12	78.83	0.18
Reach-1	52350	1171	969	977.08	0.11	977.18	0.000265	2.55	467.49	74.23	0.17
Reach-1	52350	804	969	975.83	0.08	975.9	0.000232	2.14	379.48	68.18	0.16
Reach-1	52350	379	969	973.96	0.04	973.99	0.000173	1.49	255.96	63.45	0.13
Reach-1	52350	110	969	972.05	0.02	972.06	0.00011	0.8	137.01	61.06	0.09

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Reach-1	52398.*	7180	968.58	988.1	0.06	988.15	0.000066	2.24	7014.85	1276.31	0.1
Reach-1	52398.*	5960	968.58	986.26	0.09	986.33	0.000107	2.61	4743.83	1186.52	0.12
Reach-1	52398.*	3602	968.58	982.64	0.13	982.77	0.000207	2.97	1705.17	535.95	0.16
Reach-1	52398.*	2746	968.58	980.43	0.16	980.59	0.000316	3.18	911.99	201.93	0.2
Reach-1	52398.*	1686	968.58	978.52	0.11	978.62	0.000266	2.54	662.91	99.81	0.17
Reach-1	52398.*	1450	968.58	977.89	0.1	977.98	0.000245	2.41	602.18	92.57	0.17
Reach-1	52398.*	1375	968.58	977.69	0.09	977.77	0.000241	2.36	583.18	91.29	0.16
Reach-1	52398.*	1328	968.58	977.55	0.09	977.63	0.000239	2.33	570.7	90.62	0.16
Reach-1	52398.*	1171	968.58	977.11	0.08	977.18	0.000228	2.2	531.18	88.48	0.16
Reach-1	52398.*	804	968.58	975.86	0.06	975.91	0.000206	1.89	424.35	82.43	0.15
Reach-1	52398.*	379	968.58	973.97	0.04	974	0.00016	1.37	277.25	73.28	0.12
Reach-1	52398.*	110	968.58	972.05	0.01	972.06	0.000095	0.75	145.89	64.01	0.09
Reach-1	52400	7180	968	987.89	0.3	988.24	0.000262	5.09	1815.17	140	0.21
Reach-1	52400	5960	968	986.09	0.27	986.4	0.000261	4.76	1571.4	129.54	0.2
Reach-1	52400	3602	968	982.59	0.19	982.79	0.000227	3.8	1133.48	120.81	0.18
Reach-1	52400	2746	968	980.41	0.18	980.6	0.000256	3.58	875.9	115.58	0.19
Reach-1	52400	1686	968	978.52	0.11	978.63	0.000186	2.7	675.96	91.77	0.16
Reach-1	52400	1450	968	977.89	0.09	977.98	0.000174	2.49	621.35	83.43	0.15
Reach-1	52400	1375	968	977.68	0.09	977.77	0.00017	2.43	604.23	82.73	0.15
Reach-1	52400	1328	968	977.55	0.09	977.63	0.000168	2.38	592.96	82.26	0.15
Reach-1	52400	1171	968	977.12	0.08	977.19	0.000156	2.22	557.89	80.8	0.14
Reach-1	52400	804	968	975.87	0.05	975.92	0.000132	1.82	459.61	76.64	0.12
Reach-1	52400	379	968	973.98	0.03	974	0.00009	1.21	319.74	71.44	0.1
Reach-1	52400	110	968	972.06	0.01	972.07	0.000042	0.59	187.88	66.17	0.06
Reach-1	52490	7180	969.2	988.14	0.16	988.28	0.000149	3.62	3426.97	400	0.15
Reach-1	52490	5960	969.2	986.27	0.18	986.44	0.000188	3.77	2680.11	400	0.17
Reach-1	52490	3602	969.2	982.62	0.19	982.82	0.000268	3.77	1300.54	278.91	0.19
Reach-1	52490	2746	969.2	980.42	0.2	980.63	0.000341	3.72	851.5	156.74	0.21
Reach-1	52490	1686	969.2	978.52	0.13	978.65	0.00028	2.92	603.39	102.13	0.18
Reach-1	52490	1450	969.2	977.89	0.12	978	0.000274	2.73	545.15	84.79	0.18
Reach-1	52490	1375	969.2	977.68	0.12	977.79	0.000271	2.67	527.84	83.88	0.18
Reach-1	52490	1328	969.2	977.55	0.11	977.65	0.00027	2.63	516.47	83.28	0.18
Reach-1	52490	1171	969.2	977.13	0.1	977.22	0.000259	2.47	481.98	81.42	0.17
Reach-1	52490	804	969.2	975.88	0.08	975.95	0.000249	2.1	383.8	75.89	0.16
Reach-1	52490	379	969.2	973.99	0.05	974.03	0.000222	1.53	247.38	69.48	0.14
Reach-1	52490	110	969.2	972.07	0.02	972.08	0.000192	0.93	118.64	64.68	0.12
Reach-1	52523	7180	968.61	988.26	0.05	988.29	0.000047	1.99	8467.7	1474.4	0.09
Reach-1	52523	5960	968.61	986.41	0.07	986.45	0.000072	2.28	5834.31	1299.52	0.1
Reach-1	52523	3602	968.61	982.75	0.09	982.84	0.000136	2.6	2374.62	657.87	0.14
Reach-1	52523	2746	968.61	980.52	0.13	980.65	0.000236	2.96	1216.61	379.84	0.17
Reach-1	52523	1686	968.61	978.57	0.1	978.66	0.000228	2.48	697.36	157.4	0.16
Reach-1	52523	1450	968.61	977.93	0.09	978.01	0.00023	2.34	619.01	94.64	0.16
Reach-1	52523	1375	968.61	977.72	0.09	977.8	0.000227	2.29	599.5	93.61	0.16
Reach-1	52523	1328	968.61	977.58	0.09	977.66	0.000225	2.26	586.7	92.92	0.16
Reach-1	52523	1171	968.61	977.15	0.08	977.22	0.000214	2.14	547.13	90.77	0.15
Reach-1	52523	804	968.61	975.9	0.06	975.95	0.000192	1.84	437.27	84.5	0.14
Reach-1	52523	379	968.61	974	0.03	974.03	0.000149	1.33	285.9	75.01	0.12
Reach-1	52523	110	968.61	972.08	0.01	972.09	0.000087	0.73	150.96	65.4	0.08
Reach-1	52630	7180	968.6	988.03	0.33	988.41	0.000298	5.26	1712.68	126	0.22
Reach-1	52630	5960	968.6	986.21	0.3	986.56	0.000305	4.96	1483.89	126	0.22

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Reach-1	52630	3602	968.6	982.66	0.22	982.9	0.000281	4.05	1043.1	120.45	0.2
Reach-1	52630	2746	968.6	980.48	0.21	980.71	0.000327	3.86	787.7	108.53	0.21
Reach-1	52630	1686	968.6	978.57	0.13	978.7	0.000246	2.93	607.08	83.77	0.17
Reach-1	52630	1450	968.6	977.93	0.12	978.05	0.000236	2.73	554.89	80.87	0.17
Reach-1	52630	1375	968.6	977.73	0.11	977.84	0.000232	2.66	538.32	79.93	0.17
Reach-1	52630	1328	968.6	977.6	0.11	977.71	0.000229	2.61	528.22	79.35	0.17
Reach-1	52630	1171	968.6	977.17	0.1	977.26	0.000217	2.44	494.27	77.37	0.16
Reach-1	52630	804	968.6	975.92	0.07	975.98	0.000193	2.04	400.95	72.43	0.15
Reach-1	52630	379	968.6	974.01	0.04	974.04	0.000152	1.4	269.85	65.05	0.12
Reach-1	52630	110	968.6	972.09	0.01	972.1	0.000075	0.73	151.13	58.31	0.08
