Report of the West Valley Erosion Working Group

Study 2: Recent Erosion and Deposition Processes

Task 2.2: Infiltration and Soil Moisture Determination

Task 2.5: Erodibility of Cohesive Sediment

Task 2.6: Erodibility of Clastic Sediment in Selected Gullies, Stream Channels, and Streambanks

WEST VALLEY DEMONSTRATION PROJECT AND WESTERN NEW YORK NUCLEAR SERVICE CENTER

Submitted to:

United States Department of Energy, and
New York State Energy Research and Development Authority

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Enviro Compliance Solutions, Inc. (ECS) Contract Number DE-EM0002446/0920/13/DE-DT0005364/001

March 1, 2017

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United States Department of Energy, and
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EXECUTIVE SUMMARY

Enviro Compliance Solutions, Inc. and the West Valley Erosion Working Group recommended an erosion assessment to be performed as part of the Phase 1 Studies at the West Valley Demonstration Project and Western New York Nuclear Service Center. These studies seek to improve forecasts of future erosion at this facility, which includes a focus on recent erosion and deposition processes. The EWG identified a list of environmental parameters that would reduce uncertainties in predicting future erosion using a landscape evolution model (WVDP Erosion Working Group, 2015), and these included soil-infiltration capacities measured using a double-ring infiltrometer (Task 2.2), soil/till-detachment thresholds quantified using the Jet Erosion Test (Task 2.5), and bed-sediment entrainment thresholds determined using Wolman pebble counts (Task 2.5). The infiltration and erodibility studies were performed in trenches dug by the EWG activities in support of Study 1 - Terrain Analysis, Age Dating, and Paleoclimate, and restricted in space to the Heinz Creek Terrace, the Tree Farm Terrace, and the Abandoned Meander Terrace. Pebble counts were conducted in several streams near the facility, but outside the Access Prohibited Area. The objective of this report is to summarize these field activities and to tabulate and interpret all data collected.

A total of 36 soil moisture measurements were obtained and 37 infiltration studies were conducted at the three field locations noted above. Soil moisture rates varied from 2.2±0.5% for the coarsest-grained, most unconsolidated sediment to 47.8±2.3% for the finest-grained, most consolidated sediment. Infiltration rates varied from 0.5±0.9 mm/hr (0.32±0.59 m^3/yr) for the finest-grained, most consolidated sediment to 852.7±59.6 mm/hr (545.01±38.08 m^3/yr) for the coarsest-grained, most unconsolidated sediment. The infiltration data were aggregated to place these into a landscape perspective. An ensemble average of all measurements produced an infiltration rate of 32.8±59.1 mm/hr (20.98±37.8 m^3/yr). Infiltration rates also were aggregated into discrete 25-ft elevations and averaged, which produced variable rates ranging from 0.9±0.06 mm/hr (0.59±0.05 m^3/yr) for the 1275 to 1300 ft interval to 78.4±84.6 mm/hr (50.14±54.08 m^3/yr) for the 1225 to 1250 ft interval. Lastly, a frequency analysis of the infiltration rate data showed that about 58% of all measurements fell below a rate of 10 mm/hr (5.88 m^3/yr). An average infiltration rate using just these selected observations produced a value of 2.1±2.1 mm/hr (1.33±1.37 m^3/yr).

A total of 37 JET datasets were deemed acceptable for the assessment of glacial sediment erodibility. Using the Scour Depth Solution method, which produced the lowest erosion rate prediction error, values of the critical tractive shear stress τ_c ranged from 11.59±0.70 to 90.16±5.41 Pa, and values for the erodibility coefficient k_d ranged from 0.16±0.02 to 7.93±0.79 cm^3/N-s. Erodibility indices also were aggregated to place these data into a landscape perspective. Ensemble averaging of all measurements produced values of 41.73±16.40 Pa for τ_c and 2.05±1.75 cm^3/N-s for k_d. Erodibility indices were aggregated into discrete 25-ft elevations and averaged, which produced variable values of τ_c with elevation ranging from 35.53±5.69 Pa for the 1350 to 1375 elevation interval to 76.88±12.30 Pa for the 1200 to 1225 elevation interval. This approach also produced variable values of k_d with elevation ranging from 0.15±0.02 cm^3/N-s for the 1200 to 1225 elevation interval to

5.40±0.86 cm^3/N-s for the 1350 to 1375 elevation interval. A frequency analysis of the τ_c data showed that 75% of the measurements fell within the range of 30 to 60 Pa, and when averaged, produced values of 41.70±7.60 Pa for τ_c and 1.76±1.20 cm^3/N-s for k_d.

A total of 49 pebble counts were conducted in and near the WNYNSC along major and minor creeks as well as two locations on Cattaraugus Creek. These results showed that bed surface grain size varied from sands (less than 2 mm in diameters) to boulders (between 256 to 512 mm), with a median grain size of 53±18 mm. Additional analysis of longitudinal trends in surface grain size percentiles along Heinz Creek, Gooseneck Creek, and Buttermilk Creek did not show any statistically significant variation, and a Pearson correlation analysis identified those datasets that showed the weakest correlations within the population (13 in total). Given this information, an aggregated grain size distribution representative of the WNYNSC produced the following percentiles: $D_{10} = 11$ mm, $D_{16} = 17$ mm, $D_{50} = 47$ mm, $D_{84} = 117$ mm, $D_{90} = 154$ mm, and $D_{95} = 225$ mm.

These on-site determinations of infiltration rate, erodibility indices of the glacial materials, and stream bed grain size distributions agree well with previous work as well as those analyses presented in the Final Environmental Impact Statement (2010). It is envisioned that these data will further constrain the input parameters to numerically simulate landscape evolution at the WVDP and to reduce the predictive uncertainty of future erosion at the site.

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List of Acronyms

APA	Access Prohibited Area
ECS	Enviro Compliance Solutions, Inc.
EWG	Erosion Working Group
NYSERDA	New York State Energy Research and Development Authority
WVDP	West Valley Demonstration Project
WNYNSC	Western New York Nuclear Service Center

1. Introduction

Enviro Compliance Solutions, Inc. (ECS) and the West Valley Erosion Working Group (EWG) recommended erosion studies to be performed as part of the Phase 1 Studies at the West Valley Demonstration Project (WVDP) and Western New York Nuclear Service Center (WNYNSC; WVDP Erosion Working Group, 2015). The primary goals of the Phase 1 Erosion Studies are to enable improved forecasts of future erosion at the WVDP and WNYNSC, to reduce the associated uncertainty of these forecasts, and to assist the agencies in reaching consensus on the likely effects of future erosion. These studies are divided into three activities: Study 1 - Terrain Analysis, Age Dating, and Paleoclimate, Study 2 - Recent Erosion and Deposition Processes, and Study 3 - Model Refinement, Validation, and Improved Erosion Projections.

The EWG identified a list of environmental parameters that would reduce uncertainties in prediction future erosion using a landscape evolution model (WVDP Erosion Working Group, 2015). These parameters include bed-sediment entrainment thresholds, soil/till-detachment thresholds, storm depths, durations, and frequency parameters, soil/till detachabilities, and soil-infiltration capacities. Several activities were proposed in Study 2 to quantify these erosion-related parameters and task implementation plans were prepared, approved, and implemented to accomplish these goals.

The objective of this report is to summarize the field activities conducted this past summer (2016), to review the methods employed, and to tabulate and interpret the preliminary data collected. The three tasks summarized here are the following:

1. Task 2.2: Infiltration and Soil Moisture Determination
2. Task 2.5: Erodibility of Cohesive Sediment
3. Task 2.6: Erodibility of Clastic Sediment in Selected Gullies, Stream Channels, and Streambanks

For Task 2.2, field activities sought to quantify infiltration capacity or rate and volumetric moisture content for selected surficial geological materials, and this would be accomplished using a double ring infiltrometer and a soil moisture probe. For Task 2.5, field activities sought to quantify the erodibility indices for selected surficial geological materials, and this would be accomplished using the jet erosion test (JET). For Task 2.6, field activities sought to quantify the surface grain size statistics of selected stream channels, and this would be accomplished using pebble counts.

The geological material of interest for Tasks 2.2 and 2.5 is glacial till, and in particular, the Lavery Till. Access to and exposure of this till within the WNYNSC is complicated by current land use and land cover, restricted access enforced by federal and state agencies, and private land ownership. As such, these tasks were combined with those activities of Study 1, which engaged local contractors to provide access to specific terraces within the landscape and to dig relatively large trenches to expose the geological materials of interest. These trenching activities, coupled with support from ECS personnel to provide an ample water supply, greatly facilitated the success of Task 2 activities.

2. Methods

For Task 2.2, field activities sought to quantify infiltration capacity or rate and volumetric moisture content for selected surficial geological materials accomplished using a double ring infiltrometer and a soil moisture probe.

Volumetric moisture contents for selected exposed sediments were measured using a HydroSense probe inserted at various locations within the geologic material of interest (Figure 1). The probe can measure volumetric water content ranging from 0 to 50%, with a typical resolution <0.05% and an accuracy of 3%. The probe has a rod diameter of 5 mm and a rod length of 120 mm.

Five soil moisture content measurements were obtained in selected excavated trenches prior to infiltration testing and recorded on the double ring infiltrometer data sheet (Figure 3). Under wetter conditions, the trenches may fill with water and require pumping and drying overnight before soil moisture and infiltration testing could proceed. The measurements were averaged to obtain the average soil moisture content of the selected exposed sediment.

(a) (b)

Figure 1. *For volumetric water content measurements, (a) the Hydrosense soil moisture probe was used (image from Campbell Scientific), and (b) several measurements were recorded for a given geological unit.*

Infiltration is the downward movement of water into soil, and the infiltration rate is the maximum rate at which a soil will absorb water impounded on the surface at a shallow depth (Johnson, 1963). Different methods and types of equipment have been used for measuring infiltration rate, but the principal method involves measuring water entry into the sediment from infiltrometer rings. Ring infiltrometers consist of metal cylinders that are partially driven into the soil and filled with water. The water level within the rings is held constant, forcing water to penetrate the sediment in a downward fashion, and the rate at which the water moves into the sediment is measured over time.

The rate of infiltration is greatly affected by the permeability of the material of interest, and usually, the sediments are unsaturated when an infiltration test is started. When water is first introduced to the sediment surface, the infiltration rate is generally high. As water application continues and the uppermost sediments become saturated, the infiltration rate gradually decreases and reaches a nearly constant rate, typically within a few hours. This constant infiltration rate is considered the saturated infiltration rate or saturated vertical hydraulic conductivity of the sediment (Johnson, 1963).

To determine the saturated infiltration rate, a standard double ring infiltrometer (ASTM D-3385) consisting of two steel rings was used (Figure 2; Johnson, 1963). Both rings are 508 mm tall (20 in), where the outer ring measures 610 mm (24 in) in diameter and the inner ring measures 305 mm (12 in) in diameter (Figure 2). Maintaining the same water level in both rings creates a constant head that forces infiltration of water in the inner ring downward rather than laterally. The change in vertical water level was measured in the inner ring as a function of time.

For an infiltration test, the parent material of the geological surface must be exposed, and the trenches dug for Study 1 were ideal for this purpose. The area or ledge must be wide enough to drive the outer ring at least 0.1 m into the parent material without threat of collapse. The outer ring was first placed on the surface and 4×4 wooden block is placed on top of the ring. The outer ring was tamped into the sediment to the desired depth using a sledge hammer, and the ring was leveled. The inner ring was then centered inside the outer ring, tamped into the sediment to a similar depth, and leveled, ensuring that the sediment surface inside this ring was not disturbed. To prevent lateral water leakage from the rings, the outside of both rings was backfilled and packed with clayey sediment.

Once the double ring infiltrometer was in place, a millimeter ruler was attached to the inside of the inner ring. Both rings were then filled with water, typically to a depth of about 0.25 m and making sure the water level is the same within both rings. Care must be taken in the filling of the apparatus so not to disturb the surface sediment. A manometer may be utilized for maintaining a constant water level and for measuring the quantity of the water, but this was not used here (Figure 2).

When constant hydraulic head was established, the water level in the inner ring was measured to the nearest millimeter and the time was initiated. Additional water was kept at the test site to refill rings to maintain a nearly constant hydraulic head. In relatively coarser-grained and dryer sediments, initial infiltration rates could be quite large, which required refilling the rings often and recording the new starting height. For the first two hours, water level readings in the inner ring were taken every 5 to 15 minutes. After two hours, readings could be taken at 15- to 30-min intervals for up to six hours (or longer). Water level readings (cm) were recorded on the double ring infiltrometer data sheet at each time interval. To prevent evaporation between longer time intervals, the rings should be covered between water measurements. The infiltration rate over time should asymptotically approach a constant value, signaling that infiltration has reached steady-state conditions; a saturated infiltration rate is attained.

(b)

(a)

Figure 2. *Double ring infiltrometer used in this study showing (a) its components (image from Humboldt), and (b) its application. The manometers were not used.*

For Task 2.5, field activities sought to quantify the erodibility indices for selected surficial geological materials, accomplished using the jet erosion test (JET). The JET is used to estimate the erodibility of glacial materials by simulating erosion by a water over a fixed period of time (Hanson 1990a; Hanson 1990b). The JET forces water to penetrate the geologic material surface in a vertical fashion, forming a scour hole where material has been eroded away (Hanson, 1990a). The depth of the scour hole created by the jet stream is measured in the field at fixed time intervals and analytical methods are then employed to estimate the material's critical shear stress τ_c and erodibility coefficient k_d based on the JET data.

The *in situ* JET apparatus developed by Hanson and Cook (2004) consists of a jet tube, nozzle, point gage, submergence tank, and adjustable head tank (Figure 3). The 0.92 m long jet tube is made of clear acrylic tubing (6.4 mm thick) to allow visual observation of air accumulation in the jet tube. An air relief valve is attached to the top of the jet tube to allow air to escape from the jet tube column during initial filling. The jet tube has an 89-mm diameter orifice plate 12.7 mm thick with a 6.4 mm diameter nozzle in the center of the plate. A 32 mm hose delivers water to the jet tube 0.41 upstream of the orifice plate. A point gage is attached to the top of the jet tube and aligned with the jet nozzle so that it can pass through the nozzle to the sediment surface to read the depth of the eroded scour hole. The diameter of the point gage is equivalent to the nozzle diameter so that when the point gage rod passes through the nozzle opening, the flow is shut off. A deflector plate is also attached to the bottom of the jet tube to deflect the jet stream and protect the sediment surface from erosion during initial filling of the tank. The deflector plate is moved out of the way during testing to allow the jet stream to impinge upon the sediment surface (Hanson and Cook, 2004).

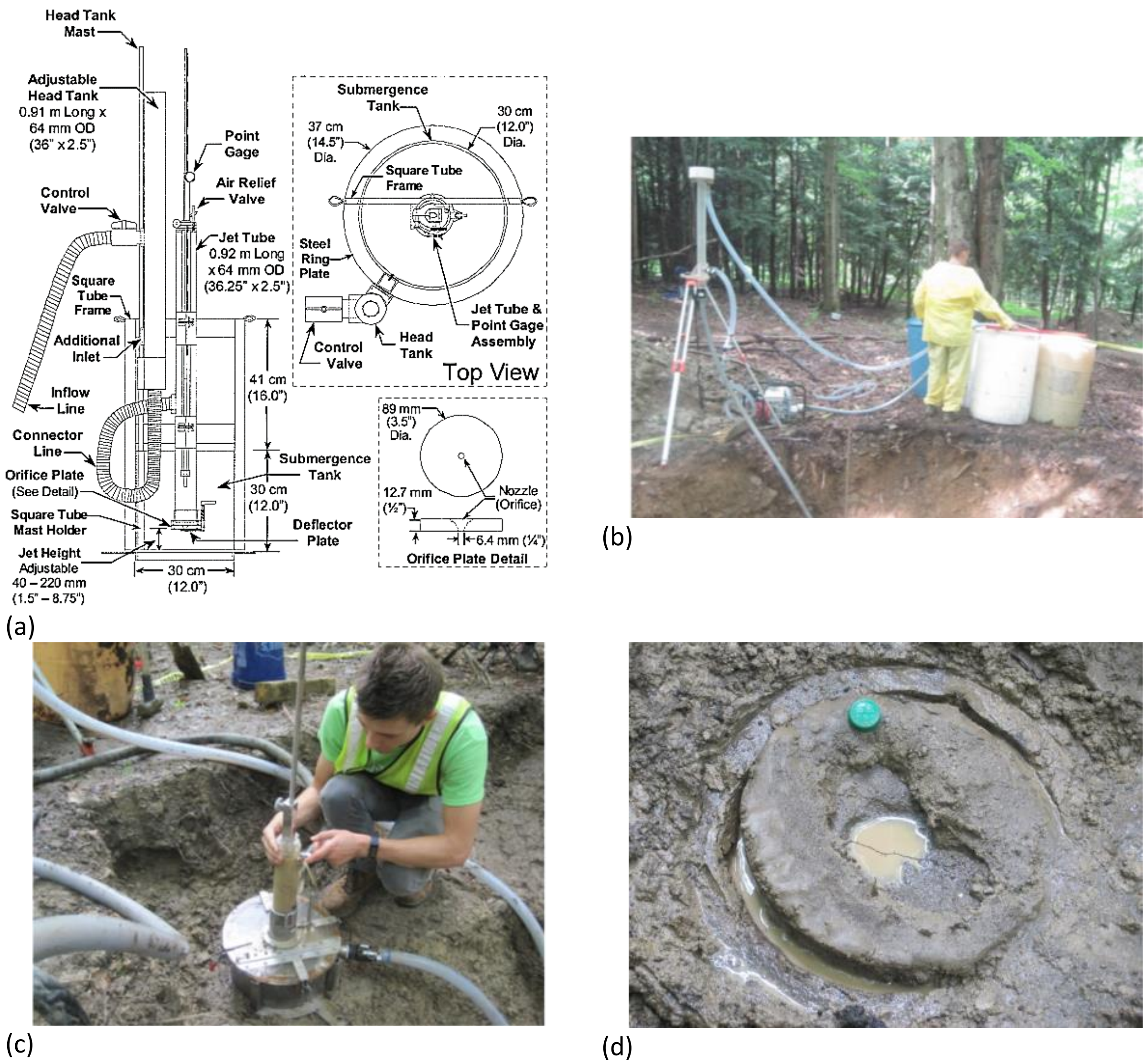


Figure 3. *The JET apparatus showing (a) a drawing of the device (Hanson and Cook, 2004), (b) stand-pipe mounted to a tripod, water pump, and local water source (drums), (c) a sealed JET cylinder placed onto a geological material within a dug trench, vertical jet pipe, and point gauge, and (d) exposed scour hole (ponded water) once the JET cylinder is removed upon completion of test.*

The adjustable 0.91 m tall head tank is made of 50 mm clear acrylic tubing to allow visual observation of the water level inside of the head tank. The head tank sits on top of a tripod to allow the height of the head to be adjusted up and down in order to maintain constant head. The jet submergence tank is made of 16-gauge steel 0.30 m in diameter and is 0.30 m in height. The tank is open on both ends and has a 25-mm^2 tube frame attached that holds the jet tube in the center of the tank. The tank also has a discharge tube attached to the wall to allow excess water to be discharged during testing. A steel ring plate is attached to the outside perimeter of the tank 25 mm from the bottom and is driven 50 mm into the sediment until it makes contact with the sediment surface to seal the bottom to allow the tank to be filled with water, submerging the jet orifice (Hanson and Cook, 2004). A tube that is attached to the side head tank is filled with water by a connection to a gas-powered water pump and excess water is discharged back into the supply barrels by an overflow tube to maintain constant head. An additional tube runs from the bottom of the head tank to the side of the submergence tank to deliver water into the submergence tank. During testing, two 55 gal barrels of water are utilized in absence of a running water supply and are sufficient to supply water for a 2-hour test.