Reach-1	52773	7180	967.5	988.08	0.34	988.45	0.000302	5.36	1874.84	165	0.22
Reach-1	52773	5960	967.5	986.25	0.33	986.61	0.000324	5.18	1572.22	165	0.22
Reach-1	52773	3602	967.5	982.68	0.25	982.95	0.000309	4.33	1013.97	124.51	0.21
Reach-1	52773	2746	967.5	980.52	0.23	980.76	0.000341	4.04	775.85	97.61	0.21
Reach-1	52773	1686	967.5	978.59	0.14	978.73	0.000252	3.07	601.75	84.94	0.18
Reach-1	52773	1450	967.5	977.95	0.12	978.08	0.000239	2.85	548.99	81.77	0.17
Reach-1	52773	1375	967.5	977.75	0.12	977.86	0.000234	2.78	532.25	80.74	0.17
Reach-1	52773	1328	967.5	977.62	0.11	977.74	0.00023	2.72	522.3	80.12	0.17
Reach-1	52773	1171	967.5	977.19	0.1	977.29	0.000216	2.55	487.94	77.95	0.16
Reach-1	52773	804	967.5	975.94	0.07	976.01	0.000185	2.1	394.51	71.56	0.14
Reach-1	52773	379	967.5	974.02	0.04	974.05	0.000128	1.4	271.15	57.18	0.11
Reach-1	52773	110	967.5	972.1	0.01	972.1	0.000048	0.66	166.1	51.92	0.07
Reach-1	52873	7180	968	988.22	0.24	988.49	0.000212	4.5	2268.88	220	0.18
Reach-1	52873	5960	968	986.38	0.23	986.64	0.00023	4.39	1863.31	220	0.19
Reach-1	52873	3602	968	982.78	0.18	982.99	0.000226	3.72	1111.72	153.43	0.18
Reach-1	52873	2746	968	980.62	0.16	980.79	0.00024	3.42	862.29	100.61	0.18
Reach-1	52873	1686	968	978.65	0.1	978.75	0.000173	2.57	679.63	85.21	0.15
Reach-1	52873	1450	968	978.01	0.08	978.1	0.000162	2.37	626.88	80.11	0.14
Reach-1	52873	1375	968	977.81	0.08	977.89	0.000157	2.3	610.32	79.22	0.14
Reach-1	52873	1328	968	977.67	0.08	977.75	0.000155	2.26	599.65	78.68	0.14
Reach-1	52873	1171	968	977.23	0.07	977.3	0.000144	2.1	565.52	76.93	0.13
Reach-1	52873	804	968	975.97	0.05	976.02	0.000119	1.71	471.98	71.9	0.11
Reach-1	52873	379	968	974.04	0.02	974.06	0.000074	1.12	339.74	65.89	0.09
Reach-1	52873	110	968	972.11	0.01	972.11	0.000025	0.51	216.19	61.63	0.05
Reach-1	52883	7180	969.61	988.48	0.05	988.51	0.000046	1.93	8706.48	1484	0.08
Reach-1	52883	5960	969.61	986.62	0.06	986.67	0.000073	2.23	6032.72	1343.24	0.1
Reach-1	52883	3602	969.61	982.92	0.1	983	0.000154	2.65	2397.61	678.2	0.14
Reach-1	52883	2746	969.61	980.66	0.15	980.8	0.000297	3.15	1184.2	396.34	0.19
Reach-1	52883	1686	969.61	978.64	0.13	978.76	0.000337	2.79	624.99	164.26	0.19
Reach-1	52883	1450	969.61	978	0.12	978.11	0.00035	2.67	542.24	93.63	0.2
Reach-1	52883	1375	969.61	977.79	0.12	977.9	0.000349	2.63	522.82	92.43	0.19
Reach-1	52883	1328	969.61	977.65	0.12	977.76	0.000349	2.6	510.33	91.66	0.19
Reach-1	52883	1171	969.61	977.21	0.11	977.31	0.000342	2.49	470.58	89.14	0.19
Reach-1	52883	804	969.61	975.96	0.09	976.03	0.000341	2.22	362.85	81.92	0.19
Reach-1	52883	379	969.61	974.02	0.07	974.07	0.000353	1.76	215.36	70.87	0.18
Reach-1	52883	110	969.61	972.1	0.04	972.12	0.000338	1.19	92.52	53.32	0.16
Reach-1	52921	7180	969.7	988.41	0.17	988.55	0.000201	3.56	4434.94	1429.98	0.16
Reach-1	52921	5960	969.7	986.48	0.25	986.74	0.000355	4.3	2225.59	861.19	0.21
Reach-1	52921	3602	969.7	982.8	0.26	983.06	0.000496	4.1	878.04	97.89	0.24
Reach-1	52921	2746	969.7	980.59	0.27	980.85	0.000641	4.11	667.58	91.79	0.27
Reach-1	52921	1686	969.7	978.62	0.2	978.8	0.000533	3.4	496.07	79.69	0.24

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Reach-1	52921	1450	969.7	977.98	0.18	978.15	0.000531	3.25	446.39	76.56	0.24
Reach-1	52921	1375	969.7	977.77	0.18	977.93	0.000529	3.19	430.45	75.52	0.24
Reach-1	52921	1328	969.7	977.64	0.18	977.79	0.000528	3.16	420.2	74.85	0.24
Reach-1	52921	1171	969.7	977.2	0.16	977.34	0.000516	3.02	387.68	72.68	0.23
Reach-1	52921	804	969.7	975.94	0.14	976.05	0.000504	2.68	300.38	66.5	0.22
Reach-1	52921	379	969.7	974.02	0.09	974.09	0.000497	2.09	181.24	57.91	0.21
Reach-1	52921	110	969.7	972.11	0.06	972.14	0.00064	1.45	76.06	52.15	0.21
Reach-1	52928 Bridge										
Reach-1	52935	7180	969.7	989.63	0.07	989.73	0.000077	3.06	6399.17	1789.82	0.14
Reach-1	52935	5960	969.7	987.17	0.12	987.39	0.00016	3.95	2896.52	1066.49	0.19
Reach-1	52935	3602	969.7	982.81	0.15	983.07	0.000285	4.1	878.36	97.89	0.24
Reach-1	52935	2746	969.7	980.59	0.16	980.86	0.000367	4.11	667.95	91.8	0.27
Reach-1	52935	1686	969.7	978.62	0.11	978.8	0.000306	3.4	496.32	79.71	0.24
Reach-1	52935	1450	969.7	977.99	0.11	978.15	0.000304	3.25	446.64	76.57	0.24
Reach-1	52935	1375	969.7	977.78	0.1	977.94	0.000303	3.19	430.71	75.54	0.24
Reach-1	52935	1328	969.7	977.64	0.1	977.8	0.000302	3.16	420.44	74.87	0.23
Reach-1	52935	1171	969.7	977.2	0.09	977.34	0.000295	3.02	387.92	72.7	0.23
Reach-1	52935	804	969.7	975.94	0.08	976.06	0.000289	2.68	300.49	66.51	0.22
Reach-1	52935	379	969.7	974.02	0.05	974.09	0.000285	2.09	181.32	57.91	0.21
Reach-1	52935	110	969.7	972.12	0.03	972.15	0.000355	1.43	76.87	52.19	0.21
Reach-1	52970	7180	967.8	989.52	0.15	989.83	0.000134	4.82	2172.46	184	0.19
Reach-1	52970	5960	967.8	987.12	0.16	987.44	0.000156	4.78	1731.14	184	0.2
Reach-1	52970	3602	967.8	982.82	0.13	983.07	0.000168	4.11	994.72	101.52	0.2
Reach-1	52970	2746	967.8	980.66	0.12	980.88	0.000184	3.81	783.4	92.84	0.2
Reach-1	52970	1686	967.8	978.7	0.07	978.82	0.000137	2.89	610.73	83.36	0.17
Reach-1	52970	1450	967.8	978.06	0.06	978.17	0.00013	2.68	558.89	80.3	0.16
Reach-1	52970	1375	967.8	977.85	0.06	977.96	0.000127	2.61	542.2	79.29	0.16
Reach-1	52970	1328	967.8	977.72	0.06	977.82	0.000126	2.56	531.43	78.63	0.16
Reach-1	52970	1171	967.8	977.28	0.05	977.36	0.000118	2.39	497.15	76.5	0.15
Reach-1	52970	804	967.8	976.02	0.04	976.08	0.000102	1.97	407.72	64.18	0.14
Reach-1	52970	379	967.8	974.08	0.02	974.11	0.000062	1.31	289.29	58.24	0.1
Reach-1	52970	110	967.8	972.15	0	972.15	0.000021	0.6	182.2	52.87	0.06
Reach-1	53033	7180	969.78	989.72	0.07	989.86	0.000075	3.25	3660.65	498.14	0.14
Reach-1	53033	5960	969.78	987.29	0.09	987.47	0.000107	3.5	2486.22	439.64	0.16
Reach-1	53033	3602	969.78	982.92	0.09	983.09	0.00016	3.34	1178.05	190.04	0.19
Reach-1	53033	2746	969.78	980.72	0.1	980.89	0.000227	3.35	826.94	129.01	0.22
Reach-1	53033	1686	969.78	978.72	0.08	978.84	0.000208	2.78	606.52	101	0.2
Reach-1	53033	1450	969.78	978.07	0.07	978.18	0.000211	2.67	542.9	96.95	0.2
Reach-1	53033	1375	969.78	977.86	0.07	977.97	0.000211	2.63	522.58	95.62	0.2
Reach-1	53033	1328	969.78	977.72	0.07	977.83	0.000212	2.61	509.5	94.76	0.2
Reach-1	53033	1171	969.78	977.28	0.06	977.38	0.00021	2.5	467.9	91.95	0.2
Reach-1	53033	804	969.78	976.01	0.06	976.09	0.000217	2.26	356.46	83.97	0.19
Reach-1	53033	379	969.78	974.07	0.04	974.12	0.000245	1.85	205.08	71.72	0.19
Reach-1	53033	110	969.78	972.13	0.03	972.16	0.000361	1.39	79.15	57.22	0.21
Reach-1	53073	7180	969.81	989.68	0.1	989.88	0.000106	3.78	2249.12	172.5	0.17
Reach-1	53073	5960	969.81	987.27	0.11	987.48	0.000132	3.77	1834.9	172.5	0.18
Reach-1	53073	3602	969.81	982.91	0.11	983.1	0.000197	3.53	1088.43	161.62	0.21
Reach-1	53073	2746	969.81	980.71	0.12	980.91	0.0003	3.61	764.91	126.67	0.24
Reach-1	53073	1686	969.81	978.71	0.1	978.86	0.000303	3.11	542.57	101.57	0.24
Reach-1	53073	1450	969.81	978.07	0.1	978.21	0.000316	3.03	478.69	96.08	0.24

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Reach-1	53073	1375	969.81	977.86	0.09	978	0.00032	3	458.54	94.28	0.24
Reach-1	53073	1328	969.81	977.72	0.09	977.86	0.000323	2.98	445.61	93.11	0.24
Reach-1	53073	1171	969.81	977.27	0.09	977.4	0.000327	2.89	404.87	89.31	0.24
Reach-1	53073	804	969.81	976.01	0.08	976.12	0.000357	2.69	298.8	78.57	0.24
Reach-1	53073	379	969.81	974.06	0.07	974.14	0.000404	2.31	163.91	59.24	0.24
Reach-1	53073	110	969.81	972.13	0.04	972.18	0.000437	1.64	67.08	43.39	0.23
Reach-1	53108	7180	969.84	989.64	0.13	989.89	0.000124	4.39	2400.64	204.5	0.18
Reach-1	53108	5960	969.84	987.24	0.14	987.51	0.000154	4.43	1910.04	204.5	0.2
Reach-1	53108	3602	969.84	982.87	0.14	983.13	0.000215	4.17	1040.86	160.53	0.22
Reach-1	53108	2746	969.84	980.69	0.14	980.94	0.000275	4.06	756.73	116.21	0.24
Reach-1	53108	1686	969.84	978.71	0.1	978.88	0.000258	3.3	542.27	100.68	0.23
Reach-1	53108	1450	969.84	978.06	0.1	978.22	0.000273	3.16	478.49	95.57	0.23
Reach-1	53108	1375	969.84	977.85	0.1	978	0.000278	3.11	458.36	93.9	0.23
Reach-1	53108	1328	969.84	977.72	0.1	977.87	0.00028	3.08	446.12	92.87	0.23
Reach-1	53108	1171	969.84	977.27	0.09	977.41	0.000289	2.96	405.52	89.37	0.23
Reach-1	53108	804	969.84	976.01	0.08	976.13	0.000349	2.7	299.22	79.47	0.24
Reach-1	53108	379	969.84	974.06	0.07	974.14	0.000383	2.28	166.31	59.04	0.24
Reach-1	53108	110	969.84	972.15	0.04	972.19	0.000457	1.64	67.07	45.07	0.24
Reach-1	53140	7180	969	989.62	0.14	989.9	0.000127	4.6	2222.6	175	0.18
Reach-1	53140	5960	969	987.23	0.14	987.51	0.000147	4.54	1804.01	175	0.19
Reach-1	53140	3602	969	982.9	0.12	983.14	0.000168	3.99	1066.09	139.85	0.2
Reach-1	53140	2746	969	980.74	0.11	980.95	0.000186	3.71	821.76	101.72	0.2
Reach-1	53140	1686	969	978.77	0.07	978.89	0.000144	2.85	628.91	93.42	0.17
Reach-1	53140	1450	969	978.12	0.06	978.23	0.00014	2.66	569.32	90.7	0.17
Reach-1	53140	1375	969	977.91	0.06	978.01	0.000138	2.6	550.22	89.53	0.16
Reach-1	53140	1328	969	977.78	0.06	977.88	0.000137	2.55	538.57	88.59	0.16
Reach-1	53140	1171	969	977.33	0.05	977.42	0.000131	2.4	499.87	85.38	0.16
Reach-1	53140	804	969	976.08	0.04	976.14	0.000118	2	401.77	69.15	0.15
Reach-1	53140	379	969	974.12	0.02	974.15	0.00009	1.4	270.67	66.12	0.12
Reach-1	53140	110	969	972.19	0.01	972.19	0.000057	0.76	144.39	64.19	0.09
Reach-1	53233	7180	968	989.67	0.15	989.92	0.000123	4.7	2895.15	300	0.18
Reach-1	53233	5960	968	987.22	0.17	987.53	0.000162	4.95	2162.01	300	0.21
Reach-1	53233	3602	968	982.85	0.17	983.18	0.000215	4.73	954.21	136.35	0.23
Reach-1	53233	2746	968	980.7	0.15	980.99	0.000232	4.39	717.88	93.97	0.23
Reach-1	53233	1686	968	978.75	0.09	978.92	0.00017	3.31	552.3	77.87	0.19
Reach-1	53233	1450	968	978.11	0.08	978.25	0.00016	3.07	503.58	73.79	0.18
Reach-1	53233	1375	968	977.9	0.08	978.03	0.000157	2.98	488.2	72.45	0.18
Reach-1	53233	1328	968	977.77	0.08	977.9	0.000154	2.93	478.84	71.62	0.18
Reach-1	53233	1171	968	977.33	0.07	977.44	0.000144	2.73	447.79	68.82	0.17
Reach-1	53233	804	968	976.08	0.05	976.15	0.000121	2.23	366.87	60.83	0.15
Reach-1	53233	379	968	974.13	0.02	974.16	0.000084	1.48	255.73	53.47	0.12