The following procedure, modified from Hanson and Cook (2004), was employed to assess the erodibility of the exposed glacial sediments surrounding the WNYNSC. All JET deployments were conducted within trenches dug by a backhoe to expose the glacial sediment of interest and to facilitate the use of the JET device. These trenches were 5 to 10 m long, 5 to 10 m wide, and as much as 5 m deep.

1. Select a site and determine the layout of the apparatus, hoses, and pump. The site should display homogeneous material of interest on a flat surface (bench). Water barrels should be set up close to the pump and JET apparatus, but away from the edge of the trench to avoid collapse of the trench wall. Two 55 gal barrels are filled with water, which is enough for a 2-hour test.
2. Drive the submergence tank ring into the soil surface by placing a 2×4 wood block over the ring and by hitting it gently with a hammer. The tank is driven into the sediment until the bottom of the steel plate is flush with the sediment surface.
3. When the tank is tamped into the sediment surface, the jet tube and point gage are attached to the frame on the submergence tank. The initial height of the jet nozzle should be set between 6 and 35 nozzle diameters relative to the ground surface.
4. The jet head tank is placed on top of the tripod and raised to the desired height. The height of the head tank is then measured. The total head height is calculated by measuring from the bottom of the submergence tank to the bottom of the head tank and adding this value to the height of the pre-measured head tank. An approximate head setting should be determined prior to testing based on an estimate of the maximum stress that the sediment would experience under conditions of interest. This head measurement is recorded on the JET data sheet.
5. Place the water pump on a level surface at the height of the jet tripod apparatus. The pump should be placed close enough to the JET apparatus so that the hoses can reach their appropriate connections but far enough away from the trench ledge to avoid collapse of the trench wall.
6. Connect hoses from the water barrel to the pump, the water pump to the head tank, the head tank to the jet tube, and the submergence tank to a discharge area. A valve on the hose

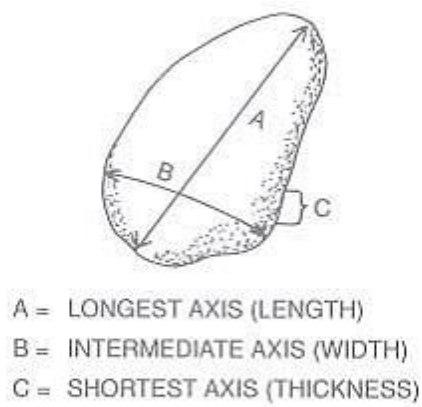
from the pump to the head tank is used to control flow and pressure into the head tank and should be adjusted prior to turning on the pump to avoid initial overflow. The fully assembled JET apparatus is now setup.

7. The initial height of the jet nozzle orifice is measured by lowering the point gage to the sediment surface at time zero. This nozzle height measurement is recorded on the JET data sheet. The point gage is then pulled out of the nozzle to a distance of at least 10 nozzle diameters to prevent flow disturbance from the point gage.
8. The deflector plate is placed beneath the jet nozzle to close off the nozzle during initial filling. The pump is turned on and allowed to run until the head tank is full and until constant head is maintained. The air valve is opened to bleed air in the nozzle out of the system.
9. Once the head tank and submergence tank are filled, the pump deflector plate is moved out of the way to begin the test. The pump delivers a jet stream to the sediment surface for predetermined time intervals, typically between 5 and 10 minutes. Scour depth readings are taken by lowering the point gage to the scour hole surface. Feeling the tip of the point gage above the sediment surface is often necessary to avoid penetration into the soil. Small pebbles may need to be removed if they are suspended by the jet stream to prevent disturbance of the jet stream. A set of 10 to 12 scour depth readings is recommended for each test.

To complete Task 2.6, field activities sought to quantify the surface grain size statistics of selected stream channels near the WVDP. The Wolman pebble count method provides a simple technique for determining the grain size statistics for the surface sediments of coarse-bedded streams (gravel and larger; Wolman, 1954; Figure 4). The location of the streambed selected for a pebble count was first determined using a GPS and recorded. The pebble count was then started on one side of a selected stream bed near one bank. The pebble counter walked heel to toe in a zig-zag fashion from one end of the stream bank to the other (Figure 5). For every step taken, the counter picked up the pebble directly beneath his/her big toe. If the pebble selected was embedded, it was measured in situ. The b-axis (intermediate) of the particle was measured in millimeters and recorded on the pebble count data sheet (Figure 5). In practice, the actual size of the pebble was not recorded; its bin size was recorded. The following bins were employed: <2 mm, 2 to 4 mm, 5 to 8 mm, 9 to 16 mm, 17 to 32 mm, 33 to 64 mm, 65 to 90 mm, 91 to 128 mm, 129 to 180 mm, 181 to 255 mm, and >256 mm. These bin sizes correspond to sand (less than 2 mm), gravel (2 to 63 mm), cobble (64 to 255 mm), and boulder (256 to 512 mm).

After the pebble size was noted, the counter discarded it, took another step, and repeated this process until 100 pebbles or more have been counted. It is important to select pebbles as randomly as possible to minimize any bias in the particles measured, and areas disturbed by human activities should be avoided. Any non-native materials, such as rip-rap, were discounted in the study. From the distribution of pebble sizes, the following grain size percentiles (% finer than) can be obtained: D_{10}, D_{16}, D_{50}, D_{84}, D_{90}, and D_{95}. Here, D_{50} refers to the grain size D in which 50% of the sediment population is finer than this size.

Figure 4. *Selected streambed reach for Wolman pebble count method.*



(b)

(a)

Figure 5. *Wolman pebble count method showing (a) pebble axes, where the b-axis is measured, and (b) a typical survey (photo courtesy of T. Zerfas).*

3. Results

Measurements for infiltration, soil moisture, and the JET were conducted in conjunction with the trenching of Study 1, which focused on three locations within the WNYNSC: Heinz Creek Terraces, the Tree Farm Terraces, and the Abandoned Meander Terraces (see Appendix 1 for location maps). The trenches provided unrivalled opportunities to conduct these measurements directly on the glacial materials of interest. Data for the infiltration, soil moisture, and JET studies are labeled by the trench name and number (also provided in the Appendix 1) as follows: HT – Heinz Creek

Terrace; UHT – Upper Heinz Creek Terrace; FT – Tree Farm terrace; and MT – Abandoned Meander terrace. The Wolman pebble counts were conducted in streams outside the Access Prohibited Areas and where easy access and land-owner permission were provided.

3.1. Task 2.2: Infiltration and Soil Moisture Determination

Table 1 shows an example infiltration test performed at the Tree Farm Terrace at trench FT-14 (refer to the Appendix 1 for the trench location). The initial water level at the start of the test was 0.21 m. Readings were taken every 15 minutes for the first two hours of the test, every half an hour for the next four hours, and then it was left covered overnight and a final measurement was obtained the next day. All measurements were converted to infiltration rate in units of mm/hr and m^3/yr.

Table 1: *Double ring infiltrometer test for location FT-14.*

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				20.0	3.64		
Project Identification:	West Valley Demonstration Project	22					
Test Location:	FT-14	19.2					
Soil Type:		23.5					
Tested By:	CI, JZ	14.1			Ring area (mm^2)	72966	
Date:	7/20/2016	21.2			Ring area (m^2)	0.072966	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	Infiltration Rate (mm/hr)	Infiltration Rate (m^3/yr)	
0	21						
15	20.2		0.8	8	32.00	20.45	
30	19.8		0.4	4	16.00	10.23	
45	19.5		0.3	3	12.00	7.67	
60	19.1		0.4	4	16.00	10.23	
75	18.9		0.2	2	8.00	5.11	
90	18.7		0.2	2	8.00	5.11	
105	18.5		0.2	2	8.00	5.11	
120	18.2		0.3	3	12.00	7.67	
150	17.9		0.3	3	6.00	3.84	
180	17.7		0.2	2	4.00	2.56	
210	17.4		0.3	3	6.00	3.84	
240	17.1		0.3	3	6.00	3.84	
270	16.9		0.2	2	4.00	2.56	
300	16.7		0.2	2	4.00	2.56	
330	16.4		0.3	3	6.00	3.84	
360	16.1		0.3	3	6.00	3.84	
1080	9.7		6.4	64	5.33	3.41	
							STDev
				Average Infiltration Rate (mm/hr)		5.25	1.04
				Average Infiltration Rate (m^3/yr)		3.36	0.66
					Time (min)		
					0	5.25	
					360	5.25	

The time variation of infiltration rate for FT-14 is shown in Figure 6. An asymptotic infiltration rate was achieved after approximately 150 min of initiating the test. The steady-state saturation infiltration rate of 5.4±1.0 mm/hr (or 3.4±0.7 m^3/yr), using these asymptotic values, is represented by a dashed line. At this same location, several volumetric moisture contents were also taken (Table 1). Based on these values, the volumetric moisture content of the sediment within FT-14 at the time of the infiltration test was 20.0±3.6%.

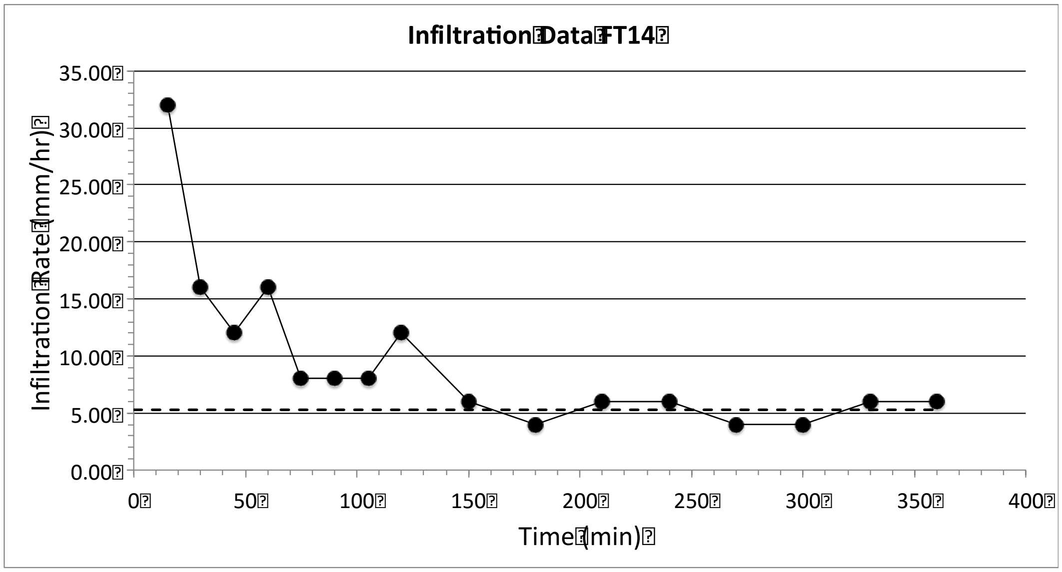


Figure 6. *Time variation in information rate for FT-14. The steady-state infiltration rate is shown as a dashed line.*

Determinations of volumetric moisture content and infiltration rate were completed for 37 trenches at the three locations (see Appendices 1 and 2). All processed data are summarized in Table 2, and some general observations can be made. Volumetric moisture content is inversely proportional to infiltration rate. For volumetric moisture content, the mean (± standard deviation) values are 18.2±1.70% for the Heinz Creek Terraces, 27.2±1.73% for the Tree Farm Terraces, and 31.1±3.0% for the Abandoned Meander Terraces. For infiltration rate, the mean (± standard deviation) values are 84.8±13.9 mm/hr for the Heinz Creek Terraces, 6.6±1.3% for the Tree Farm Terraces, and 5.1±1.0% for the Abandoned Meander Terraces. These average values are for each location, regardless of geological material and elevation.

Table 2: *Summary of average (and standard deviation; StDev) soil moisture measurements and steady-state infiltration rates for all trench locations.*

Trench	Elevation	Date	Soil Moisture		Steady-State Infiltration Rate			
	(ft)		(%)	StDev (%)	(mm/hr)	StDev (mm/hr)	(m^3/yr)	StDev (m^3/yr)
	Heinz Creek Terrace							
HT-3	1231	6/20/2016	NA	NA	23.0	5.9	14.70	3.77
HT-5	1230	6/21/2016	40.7	4.5	3.6	3.3	2.30	2.10
HT-7	1229	6/15/2016	41.2	1.6	28.0	23.5	17.90	15.02
HT-8	1241	6/21/2016	10.9	1.0	240.0	17.0	153.40	10.85
HT-11	1252	6/22/2016	26.5	3.3	12.0	5.4	7.67	3.43
HT-15	1260	6/27/2016	30.6	1.4	1.5	2.1	0.96	1.32
HT-16	1260	6/22/2016	36.9	2.7	0.5	2.5	0.32	1.57
HT-20	1271	6/28/2016	26.4	3.0	28.0	3.1	17.90	1.98
HT-23	1266	6/27/2016	18.2	3.3	96.0	6.0	61.36	3.84
HT-24	1222	6/29/2016	18.6	5.1	42.0	6.6	26.85	4.20
HT-25A	1235	6/29/2016	5.5	1.3	141.4	15.0	90.40	9.62
HT-25B	1225	6/30/2016	9.6	2.6	38.0	8.5	24.29	5.42
HT-26	1228	6/29/2016	13.1	6.5	136.7	13.7	87.35	8.74
HT-29	1239	6/28/2016	17.1	4.5	16.8	3.4	10.74	2.14
HT-32	1236	6/30/2016	3.0	0.4	852.7	59.6	545.01	38.08
HT-34	1257	7/5/2016	11.5	2.1	3.4	2.5	2.19	1.60
HT-35	1258	7/5/2016	16.1	1.7	3.2	3.4	2.05	2.14
UHT-3	1389	7/7/2016	2.2	0.5	203.3	20.2	129.97	12.95
UHT-4	1389	7/7/2016	10.3	2.4	42.0	4.0	26.85	2.56
UHT-5	1402	7/11/2016	8.4	2.5	0.5	0.9	0.32	0.59
UHT-8	1392	7/11/2016	19.1	5.7	NA	NA	NA	NA
UHT-9	1402	7/6/2016	13.0	4.0	1.0	1.9	0.64	1.18
UHT-11	1398	7/6/2016	21.4	4.9	1.3	2.1	0.85	1.32
	Tree Farm Terrace							
FT-2	1193	7/14/2016	23.9	1.8	1.0	1.8	0.64	1.16
FT-6	1191	7/14/2016	27.7	4.8	0.7	1.6	0.43	1.00
FT-12	1175	7/18/2016	16.4	3.1	2.8	1.8	1.79	1.14
FT-13	1177	7/27/2016	24.8	2.3	1.6	2.8	0.99	1.78
FT-14	1165	7/20/2016	20.0	3.6	5.3	1.0	3.36	0.66
FT-20	1152	7/26/2016	47.8	2.3	42.4	5.0	27.10	3.18
FT-22	1153	7/26/2016	26.2	2.4	0.6	1.0	0.38	0.62
FT-23	1151	7/21/2016	10.8	3.1	9.2	1.1	5.88	0.70
FT-24	1158	7/19/2016	33.4	6.0	2.4	0.6	1.56	0.56
FT-26	1201	7/27/2016	41.1	6.9	0.4	1.1	0.24	0.70
	Abandoned Meander Terrace							
MT-31	1290	8/9/2016	33.5	3.7	0.9	1.5	0.57	0.93
MT-36	1293	8/8/2016	31.1	8.5	1.0	1.7	0.64	1.09
MT-37	1293	8/8/2016	45.2	3.4	0.9	1.5	0.55	0.97
UMT-1	NA	8/11/2016	14.7	1.3	17.5	3.5	11.20	2.25

3.2. Task 2.5 Erodibility of Cohesive Sediment

Quantifying the erodibility of cohesive sediments is challenging in that many factors can affect erodibility, including soil texture, unit weight, water content, swelling potential, clay mineralogy, and pore water chemistry (Al-Madhhachi et. al 2013b). In general, the erosion rate of cohesive sediments may be approximated from JET data using the linear excess shear stress model that expresses the erosion rate ε_r (m/s; Hanson 1990a, 1990b) as follws:

$$\varepsilon_r = k_d(\tau - \tau_c)^a \qquad (1)$$

where τ is the average boundary shear stress (Pa), τ_c is the critical shear stress (Pa), k_d is the erodibility coefficient (cm^3/N-s), and *a* is an empirical exponent commonly assumed to be unity (Hanson, 1990a, 1990b; Hanson and Cook, 2004). Three solution methods have been developed to determine critical shear stress τ_c and the erodibility coefficient k_d of cohesive sediments using the JET, and these are described below.

Analytical methods for the JET were first presented by Hanson and Cook (2004) based on diffusion principles developed by Stein and Nett (1997). The method, termed the Blaisdell Solution (Blaisdell et al., 1981), assumes that the rate of variation in scour depth dJ/dt, where *J* is the scour depth (cm) and *t* is time (s), is erosion rate as a function of the applied shear stress τ. The maximum scour depth was assumed to occur when the rate of scour was equal to zero at the equilibrium depth, which can be determined by the diameter of the jet nozzle d_o (cm) and the distance from jet origin to the initial channel bed *J*. The erosion rate equation for jet scour is defined as (Hanson and Cook, 2004):

$$\frac{dJ}{dt} = k_d\left[\frac{\tau {J_p}^2}{J^2} - \tau_c\right] \text{ for } J \geq J_p \qquad (2)$$

where J_p is the potential core length from the jet origin (cm). The value of the critical shear stress for the sediment τ_c was assumed to occur when the rate of scour was equal to zero at the equilibrium scour depth J_e, which is defined as:

$$\tau_c = \tau\left(\frac{J_p}{J_e}\right)^2 \qquad (3)$$

where $\tau = C_f \rho {U_o}^2$ is the shear stress due to the jet velocity at the nozzle (Pa), C_f is the coefficient of friction, assumed to be 0.00416, ρ is the density of water (kg/m^3), U_o is the jet velocity at the orifice (cm/s), and $J_p = C_d d_o$ and C_d is the diffusion constant assumed to be 6.3. It is important to note that the equilibrium scour depth J_e is seldom reached in a typical JET application.