Reach-1	53233	110	968	972.19	0.01	972.2	0.000033	0.71	155.69	49.98	0.07
Reach-1	53278	7180	969.97	989.67	0.13	989.92	0.000124	4.39	2401.75	204.5	0.19
Reach-1	53278	5960	969.97	987.27	0.14	987.54	0.000154	4.43	1911.26	204.5	0.2
Reach-1	53278	3602	969.97	982.94	0.14	983.2	0.000214	4.16	1047.42	163.32	0.22
Reach-1	53278	2746	969.97	980.76	0.14	981.01	0.000273	4.05	760.11	116.78	0.24
Reach-1	53278	1686	969.97	978.75	0.1	978.92	0.000261	3.31	541.16	100.98	0.23
Reach-1	53278	1450	969.97	978.11	0.1	978.26	0.000275	3.17	477.58	95.9	0.23
Reach-1	53278	1375	969.97	977.89	0.1	978.04	0.000281	3.13	456.92	94.19	0.23
Reach-1	53278	1328	969.97	977.76	0.1	977.91	0.000284	3.09	444.82	93.18	0.23
Reach-1	53278	1171	969.97	977.32	0.09	977.46	0.000291	2.97	404.66	89.73	0.23

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Reach-1	53278	804	969.97	976.07	0.08	976.18	0.000353	2.71	298.3	79.88	0.24
Reach-1	53278	379	969.97	974.1	0.07	974.19	0.000406	2.32	163.6	59.34	0.25
Reach-1	53278	110	969.97	972.18	0.05	972.22	0.000535	1.73	63.75	44.75	0.25
Reach-1	53303	7180	969.99	989.69	0.13	989.93	0.000116	4.28	2481.19	204.5	0.18
Reach-1	53303	5960	969.99	987.31	0.13	987.55	0.000141	4.29	1993.85	204.5	0.19
Reach-1	53303	3602	969.99	982.97	0.13	983.21	0.000194	4.03	1119.43	179.33	0.21
Reach-1	53303	2746	969.99	980.8	0.13	981.03	0.000244	3.9	806.8	122.08	0.23
Reach-1	53303	1686	969.99	978.77	0.1	978.92	0.00023	3.18	574.7	106.09	0.22
Reach-1	53303	1450	969.99	978.12	0.09	978.26	0.000241	3.04	507.69	101.01	0.22
Reach-1	53303	1375	969.99	977.91	0.09	978.05	0.000244	2.99	486.7	99.36	0.22
Reach-1	53303	1328	969.99	977.78	0.09	977.91	0.000245	2.96	473.93	98.35	0.22
Reach-1	53303	1171	969.99	977.34	0.08	977.46	0.00025	2.83	431.45	94.89	0.22
Reach-1	53303	804	969.99	976.09	0.07	976.19	0.00029	2.56	318.69	85.05	0.22
Reach-1	53303	379	969.99	974.12	0.07	974.2	0.000436	2.26	167.59	66.7	0.25
Reach-1	53303	110	969.99	972.18	0.05	972.23	0.000542	1.73	63.46	44.69	0.26
Reach-1	53383	7180	968.6	989.58	0.19	989.99	0.000163	5.35	1719.96	116	0.21
Reach-1	53383	5960	968.6	987.23	0.18	987.61	0.000178	5.14	1446.54	116	0.22
Reach-1	53383	3602	968.6	982.96	0.14	983.23	0.00018	4.29	960.74	98.81	0.21
Reach-1	53383	2746	968.6	980.82	0.13	981.06	0.000195	3.96	759.67	89.11	0.21
Reach-1	53383	1686	968.6	978.79	0.08	978.93	0.000148	3.02	588.62	79.42	0.18
Reach-1	53383	1450	968.6	978.15	0.07	978.27	0.000141	2.8	538.6	76.24	0.17
Reach-1	53383	1375	968.6	977.94	0.07	978.06	0.000138	2.73	523.04	75.22	0.17
Reach-1	53383	1328	968.6	977.81	0.06	977.93	0.000136	2.68	513.41	74.57	0.17
Reach-1	53383	1171	968.6	977.38	0.06	977.47	0.000127	2.5	481.26	72.39	0.16
Reach-1	53383	804	968.6	976.13	0.04	976.2	0.000109	2.06	394.91	66.15	0.14
Reach-1	53383	379	968.6	974.18	0.02	974.21	0.000076	1.39	272.66	59.6	0.11
Reach-1	53383	110	968.6	972.23	0.01	972.24	0.000031	0.68	162.14	53.69	0.07
Reach-1	53533	7180	967.4	989.63	0.19	990.01	0.000171	5.34	1833.33	130	0.21
Reach-1	53533	5960	967.4	987.26	0.19	987.63	0.00019	5.18	1525.73	130	0.22
Reach-1	53533	3602	967.4	982.98	0.15	983.26	0.000195	4.38	979.7	109.86	0.21
Reach-1	53533	2746	967.4	980.84	0.13	981.08	0.000211	4.05	762.01	93.06	0.21
Reach-1	53533	1686	967.4	978.82	0.08	978.96	0.000157	3.08	588.23	80.19	0.18
Reach-1	53533	1450	967.4	978.17	0.07	978.3	0.000149	2.86	537.58	76.75	0.17
Reach-1	53533	1375	967.4	977.97	0.07	978.09	0.000145	2.78	521.99	75.72	0.17
Reach-1	53533	1328	967.4	977.84	0.07	977.95	0.000142	2.73	512.29	75.29	0.17
Reach-1	53533	1171	967.4	977.4	0.06	977.5	0.000131	2.54	479.65	73.83	0.16
Reach-1	53533	804	967.4	976.15	0.04	976.22	0.000106	2.08	392.1	65.31	0.14
Reach-1	53533	379	967.4	974.2	0.02	974.22	0.000066	1.36	278.17	54.29	0.11
Reach-1	53533	110	967.4	972.24	0	972.24	0.000023	0.63	174.7	51.35	0.06
Reach-1	53538	7180	970.18	989.8	0.11	990.03	0.000105	3.98	2078.86	140	0.17
Reach-1	53538	5960	970.18	987.43	0.11	987.65	0.000121	3.87	1747.22	140	0.18
Reach-1	53538	3602	970.18	983.1	0.09	983.28	0.000149	3.4	1142.28	137.3	0.19
Reach-1	53538	2746	970.18	980.92	0.1	981.09	0.000194	3.32	860.85	121.5	0.2
Reach-1	53538	1686	970.18	978.85	0.07	978.96	0.000196	2.75	621.55	109.73	0.2
Reach-1	53538	1450	970.18	978.19	0.07	978.3	0.000212	2.65	551.04	106.47	0.2
Reach-1	53538	1375	970.18	977.99	0.07	978.1	0.000216	2.61	529.47	105.45	0.2
Reach-1	53538	1328	970.18	977.85	0.07	977.96	0.00022	2.59	515.16	104.77	0.2
Reach-1	53538	1171	970.18	977.41	0.07	977.51	0.000232	2.5	469.21	102.55	0.2
Reach-1	53538	804	970.18	976.14	0.06	976.23	0.000277	2.33	344.52	93.25	0.21
Reach-1	53538	379	970.18	974.17	0.05	974.24	0.000312	2.02	187.29	68.56	0.22
Reach-1	53538	110	970.18	972.22	0.04	972.26	0.000439	1.55	71.05	50.71	0.23

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Reach-1	53573	7180	969.2	989.78	0.13	990.04	0.000123	4.27	1960.77	140	0.18
Reach-1	53573	5960	969.2	987.41	0.13	987.67	0.000143	4.17	1629.04	140	0.19
Reach-1	53573	3602	969.2	983.08	0.11	983.29	0.000176	3.67	1039.37	124.83	0.2