Equations 1 and 2 above can be incorporated into the dimensionless equation:

$$\frac{dJ^*}{dT^*} = \frac{(1 - J^{*2})}{J^{*2}} \qquad (4)$$

where $J^* = J/J_e$ and $J_p{}^* = J_p/J_e$. Stein and Nett (1997) expressed the reference time T_r as:

$$T_r = \frac{J_e}{k_d \tau_c} \tag{5}$$

and the dimensional time T^* as:

$$T^* = t/T_r \tag{6}$$

where *t* is the time when scour depth is measured.

Equation 4 presents the change in scour depth with time for time T^*, and when integrated, yields the following equation (Hanson and Cook, 2004):

$$T^* - T_p{}^* = -J^* + 0.5 \ln\left[\frac{1+J^*}{1-J^*}\right] + J_p{}^* - 0.5 \ln\left[\frac{1+J_p{}^*}{1-J_p{}^*}\right] \tag{7}$$

Hanson and Cook (2004) created an Excel spreadsheet using equations 2 through 7 to determine τ_c and k_d from the JET measurements. Equation 3 was used to determine the critical shear stress τ_c based on the equilibrium scour depth J_e. Blaisdell et al. (1981) developed a hyperbolic function for predicting the equilibrium scour depth, which was used in the spreadsheet developed by Hanson and Cook (2004) to calculate τ_c. The general form for the equation is as follows (Blaisdell et al., 1981):

$$(f - f_0)^2 - x^2 = A_1{}^2 \tag{8}$$

where A_1 is the value for the semi-transfer and semi-conjugate of the hyperbola, $f = \log(J/d_0) - x$, $x = \log[(U_o t)/d_o]$, and $f_o = \log(J_e/d_0)$. By plotting *f* versus *x* and by fitting the scour depth data, the coefficients A_1 and f_o can be determined using Microsoft Excel Solver. The value of J_e can be found from $J_e = d_o 10^{f_o}$. By fitting the curve of measured data based on equation 7, k_d can be determined based on the measured scour depth, time, previously determined τ_c, and the dimensionless time function (Hanson and Cook, 2004). In many cases, the Blaisdell Solution does not always converge to a reasonable solution and often under-predicts erosion rates (Simon et al., 2010; Daly et al., 2013). The Blaisdell Solution, however, continues to be the preferred method for analyzing JET data at present (Daly et. al., 2013).

A second solution of the excess shear stress equation was first proposed by Hanson and Cook (2004). The alternative solution, referred to as "Method 1," involved iteratively determining τ_c and k_d using the shear stress equation and a nonlinear curve fitting routine. The method was initially found to be unstable due to the allowance of multiple solutions depending on the initial iteration values, but this method was later revised. The Iterative Solution proposed by Simon et al. (2010) is based on "Method 1" described by Hanson and Cook (2004) with a modification to improve the robustness of the solution. The Iterative Solution method relies on the values of τ_c and k_d

estimated using the Blaisdell Solution as initial guesses. An upper bound for τ_c as a function of pressure at the jet nozzle, the nozzle diameter, and the maximum scour depth is first computed to prevent the equilibrium scour depth from being mathematically exceeded. The Microsoft Excel Solver is then used to simultaneously solve for a solution of k_d and τ_c that minimizes the root-mean-square error between the measured and predicted time (Simon et al., 2010). Simon et al. (2010) found that the Iterative Solution method provided a reduction in the scatter of the τ_c-k_d relationship, but the method also often led to an over-prediction of erosion during simulations.

Daly et al. (2013) proposed a third solution technique, which iteratively solves for k_d and τ_c that fit the observed scour depth data and that minimizes the sum of squared errors between the measured scour data and the solution of the excess shear stress equation. The method plots the original scour depth versus time data from the JET data and estimates the erodibility parameters k_d and τ_c based on the Blaisdell method as outlined by Hanson and Cook (2004). The erodibility parameters are then derived by fitting k_d and τ_c to the observed scour depths and by minimizing the sum of square error between the measured scour data and the solution of the excess shear stress equation using the generalized reduced gradient method in Microsoft Excel (Daly et al., 2013). The procedure described by Daly et al. (2013) mimics the approach for a mechanistic detachment model used by Al-Madhhachi et al. (2013a, b). This method is called the Scour Depth Solution.

To simultaneously derive values of k_d and τ_c using the three discussed methodologies, a spreadsheet routine was developed by S. Mohammad Ghaneeizad (pers. comm.), which is based on the routines developed by Hanson and Cook (2004). This updated routine includes the Blaisdell Solution, Iterative Solution, and Scour Depth Solution. The data input sheet is shown in Figure 7, which includes the time between readings (min), point gage readings (ft), head setting (in), point gage measurement at the nozzle (ft), and nozzle diameter (in). Initial parameter estimates for k_d and τ_c are also required to aid in solution convergence, but if the user does not have an initial estimate, the suggested values of k_d as a function of τ_c or a value of 1 may be entered for both parameters (Hanson and Simon, 2001; Simon et al., 2010). Once the solver is executed, this same sheet would display the values of τ_c and k_d for each solution method. The plot of scour depth as a function of time also is created, and the erosion curves for each solution methods are computed and included for graphical purposes (Figure 7). In addition, the residual sum of the squares is also computed for here solution, which is the sum of the deviations predicted from actual scour depth as compared to the observed values.

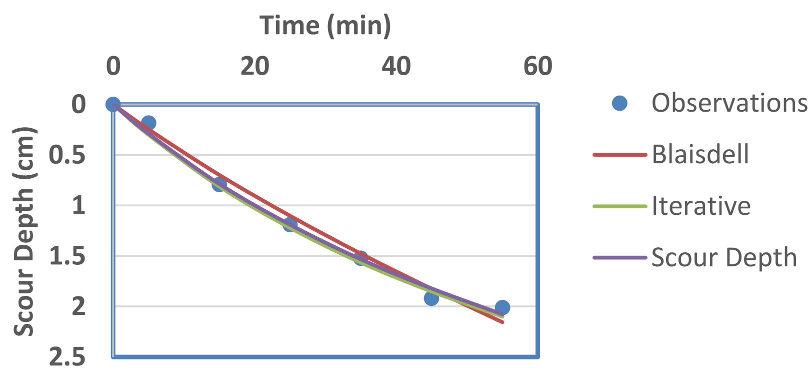
Data quality control was performed to address three issues. All JET data were processed and solutions for τ_c and k_d were derived. Data quality control was then preformed on the basis of visual observation of the solution curve fits to the measured scour depths. Some scour depth data displayed a decrease in scour depth between successive measurements, due to the deposition of pebbles or rocks beneath the point gage or by deposition of loose material into the scour hole following collapse of the scour wall (Figure 8). These scour depth outliers were removed from the data set, because scour depth must increase or remain constant with time to satisfy the assumptions of impinging jet theory. The JET spreadsheet routine was then re-run for the modified datasets.

LOCATION	FT- 6 r
DATE	7/14/2016
HEAD (IN)	120.625
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.316

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.519	0.000
5	5	2.513	0.006
15	10	2.493	0.026
25	10	2.480	0.039
35	10	2.469	0.050
45	10	2.456	0.063
55	10	2.453	0.066

SOLUTIONS	Blaisdell	Iterative	Scour Depth
τ_c (Pa)	8.67	44.02	41.89
k_d (cm^3/N·s)	0.102	0.221	0.204

(a)



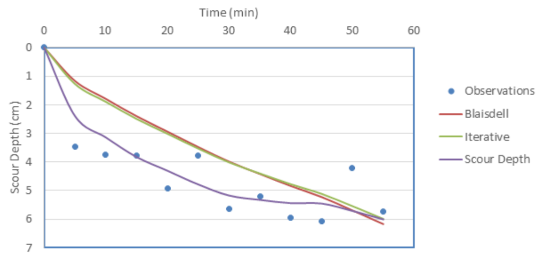
(b)

Figure 7. *JET data for FT-6 (raw) showing (a) scour data and solution spreadsheet for τ_c and k_d calculated using Blaisdell, Iterative, and Scour Depth Solutions and (b) plots of measured scour depth (cm) as a function of time in comparison to the three solution methods.*

LOCATION	HT-29 r
DATE	6/28/2016
HEAD (IN)	103.25
PT GAGE H (FT)	2.674
NOZZLE H (FT)	0.195

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.479	0.000
5	5	2.365	0.114
10	5	2.356	0.123
15	5	2.355	0.124
20	5	2.317	0.162
25	5	2.355	0.124
30	5	2.294	0.185
35	5	2.308	0.171
40	5	2.284	0.195
45	5	2.28	0.199
50	5	2.341	0.138
55	5	2.291	0.188

SOLUTIONS	Blaisdell	Iterative	Scour Depth
τ_c (Pa)	4.95	17.66	50.10
k_d (cm^3/N·s)	0.282	0.338	0.858

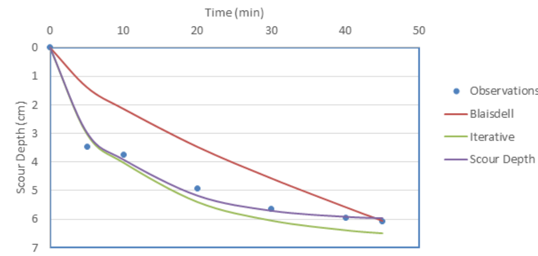


(a)

LOCATION	HT-29 m
DATE	6/28/2016
HEAD (IN)	103.25
PT GAGE H (FT)	2.674
NOZZLE H (FT)	0.195

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.479	0.000
5	5	2.365	0.114
10	5	2.356	0.123
20	10	2.317	0.162
30	10	2.294	0.185
40	10	2.284	0.195
45	5	2.28	0.199

SOLUTIONS	Blaisdell	Iterative	Scour Depth
τ_c (Pa)	1.57	47.20	49.17
k_d (cm^3/N·s)	0.327	1.051	1.057



(b)

Figure 8. *An example of quality control for the JET data for HT-29 showing (a) original data ("raw" data) with five (5) data points displaying an increase in scour depth with time, and (b) the "modified" data with these outliers removed. Curves are the three solutions for the erodibility indices.*

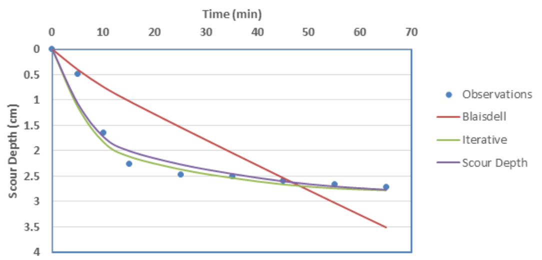
Second, some JET datasets displayed very rapid rates of erosion during the initial stages of the experiment (Figure 9). This mass erosion may be explained by entrainment of looser sandy or gravely material by the JET stream prior to the jet stream reaching the geological material of interest. These scour depth outliers were removed, and the JET spreadsheet routine was then re-run for modified datasets.

Third, there were instances where no reasonable solution was found using the three scour depth solution methods. These unusable data included tests with multiple scour wall collapse events, tests displaying insignificant erosion over the duration of the testing period, and/or tests in which the measured nozzle height of the JET apparatus was in violation of impinging jet theory (nozzle height H should be greater than $8.3d_0$). An example of such a test is shown in Figure 10.

LOCATION	FT- 2 r
DATE	7/14/2016
HEAD (IN)	117.5
PT GAGE H (FT)	2.836
NOZZLE H (FT)	0.302

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.534	0.000
5	5	2.518	0.016
10	5	2.480	0.054
15	5	2.460	0.074
25	10	2.453	0.081
35	10	2.452	0.082
45	10	2.449	0.085
55	10	2.447	0.087
65	10	2.445	0.089

SOLUTIONS	Blaisdell	Iterative	Scour Depth
τ_c (Pa)	7.51	57.61	57.13
k_d (cm^3/N·s)	0.159	1.095	1.015

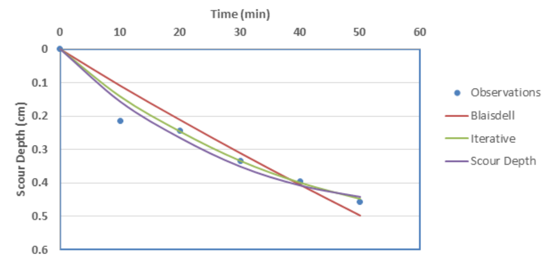


(a)

LOCATION	FT- 2 m
DATE	7/14/2016
HEAD (IN)	117.5
PT GAGE H (FT)	2.836
NOZZLE H (FT)	0.376

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.460	0.000
10	10	2.453	0.007
20	10	2.452	0.008
30	10	2.449	0.011
40	10	2.447	0.013
50	10	2.445	0.015

SOLUTIONS	Blaisdell	Iterative	Scour Depth
τ_c (Pa)	41.20	56.49	57.28
k_d (cm^3/N·s)	0.090	0.474	0.625



(b)

Figure 9. *An example of quality control for the JET data for FT-2 showing (a) original data ("raw" data) with three (3) initial data points displaying very high rates of erosion, and (b) the "modified" data with these initial points removed. Curves are the three solutions for the erodibility indices.*

LOCATION	FT- 15 r
DATE	7/14/2016
HEAD (IN)	127.125
PT GAGE H (FT)	2.833
NOZZLE H (FT)	0.263

Insignificant erosion occurred- test not included in study

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.570	0.000
12	12	2.550	0.020
22	10	2.550	0.020
32	10	2.550	0.020
42	10	2.550	0.020
52	10	2.550	0.020
62	10	2.550	0.020
70	8	2.528	0.042
80	10	2.520	0.050

SOLUTIONS	Blaisdell	Iterative	Scour Depth
τ_c (Pa)	40.96	0.06	0.00
k_d (cm^3/N·s)	0.038	0.025	0.023

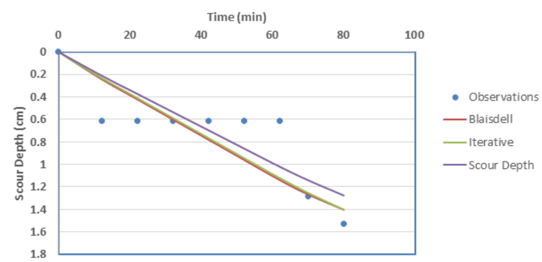


Figure 10. *An example of quality control for the JET data for FT-15 showing that the collected data are unusable.*

A sensitivity analysis was performed to determine the effects of measurement error for total head and scour depth during testing. This was accomplished by using five of the best JET datasets with the Scour Depth Method, and allowing the head measurement to vary by ±50 mm and allowing the point gage measurement to vary by ±6 mm. The average error in determining τ_c was 6% and the average error in determining k_d was 10%. These errors are considered much smaller that the error in locating the trench in space.

Table 3 summarizes all processed data and the derived erodibility indices using the three solution methods with quality control employed. In general, the erodibility indices determined using the Iterative and Scour Depth Solutions are similar in magnitude, whereas the Blaisdell Solution predicts lower values for τ_c and k_d. On the basis of simple visual inspection of the observed erosion rates and derived curves (see Appendix 3), the Scour Depth Solution appears to provide a consistently better fit to the observed scour hole data. Statistical analysis of sum of square error between the observed scour depths and solution curves also supports this observation. The average sum of the square error for the Blaisdell Solution is 9.4%, whereas this error is 22.6% for the Iterative Method Solution, and 0.4% for the Scour Depth Solution.

Table 3: *Summary of sediment erodibility indices (τ_c and k_d) derived for each solution method (Blaisdell, Iterative, and Scour Depth) for those trenches with acceptable data. Elevation (±5 ft) of the trench surface is also provided.*

Location	Elevation (ft)	τ_c (Pa)			k_d(cm^3/N-s)		
		Blaisdell	Iterative	Scour Depth	Blaisdell	Iterative	Scour Depth
Heinz Creek Terrace							
HT-3	1231	6.93	31.54	37.54	0.69	1.56	2.45
HT-5	1230	3.31	19.95	22.28	0.47	1.14	1.44
HT-8	1241	0.25	11.85	11.59	3.81	8.68	7.93
HT- 11	1252	7.97	89.71	90.16	0.08	0.46	0.42
HT-15	1260	21.51	43.69	43.92	0.20	1.33	1.65
HT-20	1271	4.07	19.88	20.11	1.14	4.68	6.18
HT-23	1266	2.35	17.4	18.96	1.14	3.20	5.06
HT-25A	1235	3.11	27.01	25.13	1.16	5.28	2.33
HT-25B	1225	9.35	33.92	35.63	0.65	1.70	2.40
HT-26	1228	13.01	54.95	56.16	0.32	1.19	1.48
HT-29	1239	1.57	47.2	49.17	0.33	1.05	1.06
HT-32	1236	7.46	47.05	51.98	0.82	2.42	3.3
HT- 34	1257	40.37	38.99	38.99	1.00	8.48	3.87
HT-35	1258	0.54	32.14	31.87	0.63	1.86	1.58
UHT-3	1359	12.71	36.02	35.53	1.11	10.94	5.4
UHT-4	1389	6.64	32.23	32.15	0.43	3.77	2.95
UHT-5	1402	0.87	40.56	36.29	0.25	1.12	0.71
UHT-8	1392	46.34	38.3	44.44	1.00	0.55	2.30
UHT-9	1402	37.91	64.8	66.32	0.07	0.4	0.57
UHT-11	1398	36.46	41.52	41.84	0.17	0.87	1.82
Tree Farm Terrace							
FT- 2	1193	41.20	56.49	57.28	0.09	0.47	0.62
FT- 6	1191	8.67	44.02	41.89	0.10	0.22	0.20
FT-9	1176	0.98	14.44	34.04	0.28	0.36	0.66
FT-12	1175	28.41	45.84	43.98	0.06	0.22	0.16
FT- 13	1177	15.54	53.68	53.76	0.38	1.67	1.74
FT-14	1165	3.55	32.58	33.07	0.12	0.48	0.50
FT-16	1156	1.81	31.21	31.35	0.65	2.07	1.8
FT-20	1152	11.44	42.4	42.62	0.37	1.27	1.83
FT-22	1153	32.96	69.31	70.15	0.22	1.19	1.46
FT-23	1151	9.31	42.77	42.79	0.32	2.42	2.17
FT-24	1158	0.21	12.47	16.43	1.35	2.39	2.85
FT-25	1159	1.98	38.29	39.95	0.38	1.23	1.43
FT-26	1201	42.47	74.95	76.88	0.03	0.12	0.15
Abandoned Meander Terrace							
MT-31	1290	7.55	38.96	39.28	0.22	0.94	1.40
MT-36	1293	13.63	50.70	52.22	0.11	0.41	0.60
MT-37	1293	12.72	41.18	43.08	0.16	0.48	0.69
UMT-1	NA	7.93	34.99	35.11	0.50	2.88	2.8

3.3. Task 2.5 Erodibility of Clastic Material

A total of 49 pebble counts were conducted in and near the WNYNSC along major and minor creeks as well as two locations on Cattaraugus Creek. Figure 11 displays the locations of the Wolman pebble counts conducted, Appendix 4 summarizes all data, and Figure 12 displays an example distribution and calculation.