Reach-1	53573	2746	969.2	980.91	0.11	981.11	0.000224	3.56	789.52	107.47	0.22
Reach-1	53573	1686	969.2	978.85	0.08	978.98	0.000211	2.91	581.45	94.35	0.2
Reach-1	53573	1450	969.2	978.2	0.08	978.32	0.000219	2.78	521.28	90	0.2
Reach-1	53573	1375	969.2	978	0.07	978.11	0.00022	2.73	503.17	88.65	0.2
Reach-1	53573	1328	969.2	977.86	0.07	977.97	0.000219	2.7	490.99	87.7	0.2
Reach-1	53573	1171	969.2	977.42	0.07	977.52	0.000212	2.58	453.16	84.68	0.2
Reach-1	53573	804	969.2	976.15	0.06	976.23	0.000202	2.29	350.94	75.91	0.19
Reach-1	53573	379	969.2	974.2	0.04	974.24	0.000174	1.75	215.97	62.49	0.17
Reach-1	53573	110	969.2	972.25	0.01	972.27	0.000113	1.03	106.72	50.02	0.12
Reach-1	53683	7180	968	989.76	0.15	990.06	0.000131	4.73	2227.32	200	0.19
Reach-1	53683	5960	968	987.39	0.16	987.7	0.000156	4.73	1751.69	200	0.2
Reach-1	53683	3602	968	983.07	0.13	983.33	0.000176	4.14	972.56	106.67	0.2
Reach-1	53683	2746	968	980.91	0.12	981.14	0.000196	3.85	761.8	91.83	0.21
Reach-1	53683	1686	968	978.86	0.08	979	0.000155	2.97	584.88	80.88	0.18
Reach-1	53683	1450	968	978.22	0.07	978.34	0.00015	2.77	533.97	77.45	0.17
Reach-1	53683	1375	968	978.02	0.07	978.13	0.000147	2.69	518.5	76.37	0.17
Reach-1	53683	1328	968	977.88	0.06	977.99	0.000146	2.65	508	75.72	0.17
Reach-1	53683	1171	968	977.44	0.06	977.54	0.000139	2.49	475.46	73.7	0.17
Reach-1	53683	804	968	976.17	0.04	976.24	0.000128	2.09	385.54	67.8	0.15
Reach-1	53683	379	968	974.22	0.02	974.26	0.000096	1.47	258.67	62.73	0.13
Reach-1	53683	110	968	972.27	0.01	972.28	0.000048	0.77	143.58	55.03	0.08
Reach-1	53773	7180	968	989.7	0.2	990.11	0.000159	5.5	1763.59	111	0.21
Reach-1	53773	5960	968	987.36	0.19	987.74	0.000169	5.24	1504.5	111	0.22
Reach-1	53773	3602	968	983.07	0.14	983.34	0.000167	4.35	1028.37	108.7	0.2
Reach-1	53773	2746	968	980.92	0.12	981.15	0.000176	3.99	810.22	93.24	0.2
Reach-1	53773	1686	968	978.87	0.08	979	0.00013	3.02	628.57	84.1	0.17
Reach-1	53773	1450	968	978.23	0.07	978.35	0.000121	2.79	576.19	81.27	0.16
Reach-1	53773	1375	968	978.03	0.06	978.15	0.000118	2.71	560.06	80.38	0.16
Reach-1	53773	1328	968	977.9	0.06	978	0.000116	2.67	549.02	79.77	0.16
Reach-1	53773	1171	968	977.46	0.05	977.56	0.000107	2.48	514.96	77.88	0.15
Reach-1	53773	804	968	976.2	0.04	976.26	0.000089	2.03	418.92	73.49	0.13
Reach-1	53773	379	968	974.24	0.02	974.27	0.000059	1.33	287.96	59.69	0.1
Reach-1	53773	110	968	972.28	0	972.29	0.000021	0.61	179.24	52.41	0.06
Reach-1	53833	7180	969.3	989.96	0.1	990.14	0.000087	3.88	3333.61	400	0.16
Reach-1	53833	5960	969.3	987.54	0.12	987.77	0.000117	4.11	2366.82	400	0.18
Reach-1	53833	3602	969.3	983.14	0.11	983.36	0.000148	3.77	1082.28	129.91	0.19
Reach-1	53833	2746	969.3	980.98	0.1	981.17	0.000167	3.53	841.78	101.71	0.19
Reach-1	53833	1686	969.3	978.89	0.07	979.01	0.000139	2.76	638.42	92.82	0.17
Reach-1	53833	1450	969.3	978.25	0.06	978.35	0.000136	2.58	580.01	89.84	0.17
Reach-1	53833	1375	969.3	978.05	0.06	978.15	0.000134	2.52	562.32	88.91	0.16
Reach-1	53833	1328	969.3	977.91	0.06	978.01	0.000134	2.48	550.11	88.27	0.16
Reach-1	53833	1171	969.3	977.49	0.05	977.57	0.000128	2.33	512.68	86.27	0.16
Reach-1	53833	804	969.3	976.21	0.04	976.27	0.00012	1.98	408.99	77.49	0.15
Reach-1	53833	379	969.3	974.25	0.02	974.28	0.000106	1.44	262.92	71.28	0.13
Reach-1	53833	110	969.3	972.29	0.01	972.3	0.000077	0.84	130.82	63.36	0.1
Reach-1	53930	7180	970.5	989.83	0.18	990.21	0.000152	5.22	1796.41	121	0.21
Reach-1	53930	5960	970.5	987.46	0.18	987.82	0.000168	5.03	1509.88	121	0.22

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Reach-1	53930	3602	970.5	983.13	0.13	983.38	0.000174	4.19	1028.21	101.43	0.21
Reach-1	53930	2746	970.5	980.97	0.13	981.19	0.000197	3.93	812.21	98.45	0.22
Reach-1	53930	1686	970.5	978.9	0.08	979.04	0.000163	3.08	613.04	92.29	0.19
Reach-1	53930	1450	970.5	978.25	0.08	978.38	0.00016	2.89	554.84	89.49	0.18
Reach-1	53930	1375	970.5	978.06	0.07	978.18	0.000158	2.82	537.28	88.63	0.18
Reach-1	53930	1328	970.5	977.92	0.07	978.04	0.000157	2.78	525.12	88.02	0.18
Reach-1	53930	1171	970.5	977.49	0.06	977.6	0.00015	2.61	487.93	86.16	0.18
Reach-1	53930	804	970.5	976.21	0.05	976.29	0.000144	2.22	382.48	77.72	0.17
Reach-1	53930	379	970.5	974.25	0.03	974.29	0.000139	1.64	237.67	70.75	0.15
Reach-1	53930	110	970.5	972.29	0.02	972.31	0.000165	1.05	104.56	64.86	0.15
Reach-1	53983	7180	969.3	990.07	0.09	990.24	0.000082	3.76	3141.42	280	0.15
Reach-1	53983	5960	969.3	987.66	0.1	987.85	0.000101	3.83	2466.67	280	0.16
Reach-1	53983	3602	969.3	983.2	0.1	983.4	0.000137	3.64	1269.35	222.08	0.18
Reach-1	53983	2746	969.3	981.02	0.1	981.21	0.000162	3.48	872.1	138.82	0.19
Reach-1	53983	1686	969.3	978.94	0.06	979.05	0.000131	2.7	652.42	91.77	0.17
Reach-1	53983	1450	969.3	978.29	0.06	978.39	0.000128	2.52	594.1	89.45	0.16
Reach-1	53983	1375	969.3	978.08	0.06	978.18	0.000127	2.46	575.5	88.7	0.16
Reach-1	53983	1328	969.3	977.95	0.05	978.04	0.000126	2.42	563.3	88.21	0.16
Reach-1	53983	1171	969.3	977.52	0.05	977.6	0.00012	2.27	525.82	86.66	0.15