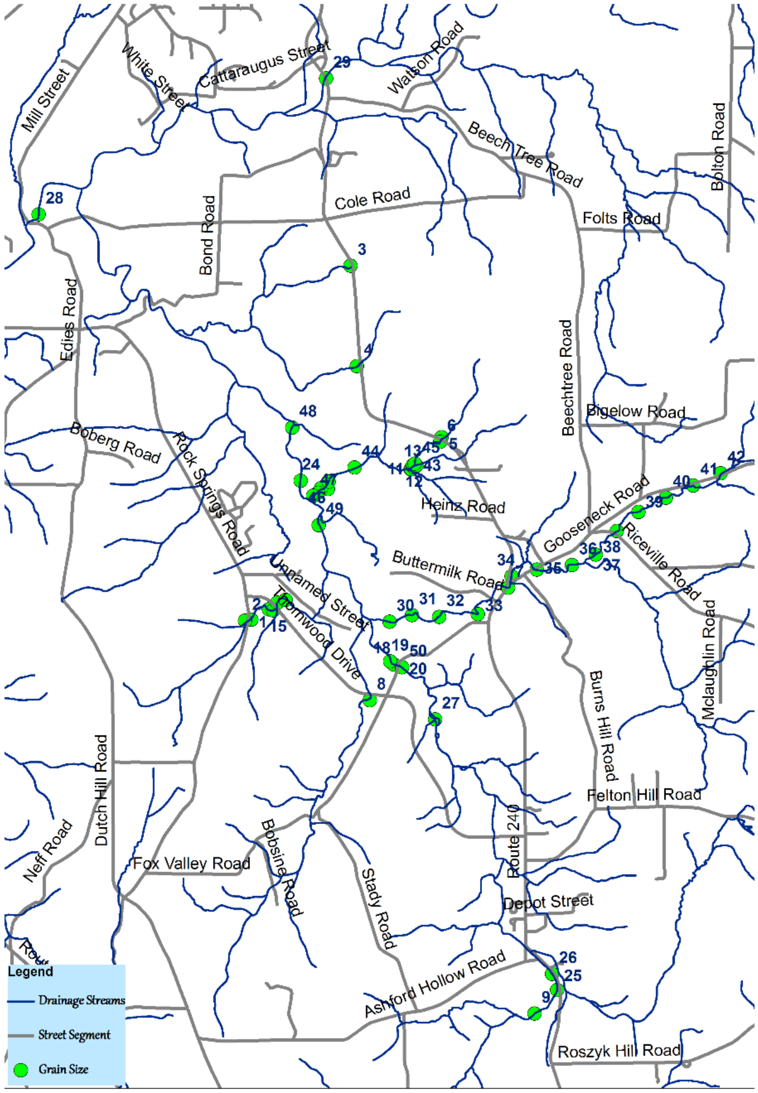
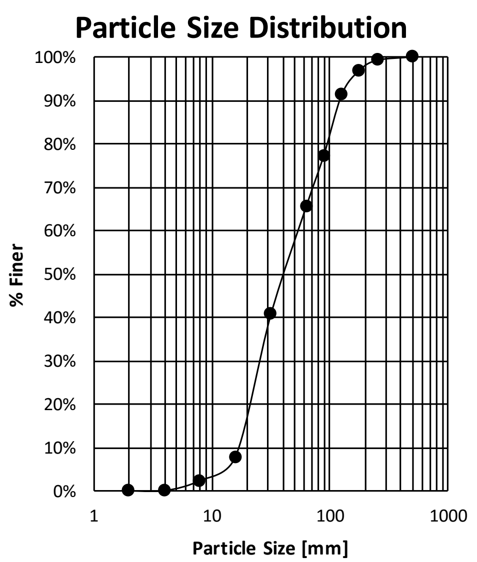


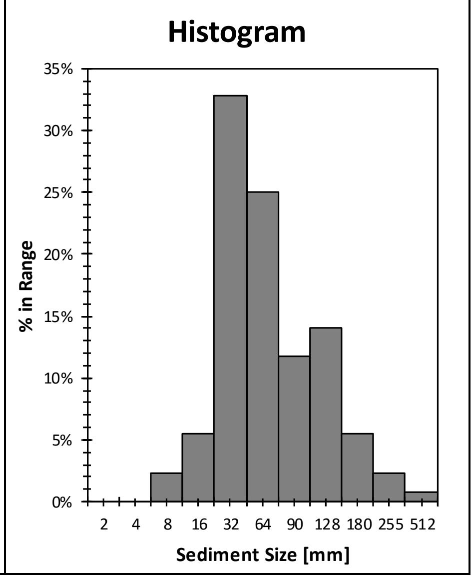
Figure 11. *Locations of all Wolman pebble counts, where green dots correspond to GS-# of location.*

For this location along Heinz Creek, 128 pebbles were measured and sorted into grain size bins. Grain sizes range from 5 to 8 mm (fine gravel) up to greater than 256 but less than 512 mm (boulder). The median grain size of this sediment population D_{50} is 44 mm, or a very coarse gravel.

Site Name:	Heinz Creek
Location:	42°27'06.2"N 78°38'30.9"W
Date:	6/23/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	0	0%	0%
	5 - 8	3	2%	2%
	9 - 16	7	5%	8%
	17 - 32	42	33%	41%
	33 - 64	32	25%	66%
Cobbles	65 - 90	15	12%	77%
	91 - 128	18	14%	91%
	129 - 180	7	5%	97%
	181 - 255	3	2%	99%
Boulders	256 - 512	1	1%	100%
	TOTALS:	**128**		





D_{10}	17.1	mm
D_{16}	20.0	mm
D_{50}	44.0	mm
D_{84}	108.0	mm
D_{90}	124.2	mm
D_{95}	162.2	mm

Figure 12. *Example data sheet, grain size distribution and plots, and derived grain size percentiles determined for a Wolman pebble count conducted on Heinz Creek.*

In general, the stream locations in the WNYNSC region investigated herein have predominantly very coarse gravel beds (Table 4). The ensemble average (and standard deviations) for the grain size percentiles for all streams visited are as follows: $D_{10} = 12 \pm 5$ mm, $D_{16} = 17 \pm 6$ mm, $D_{50} = 53 \pm 18$ mm, $D_{84} = 133 \pm 47$ mm, $D_{90} = 170 \pm 62$ mm, and $D_{95} = 250 \pm 95$ mm.

***Table 4:** Summary of grain size statistics for selected stream channel beds. Refer to Figure 12 for locations and Appendix 4 for data.*

GS-#	Site Name	Coordinate	Grain Size Percentile (mm)					
			D_{10}	D_{16}	D_{50}	D_{84}	D_{90}	D_{95}
GS-1	Rock Springs Rd., near WVDP	42°26'18.0"N 78°39'04.9"W	7.5	10.4	30.4	108.2	143.6	179.1
GS-2	Rock Springs Rd., near WVDP	42°26'17.5"N 78°39'08.3"W	20.4	25.8	58.9	154.8	210.0	295.4
GS-3	On 240, near Thomas Corners Rd	42°28'32.4"N 78°38'14.3"W	14.7	20.2	54.2	157.5	180.0	240.9
GS-4	On 240, just north of bend, west side	42°27'54.5"N 78°38'10.9"W	12.0	15.9	47.5	116.9	154.0	217.5
GS-5	On 240, upstream of road culvert	42°27'27.2"N 78°37'27.3"W	10.4	13.2	44.0	125.0	159.7	210.8
GS-6	On 240 further downstream, ~1 mi	42°27'25.7"N 78°37'28.1"W	9.6	11.9	35.0	89.0	109.9	127.7
GS-7	GS-7, Gooseneck Creek	42°26'30.2"N 78°36'53.3"W	17.5	21.7	54.7	158.4	205.7	299.1
GS-8	Thornwood Rd.	42°25'47.2"N 78°38'04.3"W	16.9	21.1	50.8	119.9	147.5	174.6
GS-9	240 at Firehouse, West Valley	42°23'48.0"N 78°36'39.6"W	14.9	19.0	47.5	170.8	246.4	374.2
GS-10	Upper Heinz Creek	42°27'15.1"N 78°37'43.2"W	14.3	20.6	56.3	155.5	185.6	315.6
GS-11	Near gas pipeline	42°27'15.1"N 78°37'43.1"W	6.1	9.8	27.3	67.8	102.4	173.9
GS-12	Near gas pipeline	42°27'16.4"N 78°37'42.1"W	8.8	12.6	35.0	109.2	166.5	252.2
GS-13	Near gas pipeline	42°27'15.7"N 78°37'41.6"W	18.4	21.2	40.0	66.9	84.2	112.8
GS-14	South East of Rock Springs Road	42°26'21.7"N 78°38'56.0"W	16.7	20.9	52.6	110.7	134.9	210.0
GS-15	South East of Rock Springs Road	42°26'21.5"N 78°38'53.9"W	26.7	34.4	100.1	222.0	255.0	383.5
GS-16	South East of Rock Springs Road	42°26'24.2"N 78°38'51.6"W	15.4	19.4	47.5	86.1	101.4	123.1
GS-17	South East of Rock Springs Road	42°26'25.4"N 78°38'47.3"W	15.2	19.0	41.8	84.0	114.7	157.9
GS-18	Near Fox Valley Rd	42°26'00.8"N 78°37'51.8"W	14.2	19.6	49.7	109.7	127.0	267.9
GS-19	Near Fox Valley Rd	42°26'02.1"N 78°37'53.7"W	14.2	20.9	56.0	112.4	138.4	170.8
GS-20	Near Fox Valley Rd	42°25'59.7"N 78°37'47.7"W	19.6	25.4	59.4	114.1	128.0	168.9
GS-21	Near Fox Valley Rd	42°27'07.7"N 78°38'25.8"W	16.1	18.8	36.1	77.1	111.5	243.7
GS-22	Heinz Creek	42°27'07.9"N 78°38'29.4"W	17.7	22.2	52.6	155.2	199.5	324.1
GS-23	Heinz Creek	42°27'06.2"N 78°38'30.9"W	17.1	20.0	44.0	108.0	124.2	162.2
GS-24	Buttermilk Creek	42°27'10.9"N 78°38'40.0"W	14.7	18.0	36.2	77.5	90.0	141.0
GS-25	N. of fire hall, Buttermilk Creek	42°23'57.1"N 78°36'28.0"W	11.4	18.9	53.2	125.6	202.5	353.5
GS-26	N. of fire hall, Buttermilk Creek	42°24'03.2"N 78°36'30.6"W	17.5	23.0	53.6	108.5	128.0	180.0
GS-27	Buttermilk Creek	42°25'39.9"N 78°37'30.6"W	7.7	12.6	42.9	96.9	127.6	166.7
GS-28	Cattaraugus Creek	42°28'51.8"N 78°40'54.5"W	9.5	13.2	43.4	99.8	119.9	145.7
GS-29	Cattaraugus Creek	42°29'43.9"N 78°38'26.7"W	4.6	5.9	20.1	54.2	62.3	78.0
GS-30	Gooseneck Creek	42°26'17.1"N 78°37'54.2"W	7.9	12.1	40.6	99.8	124.6	163.5
GS-31	Gooseneck Creek	42°26'19.6"N 78°37'42.7"W	6.9	12.2	41.0	112.2	140.4	173.2
GS-32	Gooseneck Creek	42°26'19.1"N 78°37'28.6"W	10.5	16.2	53.8	142.9	168.8	228.8
GS-33	Gooseneck Creek	42°26'20.2"N 78°37'08.7"W	8.5	13.6	52.5	154.3	225.0	360.7
GS-34	Gooseneck Creek	42°26'34.3"N 78°36'51.5"W	7.2	12.5	74.6	195.8	234.4	322.9
GS-35	Gooseneck Creek	42°26'37.0"N 78°36'38.5"W	5.9	8.5	40.0	105.7	138.4	207.5
GS-36	Gooseneck Creek	42°26'38.9"N 78°36'20.5"W	4.9	8.6	69.4	196.0	186.3	404.6
GS-37	Gooseneck Creek	42°26'42.7"N 78°36'08.1"W	6.8	10.1	42.7	112.9	153.0	280.7
GS-38	Gooseneck Creek	42°26'51.6"N 78°35'57.3"W	9.4	13.1	54.7	212.3	299.1	405.5
GS-39	Gooseneck Creek	42°26'59.0"N 78°35'46.3"W	12.2	20.6	78.0	201.4	280.7	396.4
GS-40	Gooseneck Creek	42°27'04.4"N 78°35'32.2"W	7.8	12.0	59.8	165.1	231.6	351.4
GS-41	Gooseneck Creek	42°27'08.9"N 78°35'18.4"W	6.6	9.5	38.1	76.5	88.5	115.0
GS-42	Gooseneck Creek	42°27'13.7"N 78°35'04.1"W	12.5	19.5	72.3	168.3	216.3	326.6
GS-43	Creek leading into Buttermilk Creek	42°27'13.7"N 78°35'04.1"W	10.0	13.1	39.7	119.1	168.9	265.7
GS-44	Creek leading into Buttermilk Creek	42°27'15.7"N 78°38'12.2"W	15.6	26.6	104.3	189.8	249.4	375.8
GS-45	Creek leading into Buttermilk Creek	42°27'17.2"N 78°37'41.0"W	11.7	19.9	67.5	154.5	210.0	306.4
GS-46	Creek leading into Buttermilk Creek	42°27'10.6"N 78°38'25.4"W	5.6	7.4	28.4	125.0	186.3	265.7
GS-47	Creek leading into Buttermilk Creek	42°27'05.2"N 78°38'33.3"W	13.0	21.7	100.6	276.7	364.9	438.5
GS-48	Buttermilk Creek	42°27'31.1"N 78°38'44.1"W	9.8	15.1	85.4	228.0	250.9	368.1
GS-49	Buttermilk Creek	42°26'53.9"N 78°38'30.4"W	10.9	16.0	60.8	118.0	148.8	243.8

4. Discussion

The goals of this section are to provide a landscape perspective for the observed infiltration rates, erodibility indices, and grain size distributions, to provide the landscape modeling activities with usable information, and to compare these on-site determinations of key parameters with those used previously in the Final Environmental Impact Statement (2010).

While the focus of this study was to characterize those geological materials of interest, and in particular the Lavery Till, the infiltration rates presented in Table 2 were measured for a variety of geological materials with a wide range of landscape positions, geological origins, and spatial representations. Even ignoring the anomalously high rate of infiltration measured at HT-32 (Table 2), there does not appear to be a systematic pattern of infiltration rate with elevation or with terrace (Figure 13). In general, the Heinz Creek Terrace data display greater variability than the other locations.

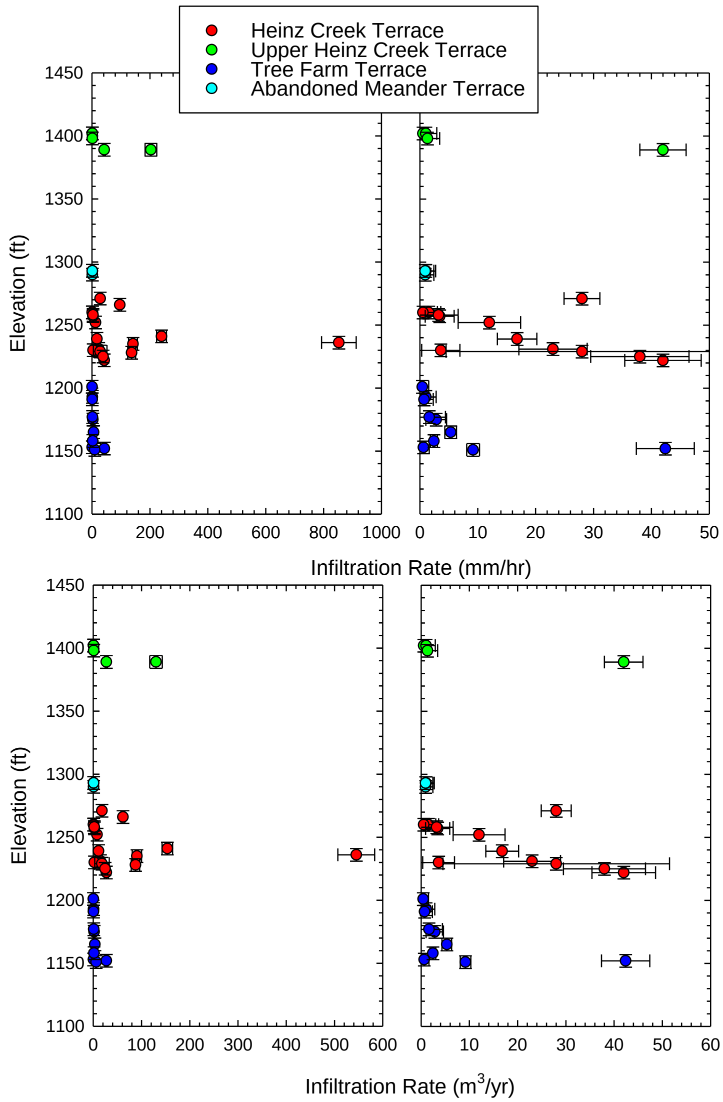


Figure 13. *Variation in infiltration rate with elevation for each terrace. Error bars are standard deviation for infiltration rate and 5 ft uncertainty in elevation.*

For the purpose of modeling landscape evolution, there are several ways these infiltration data can be aggregated. The first approach is simply to derive an average infiltration rate (and standard deviation) using all of the data (i.e., equally weighted). In this case, the average infiltration rate for the entire set of measurements (still excluding HT-32) is 32.8±59.1 mm/hr or 20.98±37.8 m^3/yr (Figure 14).