Reach-1	53983	804	969.3	976.23	0.04	976.29	0.000114	1.93	418.71	79.14	0.14
Reach-1	53983	379	969.3	974.27	0.02	974.3	0.000099	1.4	270.87	71.96	0.13
Reach-1	53983	110	969.3	972.3	0.01	972.31	0.000074	0.81	135.19	65.96	0.1
Reach-1	54083	7180	969.5	990.08	0.09	990.25	0.000083	3.76	3208.89	300	0.15
Reach-1	54083	5960	969.5	987.66	0.11	987.86	0.000106	3.87	2484.95	300	0.17
Reach-1	54083	3602	969.5	983.22	0.11	983.41	0.000148	3.69	1276.66	211.76	0.19
Reach-1	54083	2746	969.5	981.03	0.11	981.23	0.000185	3.6	882.17	149.96	0.2
Reach-1	54083	1686	969.5	978.94	0.07	979.07	0.000163	2.87	628.68	104.94	0.18
Reach-1	54083	1450	969.5	978.3	0.07	978.41	0.000164	2.71	563.03	98.82	0.18
Reach-1	54083	1375	969.5	978.1	0.07	978.2	0.000164	2.65	543.28	96.9	0.18
Reach-1	54083	1328	969.5	977.96	0.07	978.06	0.000164	2.62	529.98	95.63	0.18
Reach-1	54083	1171	969.5	977.53	0.06	977.62	0.000161	2.48	489.7	91.99	0.18
Reach-1	54083	804	969.5	976.24	0.05	976.32	0.000168	2.17	377.26	84.47	0.17
Reach-1	54083	379	969.5	974.27	0.04	974.32	0.000212	1.73	218.65	76.22	0.18
Reach-1	54083	110	969.5	972.31	0.03	972.34	0.000476	1.42	77.64	67.39	0.23
Reach-1	54183	7180	969.5	989.99	0.15	990.3	0.000132	4.67	1863.62	121	0.19
Reach-1	54183	5960	969.5	987.6	0.14	987.9	0.000146	4.49	1575.42	121	0.19
Reach-1	54183	3602	969.5	983.22	0.11	983.44	0.00016	3.83	1049.26	114.05	0.19
Reach-1	54183	2746	969.5	981.04	0.11	981.24	0.000185	3.61	815.78	100.7	0.2
Reach-1	54183	1686	969.5	978.96	0.07	979.08	0.000156	2.83	615.23	91.45	0.18
Reach-1	54183	1450	969.5	978.31	0.07	978.42	0.000154	2.66	557.29	88.62	0.17
Reach-1	54183	1375	969.5	978.11	0.06	978.21	0.000153	2.6	539.17	87.72	0.17
Reach-1	54183	1328	969.5	977.97	0.06	978.07	0.000153	2.56	527.08	87.11	0.17
Reach-1	54183	1171	969.5	977.54	0.06	977.63	0.000147	2.41	490.6	85.32	0.17
Reach-1	54183	804	969.5	976.26	0.04	976.33	0.000138	2.06	390.06	73.05	0.16
Reach-1	54183	379	969.5	974.29	0.03	974.33	0.000118	1.51	251.38	67.87	0.14
Reach-1	54183	110	969.5	972.34	0.01	972.35	0.000092	0.89	123.72	62.72	0.11
Reach-1	54283	7180	969.5	990.01	0.15	990.31	0.000123	4.69	2087.23	170	0.19
Reach-1	54283	5960	969.5	987.61	0.15	987.92	0.000141	4.61	1679.77	170	0.2
Reach-1	54283	3602	969.5	983.22	0.12	983.45	0.000152	3.91	1063.82	110.67	0.19
Reach-1	54283	2746	969.5	981.05	0.11	981.26	0.000172	3.67	831.38	103.79	0.2
Reach-1	54283	1686	969.5	978.97	0.07	979.1	0.000142	2.87	625	91.28	0.18

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Reach-1	54283	1450	969.5	978.33	0.06	978.44	0.000138	2.68	568.17	85.57	0.17
Reach-1	54283	1375	969.5	978.12	0.06	978.22	0.000136	2.61	550.45	83.71	0.17
Reach-1	54283	1328	969.5	977.98	0.06	978.08	0.000135	2.57	538.95	82.6	0.17
Reach-1	54283	1171	969.5	977.56	0.05	977.65	0.000128	2.41	504.8	81.26	0.16
Reach-1	54283	804	969.5	976.28	0.04	976.34	0.000121	2.04	403.24	77.12	0.15
Reach-1	54283	379	969.5	974.31	0.03	974.35	0.000111	1.48	257.78	71.17	0.14
Reach-1	54283	110	969.5	972.35	0.01	972.37	0.000098	0.89	123.36	65.94	0.11
Reach-1	54383	7180	969	989.91	0.22	990.38	0.00018	5.86	1808.8	159.87	0.23
Reach-1	54383	5960	969	987.54	0.21	987.97	0.000195	5.61	1460.13	125.62	0.23
Reach-1	54383	3602	969	983.18	0.16	983.49	0.000197	4.68	970.77	100.29	0.22
Reach-1	54383	2746	969	981.02	0.15	981.3	0.000214	4.34	764.1	91.43	0.23
Reach-1	54383	1686	969	978.97	0.09	979.13	0.000164	3.33	584.68	82.97	0.19
Reach-1	54383	1450	969	978.33	0.08	978.47	0.000156	3.1	532.4	80.34	0.19
Reach-1	54383	1375	969	978.12	0.08	978.25	0.000153	3.02	515.64	79.47	0.18
Reach-1	54383	1328	969	977.98	0.08	978.11	0.000151	2.97	504.7	78.87	0.18
Reach-1	54383	1171	969	977.56	0.07	977.68	0.000141	2.77	472.59	76.53	0.17
Reach-1	54383	804	969	976.29	0.05	976.37	0.000122	2.29	379.41	69.29	0.16
Reach-1	54383	379	969	974.33	0.03	974.36	0.00009	1.56	252.06	61.11	0.13
Reach-1	54383	110	969	972.37	0.01	972.38	0.000048	0.79	139.98	53.45	0.08
Reach-1	54483	7180	969.5	989.94	0.23	990.4	0.000206	5.8	1742.89	150	0.23
Reach-1	54483	5960	969.5	987.54	0.23	988	0.000242	5.76	1383.81	144.3	0.25
Reach-1	54483	3602	969.5	983.16	0.19	983.52	0.00027	4.96	858.52	102.59	0.25
Reach-1	54483	2746	969.5	981	0.18	981.34	0.000313	4.7	650.74	90.31	0.26
Reach-1	54483	1686	969.5	978.96	0.12	979.17	0.000259	3.68	479.44	76.5	0.23
Reach-1	54483	1450	969.5	978.32	0.11	978.51	0.000254	3.45	432.24	71.52	0.22
Reach-1	54483	1375	969.5	978.11	0.11	978.29	0.000252	3.37	417.37	69.88	0.22
Reach-1	54483	1328	969.5	977.98	0.1	978.15	0.00025	3.32	407.82	68.74	0.22
Reach-1	54483	1171	969.5	977.57	0.09	977.72	0.000238	3.11	380.54	64.44	0.21
Reach-1	54483	804	969.5	976.29	0.07	976.4	0.000221	2.63	305.23	56.02	0.2
Reach-1	54483	379	969.5	974.33	0.04	974.39	0.000175	1.89	200.26	51.24	0.17
Reach-1	54483	110	969.5	972.38	0.02	972.39	0.000111	1.05	104.42	46.84	0.12
Reach-1	54683	7180	968.4	990.03	0.2	990.44	0.000176	5.48	1807.62	150	0.22
Reach-1	54683	5960	968.4	987.64	0.2	988.05	0.000201	5.38	1450.96	144.95	0.23
Reach-1	54683	3602	968.4	983.27	0.16	983.57	0.000209	4.52	937.67	100.29	0.22
Reach-1	54683	2746	968.4	981.13	0.15	981.4	0.000231	4.21	732.55	91.17	0.22
Reach-1	54683	1686	968.4	979.06	0.09	979.22	0.000183	3.26	553.1	81.21	0.19
Reach-1	54683	1450	968.4	978.41	0.08	978.55	0.000176	3.04	501.95	77.7	0.19
Reach-1	54683	1375	968.4	978.2	0.08	978.33	0.000174	2.96	485.56	76.54	0.19
Reach-1	54683	1328	968.4	978.06	0.08	978.19	0.000172	2.91	474.96	75.79	0.18
Reach-1	54683	1171	968.4	977.64	0.07	977.76	0.000162	2.72	443.83	73.69	0.18
Reach-1	54683	804	968.4	976.36	0.05	976.44	0.000145	2.27	354.73	62.48	0.16
Reach-1	54683	379	968.4	974.37	0.03	974.41	0.000091	1.54	245.63	51.36	0.12
Reach-1	54683	110	968.4	972.39	0.01	972.4	0.000038	0.75	146.58	48.56	0.08
Reach-1	54783	7180	970.14	990.26	0.11	990.47	0.000107	3.98	2881.58	398.71	0.17
Reach-1	54783	5960	970.14	987.86	0.12	988.09	0.000136	4.04	2104.68	290.59	0.19
Reach-1	54783	3602	970.14	983.38	0.12	983.61	0.000202	3.86	1057.94	176.61	0.21
Reach-1	54783	2746	970.14	981.2	0.13	981.43	0.000276	3.84	733.1	121.1	0.24
Reach-1	54783	1686	970.14	979.08	0.1	979.24	0.000273	3.21	525.11	85.93	0.23
Reach-1	54783	1450	970.14	978.43	0.1	978.58	0.000276	3.08	470.28	82.61	0.23
Reach-1	54783	1375	970.14	978.22	0.09	978.36	0.000276	3.04	452.69	81.52	0.23
Reach-1	54783	1328	970.14	978.08	0.09	978.22	0.000277	3.01	441.31	80.8	0.23

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Reach-1	54783	1171	970.14	977.66	0.08	977.78	0.00027	2.87	407.79	78.66	0.22
Reach-1	54783	804	970.14	976.36	0.07	976.47	0.00028	2.59	310.28	72.05	0.22
Reach-1	54783	379	970.14	974.37	0.06	974.44	0.000327	2.14	176.71	61.87	0.22
Reach-1	54783	110	970.14	972.39	0.04	972.43	0.000353	1.54	71.21	43.31	0.21
Reach-1	54790	7180	968.8	990.22	0.14	990.49	0.000121	4.52	2169.88	160	0.18
Reach-1	54790	5960	968.8	987.83	0.14	988.1	0.000138	4.41	1791.25	155.67	0.19
Reach-1	54790	3602	968.8	983.39	0.12	983.61	0.000163	3.88	1121.65	138.84	0.2
Reach-1	54790	2746	968.8	981.23	0.11	981.43	0.000191	3.68	853.44	114.66	0.21
Reach-1	54790	1686	968.8	979.11	0.08	979.24	0.000169	2.95	620.26	105.48	0.19
Reach-1	54790	1450	968.8	978.46	0.07	978.58	0.00017	2.79	552.71	102.66	0.18
Reach-1	54790	1375	968.8	978.25	0.07	978.36	0.00017	2.73	530.98	101.74	0.18
Reach-1	54790	1328	968.8	978.11	0.07	978.22	0.00017	2.7	516.77	101.13	0.18
Reach-1	54790	1171	968.8	977.69	0.06	977.79	0.000165	2.55	474.74	98.06	0.18
Reach-1	54790	804	968.8	976.39	0.05	976.47	0.000155	2.2	365.89	69.29	0.17
Reach-1	54790	379	968.8	974.4	0.03	974.44	0.000118	1.59	238.8	59.75	0.14
Reach-1	54790	110	968.8	972.42	0.01	972.43	0.000067	0.86	127.66	52.94	0.1
Reach-1	54900	7180	970	990.28	0.12	990.51	0.000104	4.18	2520.85	250	0.17
Reach-1	54900	5960	970	987.87	0.12	988.12	0.000127	4.2	1920.05	243.89	0.18
Reach-1	54900	3602	970	983.43	0.1	983.63	0.000146	3.64	1174.87	134.01	0.19
Reach-1	54900	2746	970	981.27	0.1	981.45	0.000173	3.47	903.24	118.97	0.2
Reach-1	54900	1686	970	979.14	0.07	979.26	0.000157	2.8	658.94	110.42	0.18
Reach-1	54900	1450	970	978.49	0.07	978.6	0.000159	2.65	588.27	107.82	0.18
Reach-1	54900	1375	970	978.28	0.06	978.38	0.00016	2.6	565.61	106.98	0.18
Reach-1	54900	1328	970	978.14	0.06	978.24	0.00016	2.57	550.69	106.41	0.18
Reach-1	54900	1171	970	977.72	0.06	977.81	0.000157	2.44	506.13	104.72	0.17
Reach-1	54900	804	970	976.42	0.05	976.49	0.000168	2.14	376.86	88.01	0.17
Reach-1	54900	379	970	974.42	0.03	974.47	0.000175	1.68	225.2	70.11	0.17
Reach-1	54900	110	970	972.43	0.02	972.45	0.000208	1.15	95.48	60.16	0.16
Reach-1	54935	7180	970	990.27	0.12	990.51	0.000115	4.24	2450.85	250	0.17
Reach-1	54935	5960	970	987.87	0.13	988.13	0.000141	4.28	1849.93	243.12	0.19
Reach-1	54935	3602	970	983.44	0.11	983.64	0.000163	3.7	1141.64	125.16	0.19
Reach-1	54935	2746	970	981.27	0.11	981.46	0.000196	3.54	879.8	116.69	0.2
Reach-1	54935	1686	970	979.15	0.08	979.27	0.000179	2.86	641.1	108.4	0.19
Reach-1	54935	1450	970	978.5	0.07	978.62	0.000183	2.72	571.77	105.87	0.19
Reach-1	54935	1375	970	978.29	0.07	978.4	0.000184	2.67	549.59	105.05	0.18
Reach-1	54935	1328	970	978.15	0.07	978.26	0.000185	2.64	534.94	104.51	0.18
Reach-1	54935	1171	970	977.73	0.06	977.83	0.000183	2.5	491.15	102.85	0.18
Reach-1	54935	804	970	976.43	0.05	976.51	0.0002	2.22	363.65	87.45	0.18
Reach-1	54935	379	970	974.43	0.04	974.48	0.00026	1.82	208.26	74.7	0.19
Reach-1	54935	110	970	972.44	0.03	972.47	0.000285	1.32	83.35	53.37	0.19
Reach-1	54970	7180	970.2	990.27	0.13	990.52	0.000116	4.34	2468.06	250	0.18
Reach-1	54970	5960	970.2	987.86	0.14	988.14	0.000144	4.41	1866.74	246.37	0.19
Reach-1	54970	3602	970.2	983.44	0.12	983.66	0.000169	3.86	1072.54	116.52	0.2
Reach-1	54970	2746	970.2	981.27	0.11	981.47	0.000199	3.67	829.78	107.75	0.21
Reach-1	54970	1686	970.2	979.16	0.08	979.29	0.000177	2.93	611.26	99.2	0.19
Reach-1	54970	1450	970.2	978.51	0.07	978.63	0.000179	2.77	547.97	96.58	0.19
Reach-1	54970	1375	970.2	978.3	0.07	978.42	0.000179	2.72	527.8	95.73	0.18
Reach-1	54970	1328	970.2	978.16	0.07	978.28	0.000179	2.68	514.48	95.17	0.18