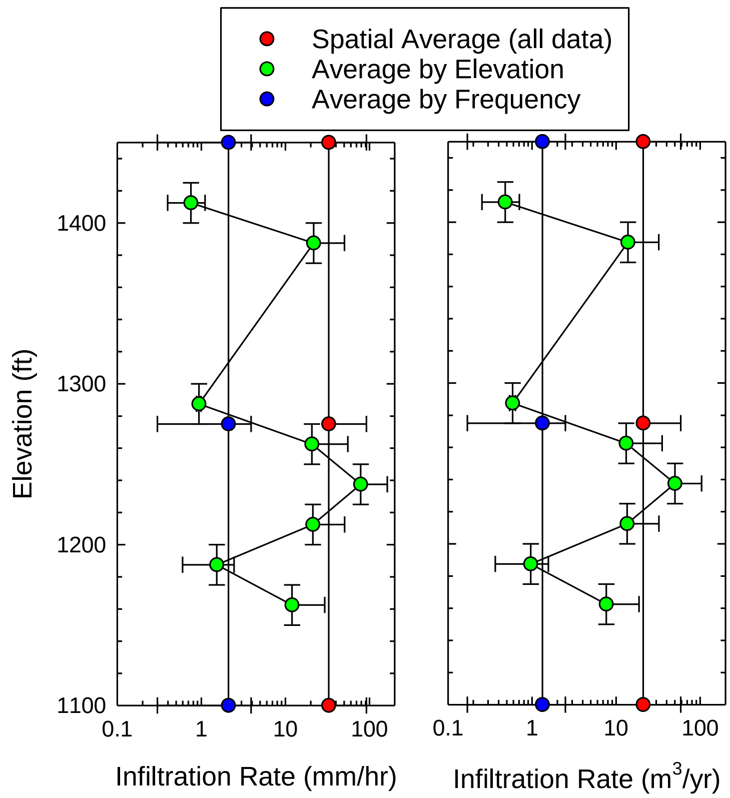


Figure 14. *Variation in infiltration rate with elevation using different aggregation methods. Error bars are standard deviation for infiltration rate and applicable elevation range.*

A second approach to aggregate the data is to determine a vertical variation in infiltration at discrete elevation intervals within the landscape. Here, all infiltration data were aggregated into 25-ft elevation intervals and their average and standard deviations determined. These values are shown in Figure 14 and Table 5. Average (and standard deviation) infiltration rates can vary vertically from 0.8±0.4 mm/hr (0.48±0.23 m^3/yr) for the elevation interval of 1400 to 1425 ft to 78.4±84.6 mm/hr (50.14±54.08 m^3/yr) for the elevation interval of 1225 to 1250 (Table 2). Although such vertical representation of infiltration rate might prove beneficial for modeling purposes, the gaps in the data due to lack of information would need to be reconciled.

A final approach to aggregate the data is to focus on frequency of occurrence of infiltration rate. There is a higher proportion of measured infiltration rates that are less than 10 mm/hr (5.88 m^3/yr); about 58% of all measurements fall below this infiltration rate (Table 2). This aggregation approach would simply accept that these more frequent observations of relatively low infiltration rate better represent the geological materials of interest within the landscape. In this case, the average (and standard deviation) infiltration rate for those measurements less than 10 mm/hr (5.88 m^3/yr), as noted above, is 2.1±2.1 mm/hr or 1.33±1.37 m^3/yr (Figure 14).

Table 5: *Variation of infiltration rate aggregated and averaged by selected landscape elevation ranges.*

Elevation Range (ft)	Infiltration Rate (mm/hr)		Infiltration Rate (m^3/yr)	
	Average	Standard Deviation	Average	Standard Deviation
1150 to 1175	12.0	17.3	7.66	11.07
1175 to 1200	1.5	0.93	0.96	0.60
1200 to 1225	21.2	29.4	13.55	18.82
1225 to 1250	78.4	84.6	50.14	54.08
1250 to 1275	20.7	34.6	13.21	22.11
1275 to 1300	0.9	0.06	0.59	0.05
1300 to 1325	NA	NA	NA	NA
1325 to 1350	NA	NA	NA	NA
1350 to 1375	NA	NA	NA	NA
1375 to 1400	21.7	28.8	13.85	18.38
1400 to 1425	0.8	0.4	0.48	0.23

These infiltration rates are corroborated by those used previously in site assessment. In the Final Environmental Impact Statement (2010, Appendix F), the following infiltration rates were used in simulating the long-term landscape evolution of the WVDP: 3.82, 8.29, 16.8, 19.4, 68.7 mm/hr. The values employed in these previous assessments agree well with the values reported herein using the different aggregation approaches, especially the lower-magnitudes rates.

Similar to the infiltration data, the erodibility indices presented in Table 3 were measured for a variety of geological materials with a wide range of landscape positions, geological origins, and spatial representations. The erodibility indices derived using the Scour Depth Solution will be the focus of the current discussion. Figure 15 plots these erodibility data within the landscape, showing that τ_c ranges from 12 to 90 Pa (a variation 8×) and k_d ranges from 0.20 to 7.93 cm^3/N-s (a variation of 40×). In general, as the value of τ_c increases, the value of k_d decreases (see Hanson and Simon, 2001). Moreover, there does not appear to be a systematic variation in erodibility with elevation.

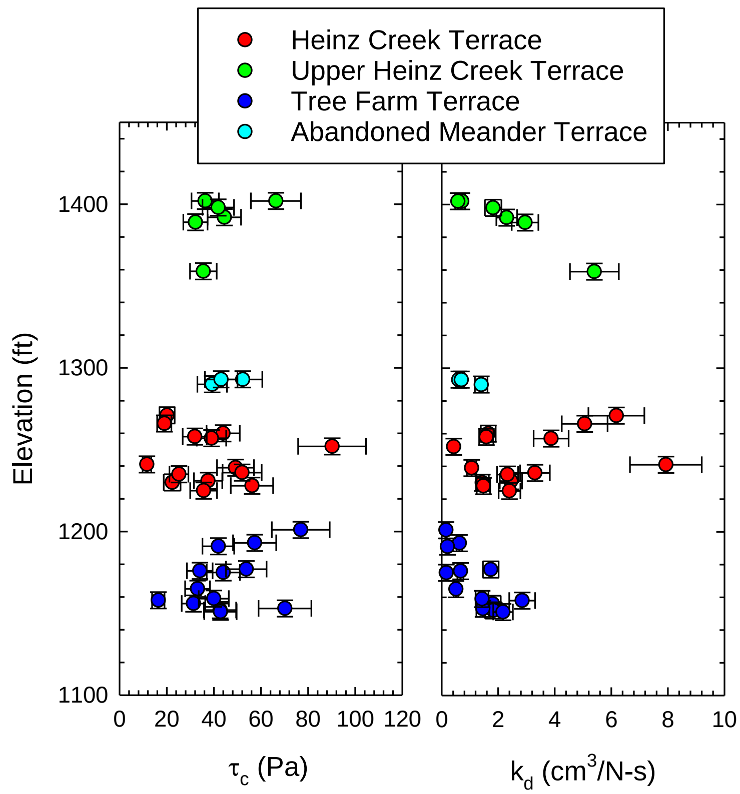


Figure 15. *Variation in the critical tractive shear stress τ_c and the erodibility coefficient k_d with elevation for each terrace. Error bars are errors for erodibility indices and 5 ft uncertainty in elevation.*

Again for the purpose of modeling landscape evolution, attempts were made to aggregate these erodibility indices. The first is simply to derive an average (and standard deviation) of critical tractive shear stress τ_c and erodibility coefficient k_d using all of the data (i.e., equally weighted). In this case, the average τ_c value is 41.73±16.40 Pa and the average k_d value is 2.05±1.75 cm^3/N-s (Figure 16). Next, all erodibility indices were aggregated into 25-ft elevation intervals and their average and standard deviations determined. These values are shown in Figure 16 and Table 6. Values of τ_c appear relatively constant in magnitude with changes in elevation within the landscape, and these are close to about 40 Pa (Figure 16, Table 6). There is a notable increase in τ_c within the 1200 to 1225 ft elevation interval. In contrast, aggregated values of k_d show much greater variation with elevation, ranging from 0.15±0.02 cm^3/N-s within the 1200 to 1225 ft elevation interval to 5.40±0.086 cm^3/N-s within the 1350 to 1375 interval (Figure 16, Table 6). It is also noted here that no erodibility indices were determined for the 1300 to 1350 ft elevation interval. Lastly, a frequency analysis was performed to determine the values of the most commonly measured indices. On the basis of the τ_c values, it was found than 75% of the measurements fall within the range of 30 to 60 Pa. Using this frequency of occurrence to filter the data, the aggregated average (and standard deviation) of critical tractive shear stress τ_c is 41.70±7.60 Pa and 1.76±1.20 cm^3/N-s for the erodibility coefficient k_d (Figure 16).

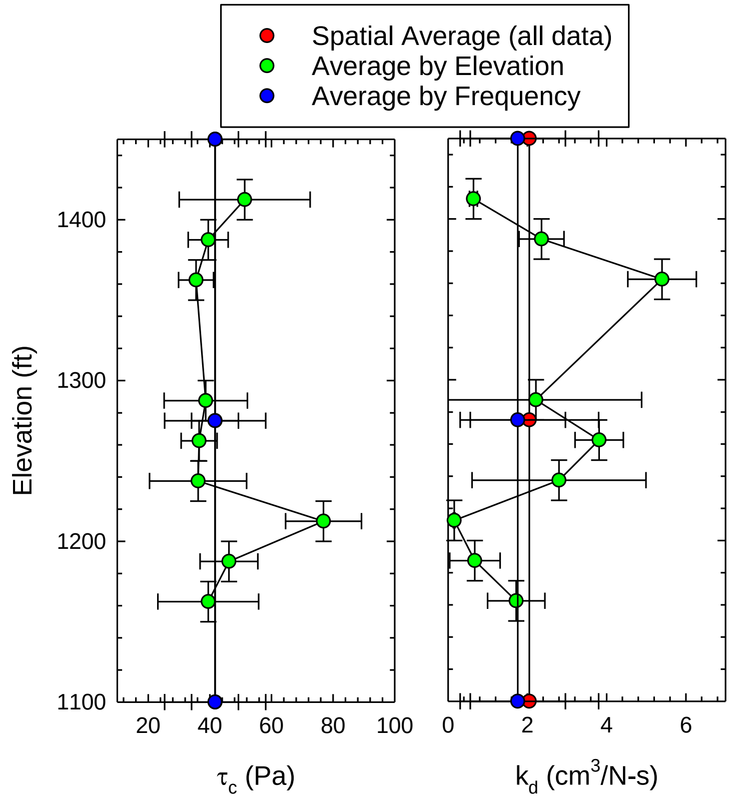


Figure 16. *Variation in the critical tractive shear stress τ_c and erodibility coefficient k_d with elevation using different aggregation methods. Error bars are standard deviation for the erodibility indices and applicable elevation range. Note that the spatial average value of τ_c is nearly identical to the average value by frequency.*

Table 6: *Variation of critical tractive shear stress τ_c and erodibility coefficient k_d aggregated and averaged by selected landscape elevation ranges.*

Elevation Range (ft)	τ_c (Pa)		k_d (cm^3/N-s)	
	Average	Standard Deviation	Average	Standard Deviation
1150 to 1175	39.48	16.33	1.72	0.72
1175 to 1200	46.19	9.37	0.68	0.64
1200 to 1225	76.88	12.30	0.15	0.02
1225 to 1250	36.19	15.76	2.80	2.19
1250 to 1275	36.51	5.84	3.81	0.61
1275 to 1300	38.67	13.51	2.22	2.67
1300 to 1325	NA	NA	NA	NA
1325 to 1350	NA	NA	NA	NA
1350 to 1375	35.53	5.69	5.40	0.86
1375 to 1400	39.48	6.48	2.36	0.57
1400 to 1425	51.31	21.23	0.64	0.10

These erodibility indices also are corroborated by those used previously in site assessment. In the Final Environmental Impact Statement (2010, Appendix F), the following values of the critical tractive shear stress τ_c were used in simulating the long-term landscape evolution of the WVDP: 1, 4, 16, 80, and 400 Pa for the bedrock, and 4, 10, 23, 54, and 124 for the regolith. These compare well with the values reported here, ca. 40 Pa. In addition, the following values of the erodibility coefficient k_d were used in simulating the long-term landscape evolution of the WVDP: 0.032, 0.317, 3.17, 31.7, and 317.1 cm^3/N-s for the till and 317.1 cm^3/N-s for the regolith. These also compare well with the values reported here, ca. 2 cm^3/N-s, especially the lower-magnitudes values.

It is common for streams whose beds are composed of sediment mixtures to exhibit downstream fining (Rice, 1999). Several grain size distributions listed in Table 4 were collected along continuous reaches of Heinz Creek (GS-47, GS-23, GS-22, GS-46, GS-44, GS-10, GS-11, GS-13, GS-12, GS-45, GS-6, and GS-5, listed from downstream to upstream), Gooseneck Creek (GS-30, GS-31, GS-32, GS-33, GS-7, GS-34, GS-35, GS-36, GS-37, GS-38, GS-39, GS-40, GS-41, and GS-42, listed from downstream to upstream), and Buttermilk Creek (GS-48, GS-24, GS-49, GS-19, GS-18, GS-20, GS-27, GS-26, GS-25, and GS-9, listed from downstream to upstream). Figure 17 summarizes the longitudinal variations of each grain size percentile of the stream bed for each creek, plotted as a function of distance upstream of the creek's confluence. Analysis of the spatial trends for each grain size percentile shows no statistically significance for any dataset. Three grain size percentiles do show trends with distance that are nearly statistically significant. These are D_{84} (p=0.07), D_{90} (p=0.08), and D_{95} (p=0.10) along Heinz Creek (Figure 17), but these are negative correlations; they show a near statistically significant trend in downstream coarsening (upstream fining). These data suggest that no systematic variation exists in grain size along the beds of these three creeks.

Given that the grain size distributions along selected stream beds do not show statistically significant variations, these data can be aggregated for the purpose of modeling landscape evolution. A Pearson correlation coefficient was derived for each grain size pair (GS-1 vs. GS-2, GS-1 vs. GS-3, etc.), and an average correlation coefficient then was determined for each grain size dataset in comparison to the entire dataset. Those grain size data that had lowest correlation coefficients (less than 0.7) within the population were identified, and these included the following: GS-2, GS-15, GS-29, GS-34, GS-36, GS-39, GS-41, GS-43, GS-44, GS-45, GS-46, GS-47, and GS-48. The remaining data were aggregated, and a representative grain size distribution for the region can be determined (Figure 18). The grain size percentiles for these aggregated data are as follows: $D_{10} = 11$ mm, $D_{16} = 17$ mm, $D_{50} = 47$ mm, $D_{84} = 117$ mm, $D_{90} = 154$ mm, and $D_{95} = 225$ mm. In general, these aggregated grain size percentiles are finer than (or smaller in magnitude) in comparison to the ensemble average values presented above, but still in agreement with those observed by Boothroyd et al. (1979) and used in the FEIS (2010).

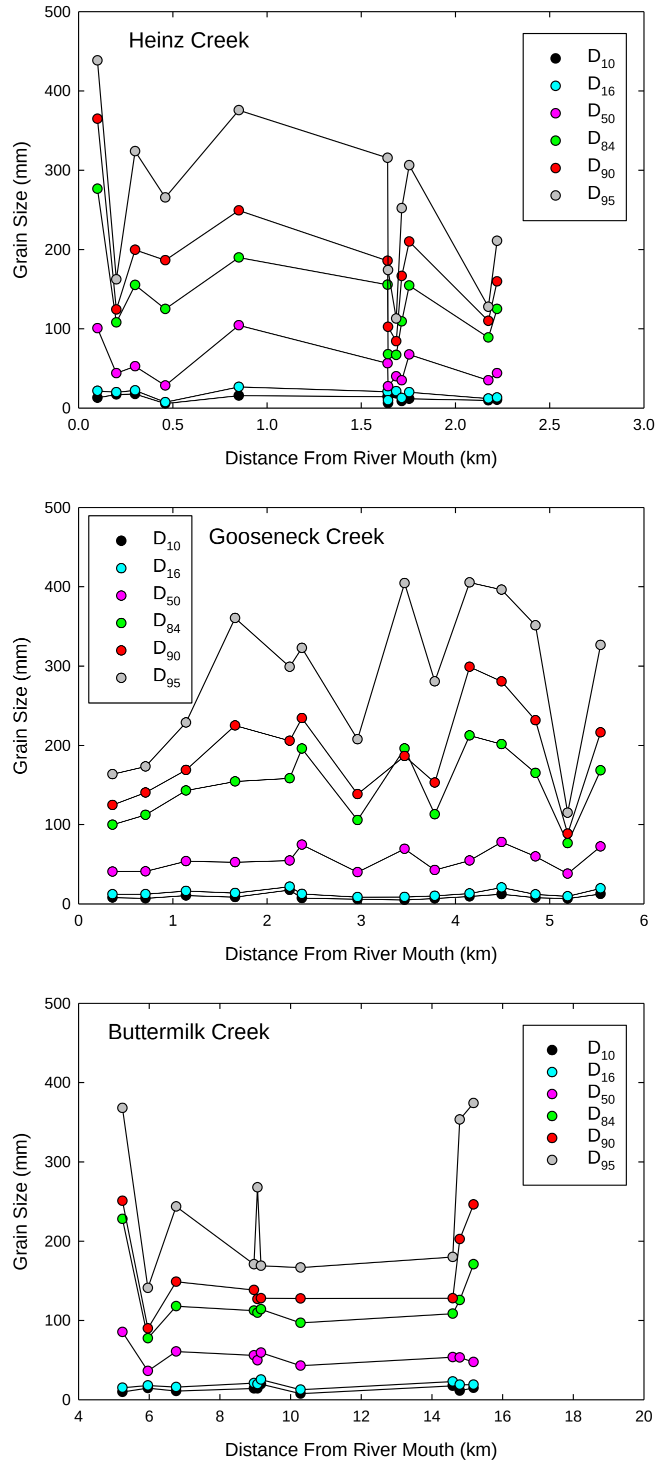
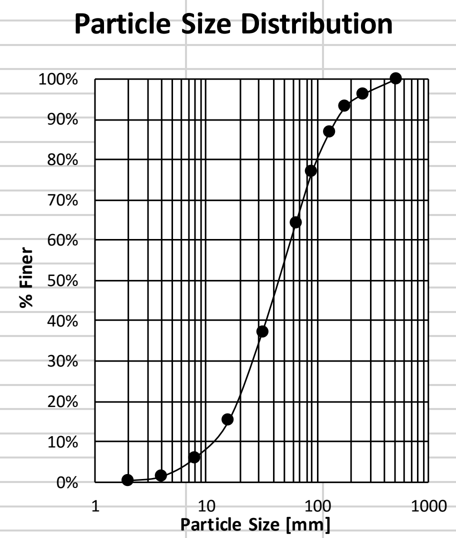
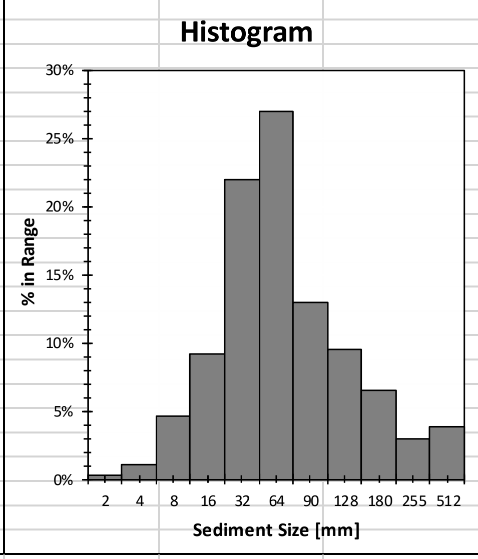