Reach-1	54970	1171	970.2	977.74	0.06	977.84	0.000175	2.53	474.8	91.98	0.18
Reach-1	54970	804	970.2	976.44	0.05	976.52	0.000184	2.22	363.31	79.29	0.18
Reach-1	54970	379	970.2	974.44	0.04	974.49	0.000205	1.75	216.16	70	0.18

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Reach-1	54970	110	970.2	972.46	0.03	972.48	0.000349	1.31	83.74	63.66	0.2
Reach-1	55030	7180	970.2	990.26	0.13	990.54	0.000115	4.42	2008.87	140	0.18
Reach-1	55030	5960	970.2	987.87	0.13	988.14	0.000129	4.28	1675.87	137.95	0.18
Reach-1	55030	3602	970.2	983.46	0.1	983.66	0.000141	3.65	1093.15	118.61	0.18
Reach-1	55030	2746	970.2	981.31	0.1	981.49	0.000158	3.4	858.36	102.22	0.19
Reach-1	55030	1686	970.2	979.19	0.06	979.3	0.000133	2.67	651.21	92.84	0.17
Reach-1	55030	1450	970.2	978.54	0.06	978.64	0.000131	2.5	592.11	89.98	0.16
Reach-1	55030	1375	970.2	978.33	0.06	978.42	0.000129	2.44	573.34	89.06	0.16
Reach-1	55030	1328	970.2	978.19	0.05	978.28	0.000129	2.41	560.95	88.44	0.16
Reach-1	55030	1171	970.2	977.77	0.05	977.85	0.000123	2.26	523.9	86.18	0.15
Reach-1	55030	804	970.2	976.46	0.04	976.52	0.000119	1.93	416.47	79.19	0.15
Reach-1	55030	379	970.2	974.46	0.02	974.49	0.00011	1.44	264.03	73.65	0.13
Reach-1	55030	110	970.2	972.48	0.01	972.49	0.000107	0.9	122.73	69.1	0.12
Reach-1	55100	7180	968.3	990.23	0.16	990.58	0.000142	4.95	2009.08	200	0.19
Reach-1	55100	5960	968.3	987.82	0.17	988.18	0.000165	4.9	1532.2	190.52	0.2
Reach-1	55100	3602	968.3	983.43	0.13	983.68	0.000166	4.07	960.07	93.09	0.2
Reach-1	55100	2746	968.3	981.3	0.11	981.51	0.000176	3.73	770.84	84.01	0.2
Reach-1	55100	1686	968.3	979.19	0.07	979.32	0.000135	2.84	603.61	75.07	0.17
Reach-1	55100	1450	968.3	978.55	0.06	978.66	0.000127	2.63	556.1	72.33	0.16
Reach-1	55100	1375	968.3	978.34	0.06	978.44	0.000125	2.56	541.06	71.44	0.16
Reach-1	55100	1328	968.3	978.2	0.06	978.3	0.000123	2.52	531.15	70.85	0.16
Reach-1	55100	1171	968.3	977.78	0.05	977.86	0.000114	2.34	501.58	68.7	0.15
Reach-1	55100	804	968.3	976.47	0.04	976.53	0.000094	1.93	416.55	63.1	0.13
Reach-1	55100	379	968.3	974.48	0.02	974.5	0.000059	1.29	294.66	59.04	0.1
Reach-1	55100	110	968.3	972.49	0	972.5	0.000022	0.61	181.41	55	0.06
Reach-1	55181	7180	970.46	990.32	0.15	990.6	0.000182	4.51	2690.83	753.31	0.19
Reach-1	55181	5960	970.46	987.82	0.18	988.2	0.000217	4.94	1206.35	318.4	0.22
Reach-1	55181	3602	970.46	983.43	0.14	983.69	0.000218	4.13	872.76	76.01	0.21
Reach-1	55181	2746	970.46	981.29	0.13	981.53	0.000243	3.86	710.59	75.98	0.22
Reach-1	55181	1686	970.46	979.2	0.09	979.35	0.000206	3.06	551.6	75.95	0.2
Reach-1	55181	1450	970.46	978.55	0.08	978.68	0.000206	2.89	502.19	75.94	0.2
Reach-1	55181	1375	970.46	978.34	0.08	978.46	0.000205	2.83	486.3	75.93	0.2
Reach-1	55181	1328	970.46	978.2	0.08	978.32	0.000206	2.79	475.72	75.93	0.2
Reach-1	55181	1171	970.46	977.78	0.07	977.89	0.000201	2.64	443.54	75.92	0.19
Reach-1	55181	804	970.46	976.47	0.06	976.56	0.000212	2.33	344.65	75.18	0.19
Reach-1	55181	379	970.46	974.47	0.04	974.52	0.000225	1.88	202.01	64.96	0.19
Reach-1	55181	110	970.46	972.49	0.02	972.52	0.000216	1.25	87.86	50.57	0.17
Reach-1	55196 Bridge										
Reach-1	55210	7180	970.46	990.34	0.15	990.62	0.000181	4.5	2709.47	754.89	0.18
Reach-1	55210	5960	970.46	988.24	0.17	988.61	0.0002	4.81	1238.3	366.46	0.21
Reach-1	55210	3602	970.46	983.43	0.14	983.69	0.000218	4.13	872.77	76.01	0.21
Reach-1	55210	2746	970.46	981.3	0.13	981.53	0.000243	3.86	710.66	75.98	0.22
Reach-1	55210	1686	970.46	979.22	0.09	979.37	0.000204	3.05	553.24	75.95	0.2
Reach-1	55210	1450	970.46	978.55	0.08	978.68	0.000206	2.89	502.46	75.94	0.2
Reach-1	55210	1375	970.46	978.34	0.08	978.47	0.000205	2.83	486.52	75.93	0.2
Reach-1	55210	1328	970.46	978.2	0.08	978.32	0.000205	2.79	475.91	75.93	0.2
Reach-1	55210	1171	970.46	977.78	0.07	977.89	0.0002	2.64	443.63	75.92	0.19
Reach-1	55210	804	970.46	976.47	0.06	976.56	0.000212	2.33	344.7	75.19	0.19
Reach-1	55210	379	970.46	974.47	0.04	974.52	0.000225	1.88	202.03	64.96	0.19
Reach-1	55210	110	970.46	972.49	0.02	972.52	0.000216	1.25	87.89	50.58	0.17

HEC-RAS Plan: Housatonic small scale proposed output

Reach-1	55258	7180	970.5	990.45	0.1	990.63	0.0001	3.65	2789.73	400	0.16
Reach-1	55258	5960	970.5	988.42	0.1	988.62	0.000121	3.66	2020.19	350.08	0.17
Reach-1	55258	3602	970.5	983.52	0.1	983.71	0.000182	3.49	1031.73	106.5	0.2
Reach-1	55258	2746	970.5	981.37	0.1	981.54	0.000209	3.39	810.94	98.23	0.21
Reach-1	55258	1686	970.5	979.25	0.07	979.37	0.000178	2.76	611.76	90.13	0.19
Reach-1	55258	1450	970.5	978.59	0.07	978.69	0.000176	2.62	552.84	87.58	0.18
Reach-1	55258	1375	970.5	978.37	0.06	978.47	0.000176	2.58	533.53	86.74	0.18
Reach-1	55258	1328	970.5	978.23	0.06	978.33	0.000176	2.55	521.39	86.2	0.18
Reach-1	55258	1171	970.5	977.8	0.06	977.89	0.000169	2.41	484.9	84.56	0.18
Reach-1	55258	804	970.5	976.49	0.05	976.56	0.000167	2.13	377.68	79.55	0.17
Reach-1	55258	379	970.5	974.48	0.03	974.53	0.000177	1.68	225.59	71.85	0.17
Reach-1	55258	110	970.5	972.5	0.02	972.52	0.000214	1.17	94.02	59.94	0.16