Figure 17. *Longitudinal variations in grain size percentiles for stream bed sediments along Heinz Creek, Gooseneck Neck, and Buttermilk Creek.*

Site Name:	Aggregated Data				
Location:					
Date:					
	Particle	**Size (mm)**	**Total #**	**% in Range**	**% Finer**
Sand and Silt	<	2	13	0%	0%
	2 -	4	43	1%	1%
	5 -	8	190	5%	6%
Gravels	9 -	16	376	9%	15%
	17 -	32	897	22%	37%
	33 -	64	1101	27%	64%
	65 -	90	527	13%	77%
Cobbles	91 -	128	389	10%	87%
	129 -	180	266	7%	93%
	181 -	255	119	3%	96%
Boulders	256 -	512	157	4%	100%
		TOTALS:	**4078**		





D_{10}	11.4	mm
D_{16}	16.5	mm
D_{50}	47.1	mm
D_{84}	117.2	mm
D_{90}	154.2	mm
D_{95}	225.4	mm

Figure 18. *Data sheet, grain size distribution and plots, and derived grain size percentiles determined for the aggregated Wolman pebble count data.*

Only limited grain size statistics of the stream beds in the WNYNSC have been previously reported. Boothroyd et al. (1979) measured the long axis of the largest clasts on exposed bars along Buttermilk Creek. They reported that maximum clast size ranged from 210 to 305 mm (with an average of 250 mm), and that no systematic variation of this clast size occurred in the downstream direction. In the FEIS (2010), a mixture of bed sediment sizes ranging from 8 to 128 mm with median grain diameter of 32 mm, was employed in simulating the long-term landscape evolution of the stream channels near the WVDP. The grain size data reported herein are in agreement with the observations reported by Boothroyd et al. (1979) and those used in the FEIS (2010).

5. Conclusions

Enviro Compliance Solutions, Inc. and the West Valley Erosion Working Group recommended erosion assessment to be performed as part of the Phase 1 Studies at the West Valley Demonstration Project and Western New York Nuclear Service Center. These studies seek to improve forecasts of future erosion at this facility, which includes a focus on recent erosion and deposition processes. The EWG identified a list of environmental parameters that would reduce uncertainties in predicting future erosion using a landscape evolution model (WVDP Erosion Working Group, 2015). These parameters included bed-sediment entrainment thresholds, soil/till-detachment thresholds, and soil-infiltration capacities. The objective of this report is to summarize the field activities conducted this past summer (2016), to review the methods employed, and to tabulate and interpret the data collected. Three tasks were undertaken: (1) Task 2.2: Infiltration and Soil Moisture Determination, (2) Task 2.5: Erodibility of Cohesive Sediment, and (3) Task 2.6: Erodibility of Clastic Sediment in Selected Gullies, Stream Channels, and Streambanks. This work was greatly facilitated by the EWG activities focused on Study 1 - Terrain Analysis, Age Dating, and Paleoclimate, as these researchers employed a backhoe to expose within trenches those geological materials of interest. The infiltration and erodibility studies were performed in these trenches, restricted in space to three field locations: the Heinz Creek Terrace, the Tree Farm Terrace, and the Abandoned Meander Terrace.

For Task 2.2, field activities sought to quantify volumetric moisture content and infiltration capacity or rate for selected surficial geological materials, and this was accomplished using a soil moisture probe and a double ring infiltrometer. A total of 36 soil moisture measurements were obtained and 37 infiltration studies were conducted at the three field locations. It was found that soil moisture values and infiltration rates were greatly conditioned by the composition, texture, and structure of the geological material tested. Soil moisture rates varied from 2.2±0.5% for the coarsest-grained, most unconsolidated sediment and to 47.8±2.3% for the finest-grained, most consolidated sediment. Infiltration rates varied from 0.5±0.9 mm/hr (0.32±0.59 m^3/yr) for the finest-grained, most consolidated sediment to 852.7±59.6 mm/hr (545.01±38.08 m^3/yr) for the coarsest-grained, most unconsolidated sediment.

Three approaches were used to aggregate these infiltration rate data to place these into a landscape perspective. First, an ensemble average of all measurements (excluding one outlier) produced a value of 32.8±59.1 mm/hr (20.98±37.8 m^3/yr). Second, infiltration rates were aggregated into discrete 25-ft elevations and averaged, which produced variable rates ranging from 0.9±0.06 mm/hr (0.59±0.05 m^3/yr) for the 1275 to 1300 ft interval to 78.4±84.6 mm/hr (50.14±54.08 m^3/yr) for the 1225 to 1250 ft interval. Third, a frequency analysis of the infiltration rate data showed that about

58% of all measurements fell below a rate of 10 mm/hr (5.88 m^3/yr). Using this as upper limit, an average infiltration rate for these measurements produced a value of 2.1±2.1 mm/hr (1.33±1.37 m^3/yr). These field measurements of saturated infiltration rate are close in magnitude to these values used previously to simulate the evolution of the landscape (FEIS, 2010).

For Task 2.5, field activities sought to quantify the erodibility indices for selected surficial geological materials, and this was accomplished using the jet erosion test (JET). The JET was employed to estimate the erodibility of glacial materials by simulating erosion by a water over a fixed period of time (Hanson, 1990a; Hanson, 1990b). Once these data were collected, the critical tractive shear stress τ_c and the erodibility coefficient k_d can be derived using three solution methods (Blaisdell, Iterative, and Scour Depth), premised on the assumption that a linear excess shear stress model for erosion rate is appropriate (Eq. 1). Following simple procedures for quality control, a total of 37 JET datasets were deemed acceptable for further analysis. It was found that the Scour Depth Solution method produced the lowest error for the prediction of the scour hole erosion rate derived from the JET apparatus, and this solution produced τ_c values ranging from 11.59±0.70 to 90.16±5.41 Pa and k_d values ranging from 0.16±0.02 to 7.93±0.79 cm^3/N-s. A general inverse relationship between τ_c and k_d was observed, as expected.

Three approaches were used to aggregate these erodibility indices to place them into a landscape perspective. First, an ensemble average of all measurements produced values of 41.73±16.40 Pa for τ_c and 2.05±1.75 cm^3/N-s for k_d. Second, erodibility indices were aggregated into discrete 25-ft elevations and averaged. This produced variable values of τ_c with elevation ranging from 35.53±5.69 Pa for the 1350 to 1375 elevation interval to 76.88±12.30 Pa for the 1200 to 1225 elevation interval. This approach also produced variable rates of k_d with elevation ranging from 0.15±0.02 cm^3/N-s for the 1200 to 1225 elevation interval to 5.40±0.86 cm^3/N-s for the 1350 to 1375 elevation interval. The aggregated values of k_d displayed greater variability with elevation as compared to the aggregated values of τ_c. Third, a frequency analysis of the τ_c data showed that 75% of the measurements fell within the range of 30 to 60 Pa. Using this frequency of occurrence to filter the data, the aggregated average value of τ_c is 41.70±7.60 Pa and the aggregated average value of k_d is 1.76±1.20 cm^3/N-s, which are very similar to the ensemble averages presented above. These field measurements of the erodibility indices for the glacial materials are close in magnitude to those values used previously to simulate the evolution of the landscape (FEIS, 2010).

For Task 2.6, field activities sought to quantify the surface grain size statistics of selected stream channels, and this was accomplished using Wolman pebble counts. A total of 49 pebble counts were conducted at a variety of stream channel locations and waterways, including several locations along Heinz Creek, Gooseneck Creek, and Buttermilk Creek. It was found that the stream channels are composed primarily of very coarse gravel, and the ensemble average (and standard deviation) grain size percentiles for all streams included the following: $D_{10} = 12 \pm 5$ mm, $D_{50} = 53 \pm 18$ mm, and $D_{90} = 170 \pm 62$ mm. Yet analysis of the longitudinal trends in surface grain size percentiles along Heinz Creek, Gooseneck Creek, and Buttermilk Creek did not show any statistically significant variation; that is, no statistically significant downstream fining of the bed surface grain size distribution was observed. A Pearson correlation analysis of these grain size data identified those datasets that showed the weakest correlations within the population (13 in total). An aggregated grain size distribution representative of the WNYNSC, which excluded these 13 grain size datasets, produced the following grain size percentiles: $D_{10} = 11$ mm, $D_{16} = 17$ mm, $D_{50} = 47$ mm, $D_{84} = 117$ mm, $D_{90} = 154$ mm, and $D_{95} = 225$ mm.

6. References

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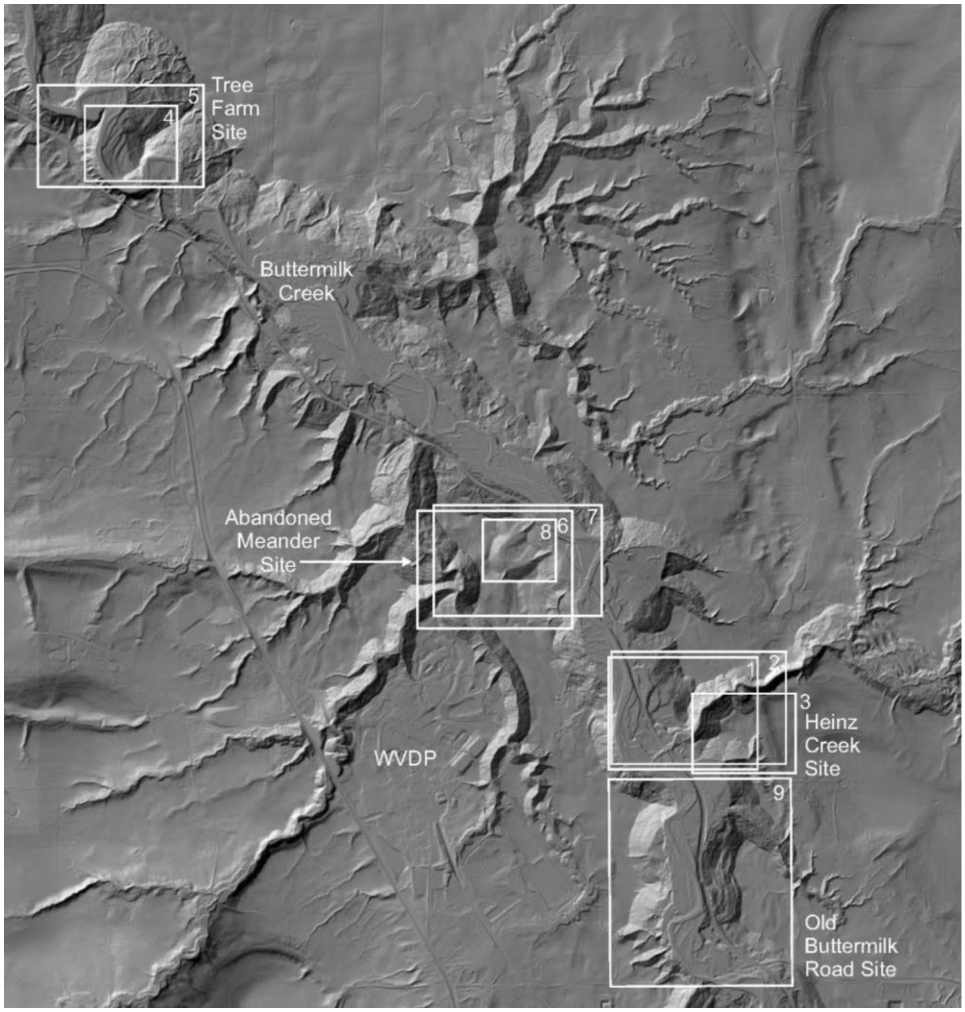
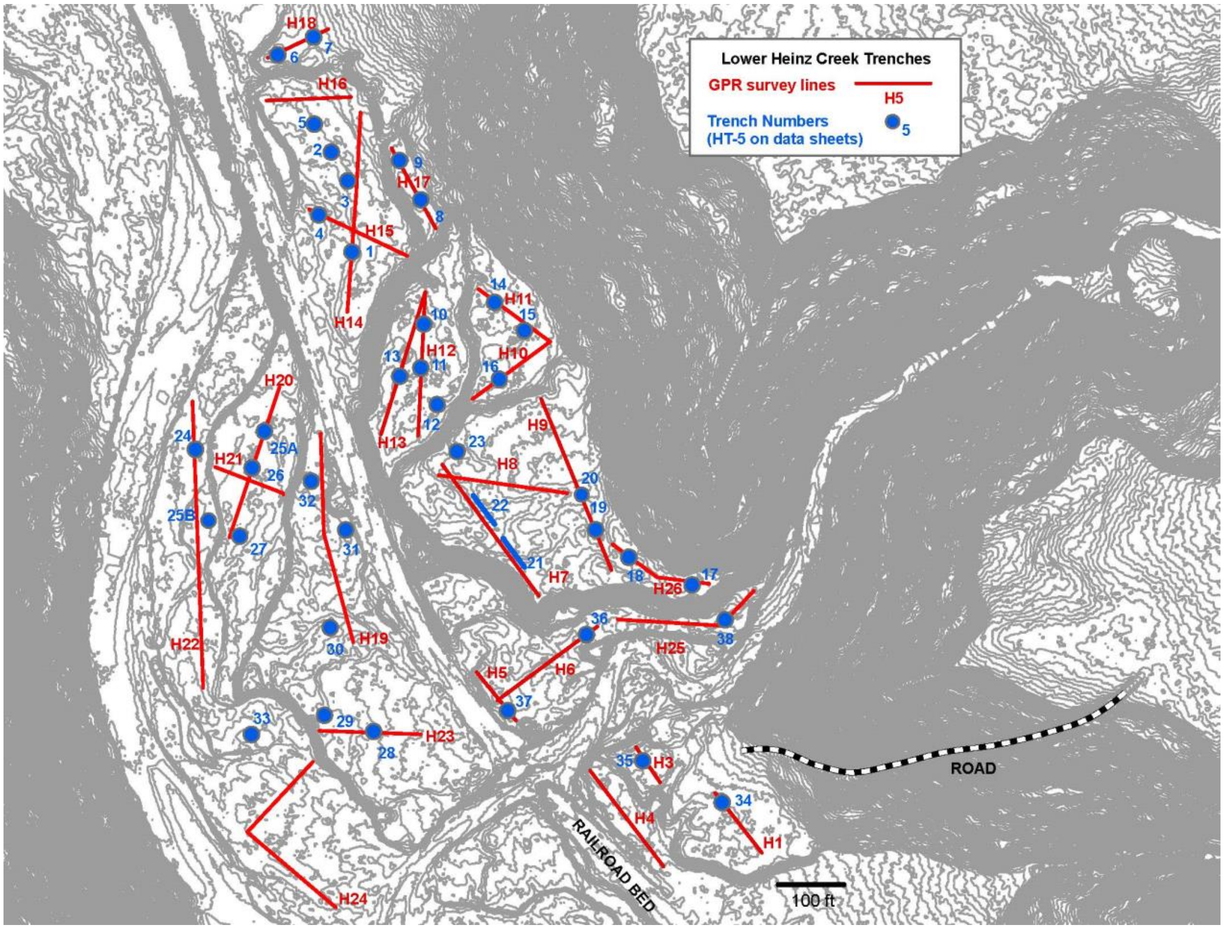
7. Acknowledgements

Chris Allan, Chris Ibsen, and Kathryn Rozwod worked fulltime during the summer of 2016 and assisted in the collection, processing, and collation of field data. Kathryn Rozwod took the lead on processing the JET data, with the assistance of Mohammad Ghaneeizad and Maliheh Karamigolbaghi. Denny Feldman and Tim Zerfas provided technical and logistical support for the field activities. Fangyu Zeng and Chengxi Zhu provided assistance in preparing this report.

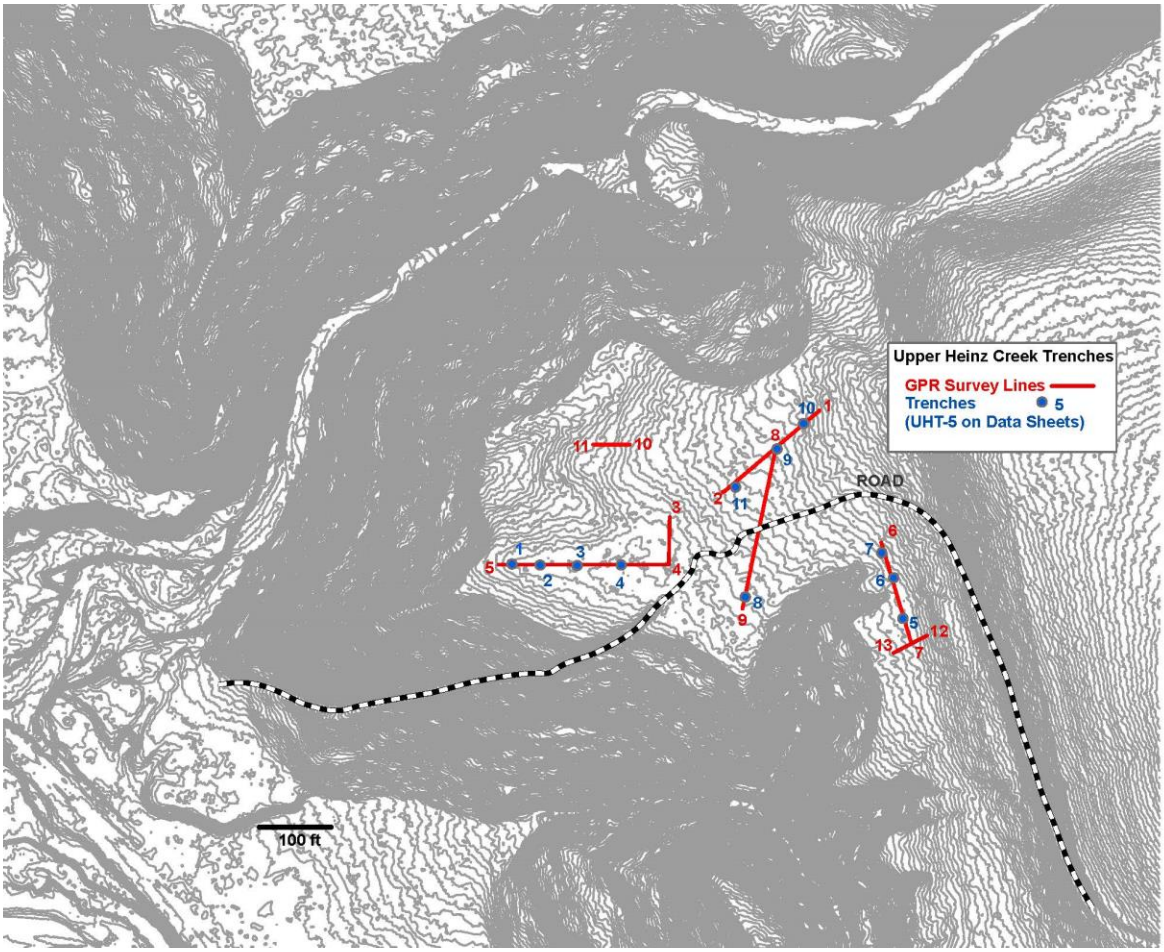
Appendix 1. Maps and plots for all trench locations near the West Valley Demonstration Project.



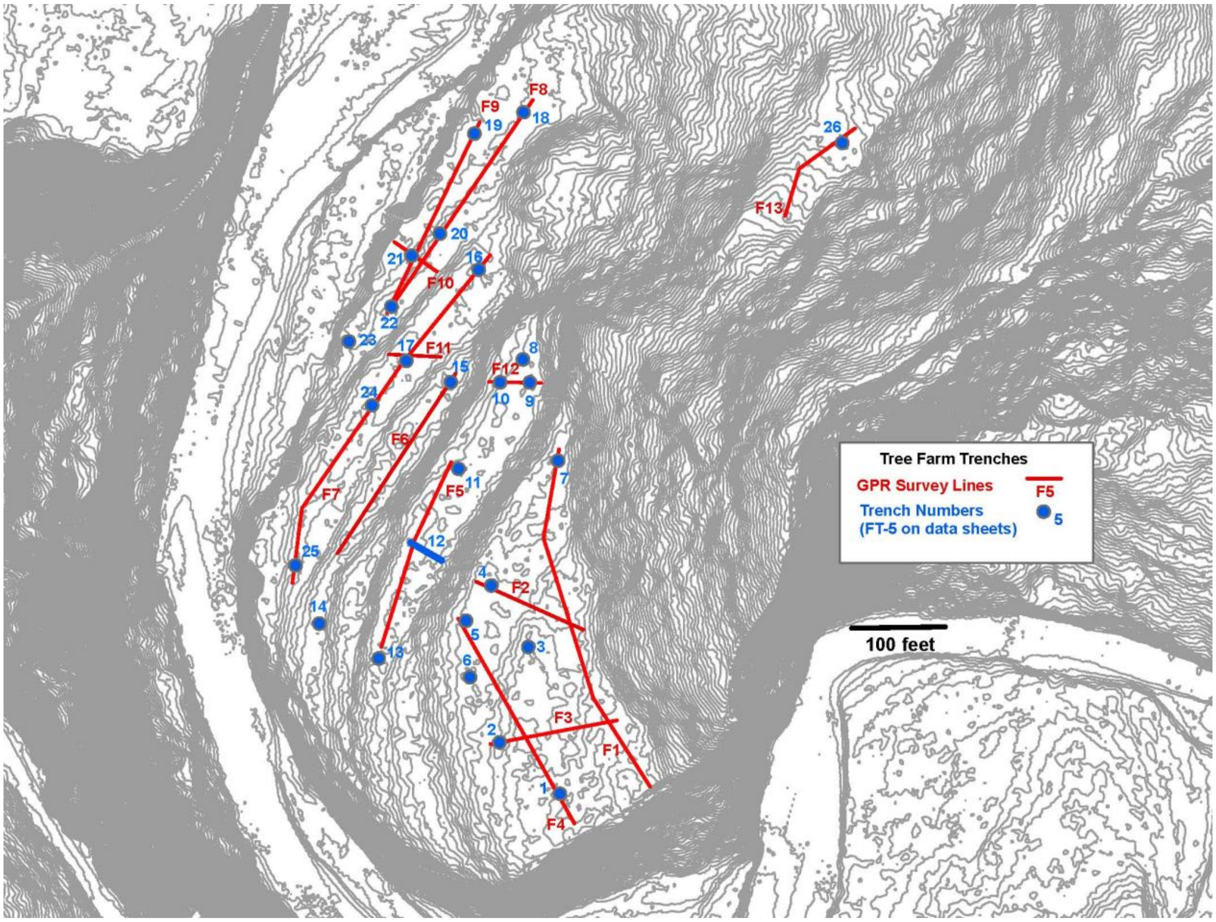
Location map for all field activities (from R. Young).



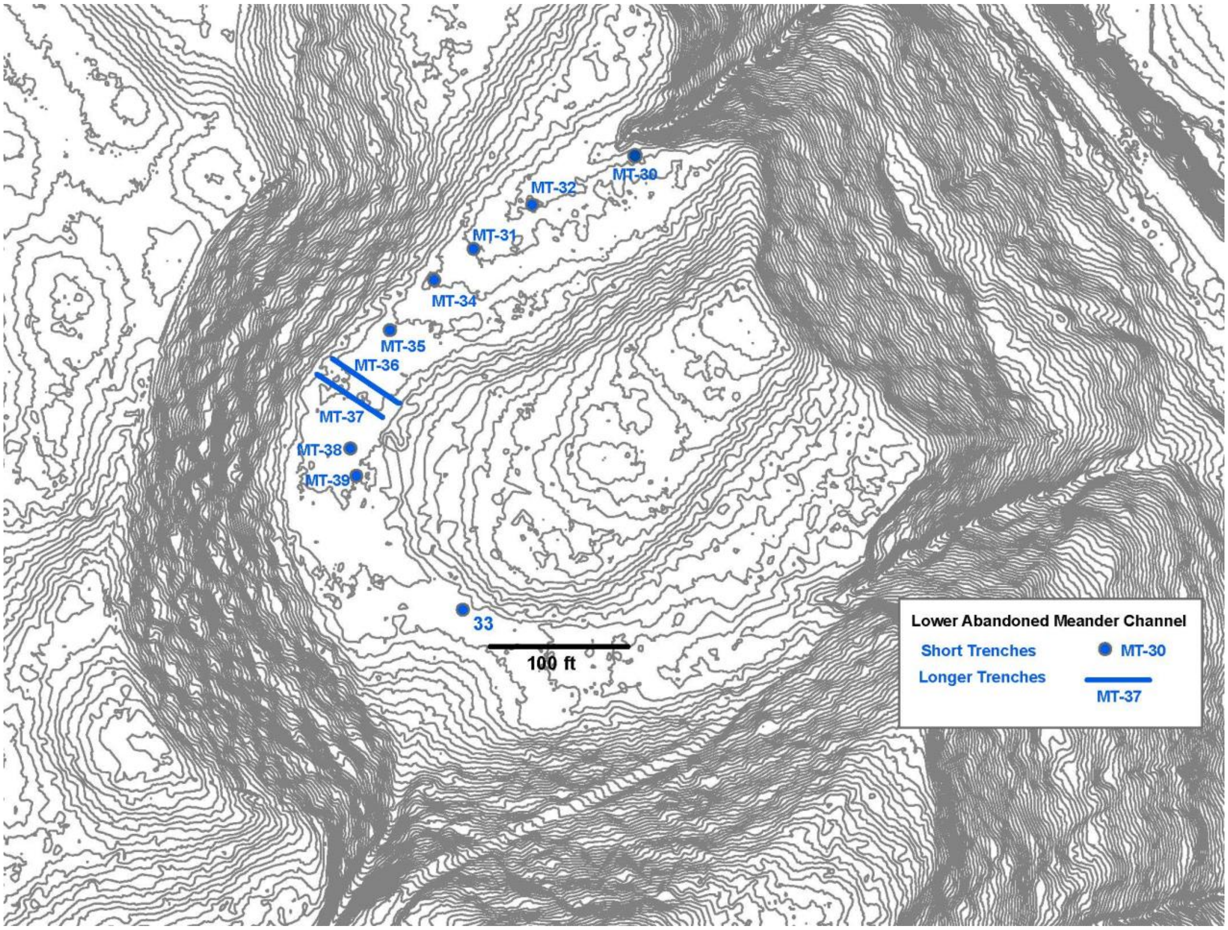
Location map for all trenches (blue circles) and ground penetrating lines (red lines) for the Heinz Creek Terrace area (from R. Young). Trench locations are identified as HT-1, HT-2, etc.



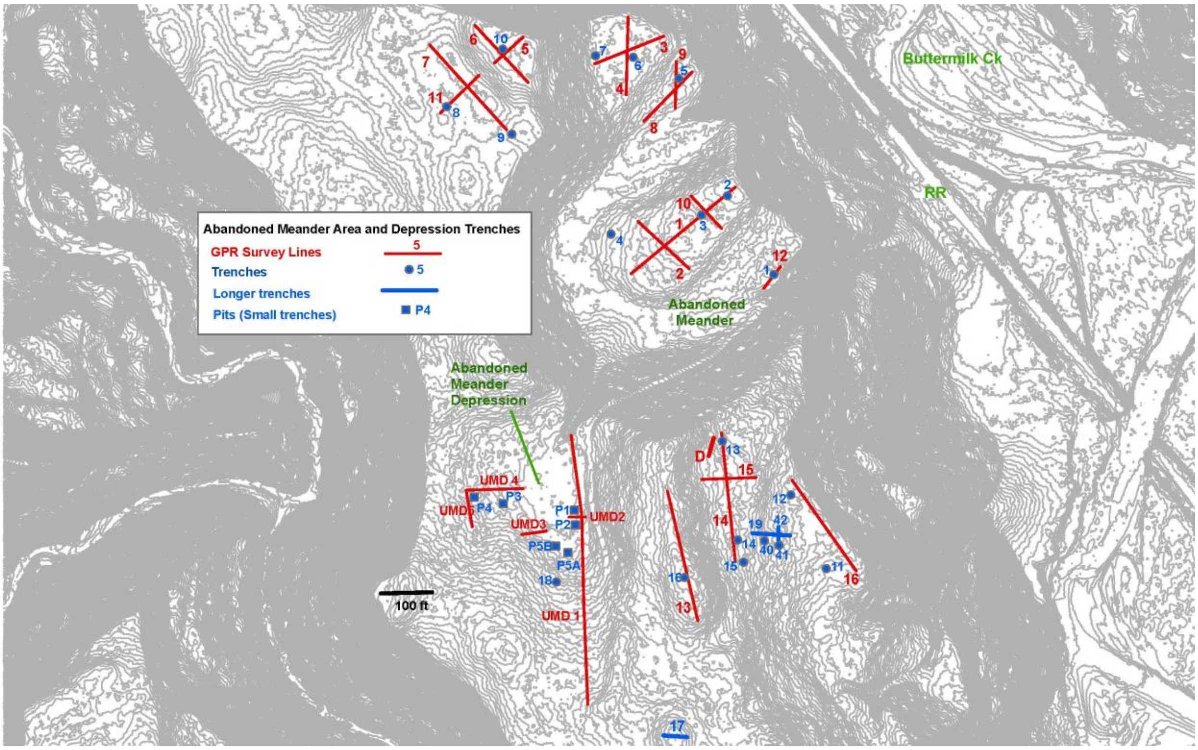
Location map for all trenches (blue circles) and ground penetrating lines (red lines) for the Upper Heinz Creek Terrace area (from R. Young). Trench locations are identified as UHT-1, UHT-2, etc.



Location map for all trenches (blue circles) and ground penetrating lines (red lines) for the Tree Farm Terrace area (from R. Young). Trenches as numbered sequentially (1, 2, etc) and are noted herein as FT-1, FT-2, etc.



Location map for all trenches (blue circles) for the Abandoned Meander Terrace area (from R. Young). Trenches as numbered sequentially (MT-31, MT-32, etc.)

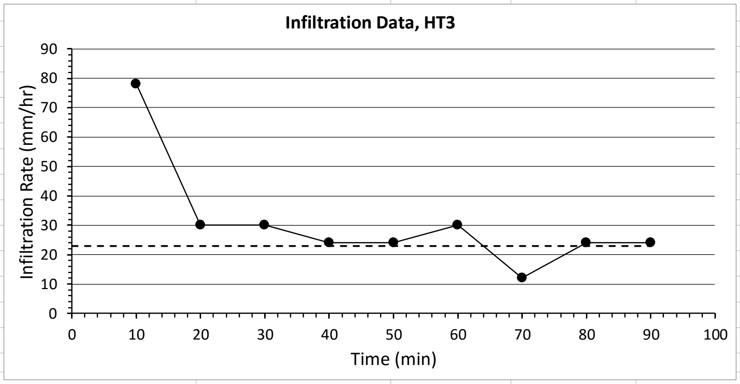


Location map for all trenches (blue circles) and ground penetrating lines (red lines) for the Upper Abandoned Meander Terrace area (from R. Young). Trenches as numbered sequentially (1, 2, etc) and are noted herein as UMT-1, UMT-2, etc.

Appendix 2. Summary of double ring infiltrometer tests and soil moisture measurements obtained at the following trench locations (numbered by trench): Heinz Terrace (HT), Upper Heinz Terrace (UHT), Tree Farm (FT), Abandoned Meander (MT), and Upper Abandoned Meander (UMT).

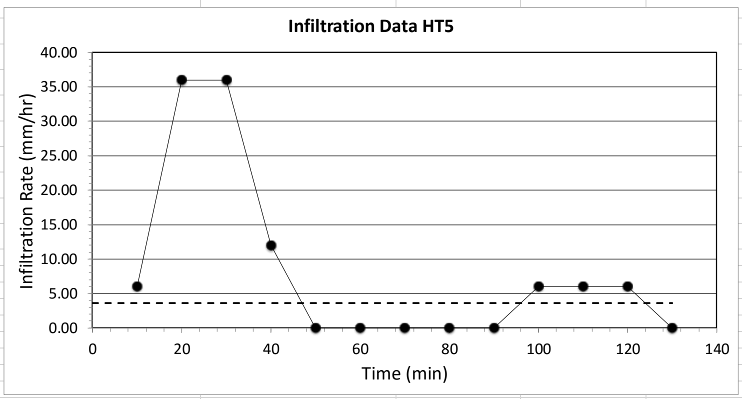
Double Ring Infiltrometer Test and Soil Moisture Measurements: <u>Heinz Terrace HT-3</u>

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
Project Identification:	West Valley Demonstration Project						
Test Location:	HT-3						
Soil Type:	Clay						
Tested By:	CI, KR				Ring area (mm^2)	72966	
Date:	6/20/2016				Ring area (m^2)	0.072966	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	Infiltration Rate (mm/hr)	Infiltration Rate (m^3/yr)	
0	22.2						
10	20.9		1.3	13	78.00	49.86	
20	20.4	22.8	0.5	5	30.00	19.18	
30	22.3		0.5	5	30.00	19.18	
40	21.9		0.4	4	24.00	15.34	
50	21.5	23.5	0.4	4	24.00	15.34	
60	23		0.5	5	30.00	19.18	
70	22.8		0.2	2	12.00	7.67	
80	22.4		0.4	4	24.00	15.34	
90	22		0.4	4	24.00	15.34	
							STDev
				Average Infiltration Rate (mm/hr)		23.00	5.90
				Average Infiltration Rate (m^3/yr)		14.70	3.77
					Time (min)		
					0	23.00	
					90	23.00	



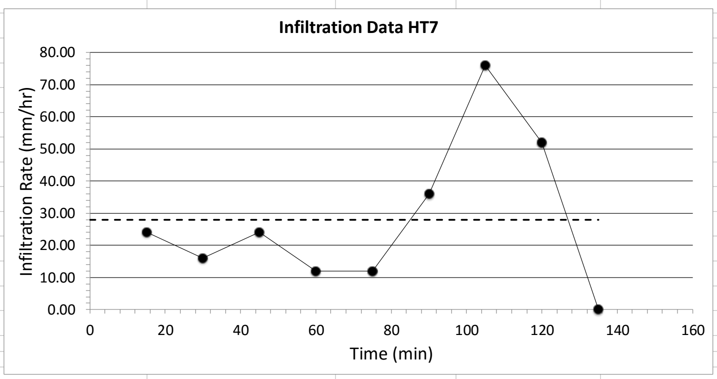
Double Ring Infiltrometer Test and Soil Moisture Measurements: <u>Heinz Terrace HT-5</u>

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				40.7	4.53		
Project Identification:	West Valley Demonstration Project	37.8					
Test Location:	HT-5	47.6					
Soil Type:	Clay	39.2					
Tested By:	CI, KR	42.8			Ring area (mm^2)	72966	
Date:	6/21/2016	36.3			Ring area (m^2)	0.072966	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	Infiltration Rate (mm/hr)	Infiltration Rate (m^3/yr)	
0	26.5						
10	26.4		0.1	1	6.00	3.84	
20	25.8		0.6	6	36.00	23.01	
30	25.2		0.6	6	36.00	23.01	
40	25		0.2	2	12.00	7.67	
50	25		0	0	0.00	0.00	
60	25		0	0	0.00	0.00	
70	25		0	0	0.00	0.00	
80	25		0	0	0.00	0.00	
90	25		0	0	0.00	0.00	
100	24.9		0.1	1	6.00	3.84	
110	24.8		0.1	1	6.00	3.84	
120	24.7		0.1	1	6.00	3.84	
130	24.7		0	0	0.00	0.00	
							STDev
				Average Infiltration Rate (mm/hr)		3.60	3.29
				Average Infiltration Rate (m^3/yr)		2.30	2.10
					Time (min)		
					0	3.6	
					130	3.6	



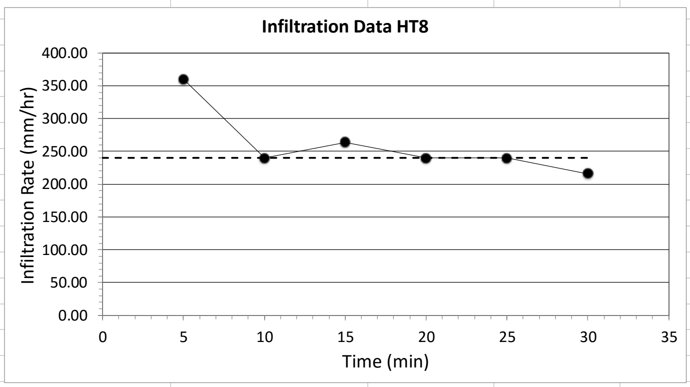
Double Ring Infiltrometer Test and Soil Moisture Measurements: <u>Heinz Terrace HT-7</u>

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev			
				41.2	1.63			
Project Identification:	West Valley Demonstration Project	42.9						
Test Location:	HT-7	42.1						
Soil Type:	Clay	39.4						
Tested By:	SB, JZ, CI, KR, CA	40.2			Ring area (mm^2)	72966		
Date:	6/15/2016				Ring area (m^2)	0.072966		
	Test done in reverse with ruler readings going high to low							
					Infiltration Rate	Infiltration Rate		
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	(mm/hr)	(m^3/yr)		
0	18.1							
15	17.5		0.6	6.0	24.00	15.34		
30	17.9	Topped 14	0.4	4.0	16.00	10.23		
45	14.6		0.6	6.0	24.00	15.34		
60	14.9		0.3	3.0	12.00	7.67		
75	15.2	Topped 10.5	0.3	3.0	12.00	7.67		
90	11.4		0.9	9.0	36.00	23.01		
105	13.3		1.9	19.0	76.00	48.58		
120	14.6		1.3	13.0	52.00	33.24		
135	14.6		0.0	0.0	0.00	0.00		
							STDev	
				Average Infiltration Rate (mm/hr)		28.00	23.49	
				Average Infiltration Rate (m^3/yr)		17.90	15.02	
					Time (min)			
					0	28		
					135	28		



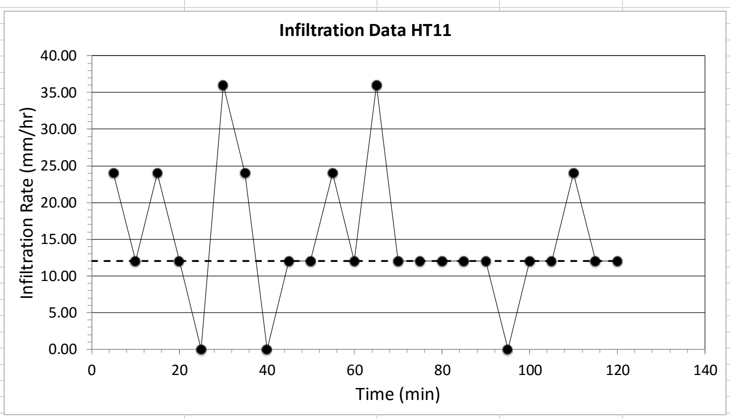
Double Ring Infiltrometer Test and Soil Moisture Measurements: Heinz Terrace HT-8

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				10.9	1.03		
Project Identification:	West Valley Demonstration Project	9.5					
Test Location:	HT-8	11.5					
Soil Type:	Gravel	12.1					
Tested By:	CI, KR	11			Ring area (mm^2)	72966	
Date:	6/21/2016	10.2			Ring area (m^2)	0.072966	
	Note: Test stopped due to drill						
					Infiltration Rate	Infiltration Rate	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	(mm/hr)	(m^3/yr)	
0	22						
5	19		3	30	360.00	230.11	
10	17	Topped 22	2	20	240.00	153.40	
15	19.8		2.2	22	264.00	168.74	
20	17.8		2	20	240.00	153.40	
25	15.8		2	20	240.00	153.40	
30	14		1.8	18	216.00	138.06	
							STDev
				Average Infiltration Rate (mm/hr)		240.00	16.97
				Average Infiltration Rate (m^3/yr)		153.40	10.85
					Time (min)		
					0	240	
					30	240	



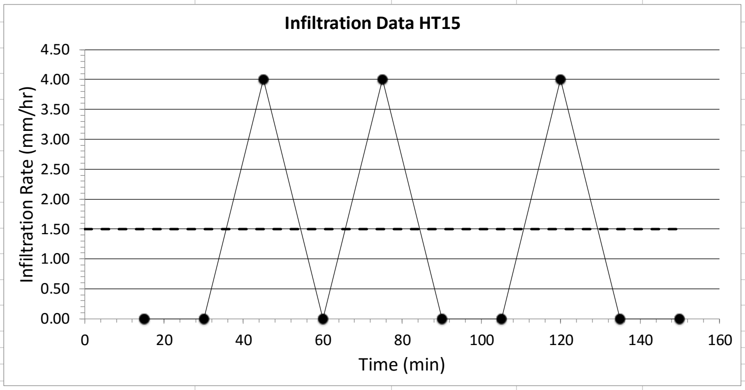
Double Ring Infiltrometer Test and Soil Moisture Measurements: <u>Heinz Terrace HT-11</u>

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				26.5	3.28		
Project Identification:	West Valley Demonstration Project	28.4					
Test Location:	HT-11	23.2					
Soil Type:	Sandy Clay	30.4					
Tested By:	CI, KR	23			Ring area (mm^2)	72966	
Date:	6/22/2016	27.5			Ring area (m^2)	0.072966	
					Infiltration Rate	Infiltration Rate	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	(mm/hr)	(m^3/yr)	
0	16						
5	15.8		0.2	2	24.00	15.34	
10	15.7		0.1	1	12.00	7.67	
15	15.5		0.2	2	24.00	15.34	
20	15.4		0.1	1	12.00	7.67	
25	15.4		0	0	0.00	0.00	
30	15.1		0.3	3	36.00	23.01	
35	14.9		0.2	2	24.00	15.34	
40	14.9		0	0	0.00	0.00	
45	14.8		0.1	1	12.00	7.67	
50	14.7		0.1	1	12.00	7.67	
55	14.5		0.2	2	24.00	15.34	
60	14.4		0.1	1	12.00	7.67	
65	14.1		0.3	3	36.00	23.01	
70	14		0.1	1	12.00	7.67	
75	13.9		0.1	1	12.00	7.67	
80	13.8		0.1	1	12.00	7.67	
85	13.7		0.1	1	12.00	7.67	
90	13.6		0.1	1	12.00	7.67	
95	13.6		0	0	0.00	0.00	
100	13.5		0.1	1	12.00	7.67	
105	13.4		0.1	1	12.00	7.67	
110	13.2		0.2	2	24.00	15.34	
115	13.1		0.1	1	12.00	7.67	
120	13		0.1	1	12.00	7.67	
							STDev
				Average Infiltration Rate (mm/hr)		12.00	5.37
				Average Infiltration Rate (m^3/yr)		7.67	3.43
					Time (min)		
					0	12	
					120	12	



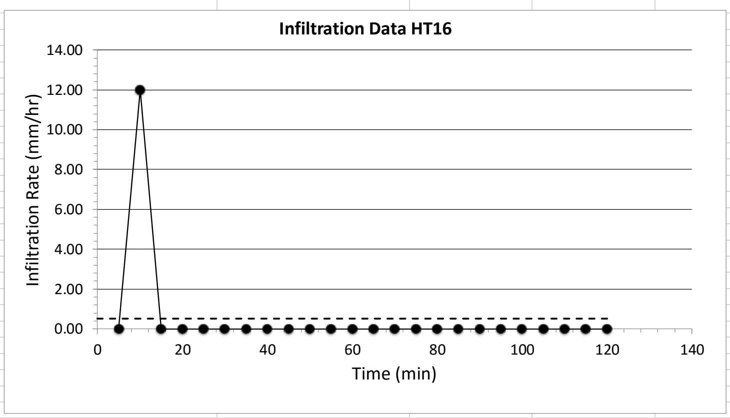
Double Ring Infiltrometer Test and Soil Moisture Measurements: <u>Heinz Terrace HT-15</u>

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				30.6	1.44		
Project Identification:	West Valley Demonstration Project	30.7					
Test Location:	HT-15	29.3					
Soil Type:	Clay	32.8					
Tested By:	CI	30.8			Ring area (mm^2)	72966	
Date:	6/27/2016	29.3			Ring area (m^2)	0.072966	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	Infiltration Rate (mm/hr)	Infiltration Rate (m^3/yr)	
0	21.2						
15	21.2		0	0	0.00	0.00	
30	21.2		0	0	0.00	0.00	
45	21.1		0.1	1	4.00	2.56	
60	21.1		0	0	0.00	0.00	
75	21		0.1	1	4.00	2.56	
90	21		0	0	0.00	0.00	
105	21		0	0	0.00	0.00	
120	20.9		0.1	1	4.00	2.56	
135	20.9		0	0	0.00	0.00	
150	20.9		0	0	0.00	0.00	
							STDev
				Average Infiltration Rate (mm/hr)		1.50	2.07
				Average Infiltration Rate (m^3/yr)		0.96	1.32
					Time (min)		
					0	1.5	
					150	1.5	



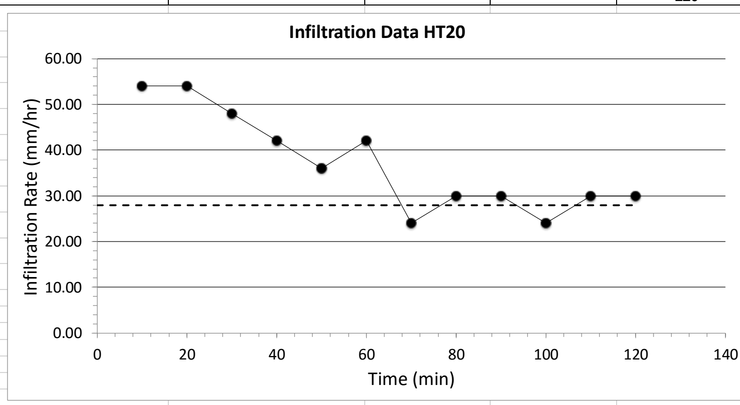
Double Ring Infiltrometer Test and Soil Moisture Measurements: <u>Heinz Terrace HT-16</u>

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				36.9	2.68		
Project Identification:	West Valley Demonstration Project	33.6					
Test Location:	HT-16	36.7					
Soil Type:	Clay	38.6					
Tested By:	CI,KR	35.3			Ring area (mm^2)	72966	
Date:	6/22/2016	40.4			Ring area (m^2)	0.072966	
					Infiltration Rate	Infiltration Rate	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	(mm/hr)	(m^3/yr)	
0	16						
5	16		0	0	0.00	0.00	
10	15.9		0.1	1	12.00	7.67	
15	15.9		0	0	0.00	0.00	
20	15.9		0	0	0.00	0.00	
25	15.9		0	0	0.00	0.00	
30	15.9		0	0	0.00	0.00	
35	15.9		0	0	0.00	0.00	
40	15.9		0	0	0.00	0.00	
45	15.9		0	0	0.00	0.00	
50	15.9		0	0	0.00	0.00	
55	15.9		0	0	0.00	0.00	
60	15.9		0	0	0.00	0.00	
65	15.9		0	0	0.00	0.00	
70	15.9		0	0	0.00	0.00	
75	15.9		0	0	0.00	0.00	
80	15.9		0	0	0.00	0.00	
85	15.9		0	0	0.00	0.00	
90	15.9		0	0	0.00	0.00	
95	15.9		0	0	0.00	0.00	
100	15.9		0	0	0.00	0.00	
105	15.9		0	0	0.00	0.00	
110	15.9		0	0	0.00	0.00	
115	15.9		0	0	0.00	0.00	
120	15.9		0	0	0.00	0.00	
							STDev
				Average Infiltration Rate (mm/hr)		0.50	2.45
				Average Infiltration Rate (m^3/yr)		0.32	1.57
					Time (min)		
					0	0.5	
					120	0.5	



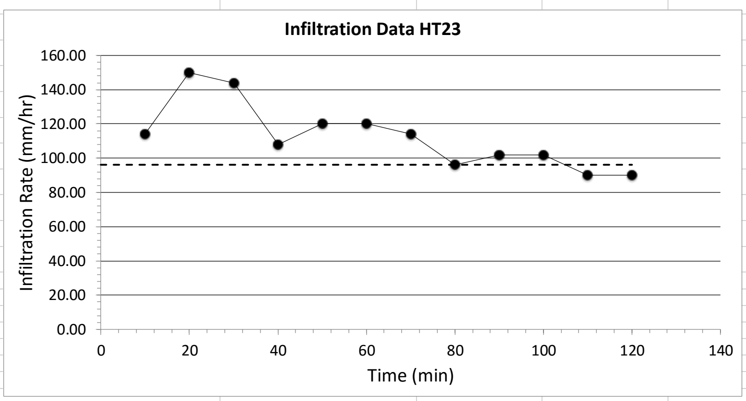
Double Ring Infiltrometer Test and Soil Moisture Measurements: <u>Heinz Terrace HT-20</u>

Double Ring Infiltrometer Test (12" & 24" Rings)		**Soil Moisture (%)**	**Average Soil Moisture (%)**		**StDev**		
				26.4	**3.02**		
Project Identification:	**West Valley Demonstration Project**	**30.4**					
Test Location:	**HT-20**	**28.8**					
Soil Type:		**24.4**					
Tested By:	**CI, JZ**	**24.9**			**Ring area (mm^2)**	**72966**	
Date:	**6/28/2016**	**23.5**			**Ring area (m^2)**	**0.072966**	
Elapsed Time (min)	**Inner Ring Reading (cm)**	**Topped (new start height)**	**Difference (cm)**	**Difference (mm)**	**Infiltration Rate (mm/hr)**	**Infiltration Rate (m^3/yr)**	
0	**25.6**						
10	**24.7**		**0.9**	**9**	**54.00**	**34.52**	
20	**23.8**		**0.9**	**9**	**54.00**	**34.52**	
30	**23**		**0.8**	**8**	**48.00**	**30.68**	
40	**22.3**		**0.7**	**7**	**42.00**	**26.85**	
50	**21.7**		**0.6**	**6**	**36.00**	**23.01**	
60	**21**		**0.7**	**7**	**42.00**	**26.85**	
70	**20.6**		**0.4**	**4**	**24.00**	**15.34**	
80	**20.1**		**0.5**	**5**	**30.00**	**19.18**	
90	**19.6**		**0.5**	**5**	**30.00**	**19.18**	
100	**19.2**		**0.4**	**4**	**24.00**	**15.34**	
110	**18.7**		**0.5**	**5**	**30.00**	**19.18**	
120	**18.2**		**0.5**	**5**	**30.00**	**19.18**	
							STDev
				Average Infiltration Rate (mm/hr)		**28.00**	**3.10**
				Average Infiltration Rate (m^3/yr)		**17.90**	**1.98**
					Time (min)		
					0	**28**	
					120	**28**	



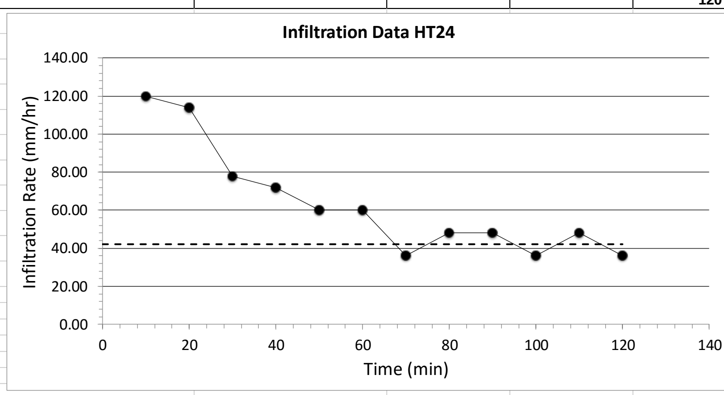
Double Ring Infiltrometer Test and Soil Moisture Measurements: <u>Heinz Terrace HT-23</u>

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				18.2	3.29		
Project Identification:	West Valley Demonstration Project	19.6					
Test Location:	HT-23	14.1					
Soil Type:		17.9					
Tested By:	CI	16.3			Ring area (mm^2)	72966	
Date:	6/27/2016	17.7			Ring area (m^2)	0.072966	
		23.8					
					Infiltration Rate	Infiltration Rate	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	(mm/hr)	(m^3/yr)	
0	23						
10	21.1	Topped 24.5	1.9	19	114.00	72.87	
20	22	Topped 24.0	2.5	25	150.00	95.88	
30	21.6	Topped 25.0	2.4	24	144.00	92.04	
40	23.2	Topped 25.0	1.8	18	108.00	69.03	
50	23	Topped 25.5	2	20	120.00	76.70	
60	23.5	Topped 26.0	2	20	120.00	76.70	
70	24.1	Topped 29.1	1.9	19	114.00	72.87	
80	27.5	Topped 28.3	1.6	16	96.00	61.36	
90	26.6	Topped 28.2	1.7	17	102.00	65.20	
100	26.5	Topped 28.2	1.7	17	102.00	65.20	
110	26.7	Topped 28.0	1.5	15	90.00	57.53	
120	26.5		1.5	15	90.00	57.53	
							STDev
				Average Infiltration Rate (mm/hr)		96.00	6.00
				Average Infiltration Rate (m^3/yr)		61.36	3.84
					Time (min)		
					0	96	
					120	96	



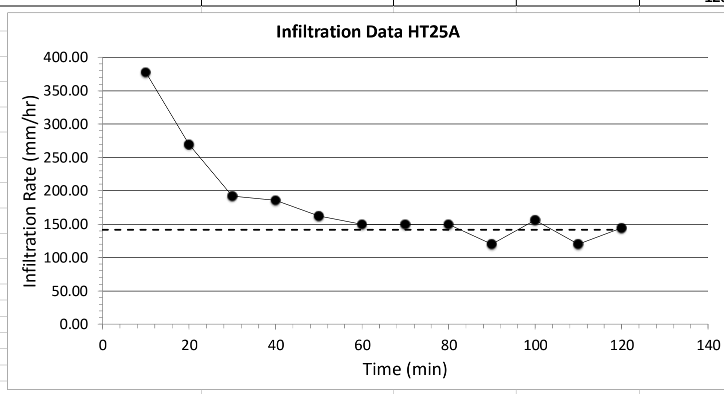
Double Ring Infiltrometer Test and Soil Moisture Measurements: <u>Heinz Terrace HT-24</u>

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				18.6	5.12		
Project Identification:	West Valley Demonstration Project	20.9					
Test Location:	HT-24	13.9					
Soil Type:		21.8					
Tested By:	CI, JZ	10.4			Ring area (mm^2)	72966	
Date:	6/29/2016	22.8			Ring area (m^2)	0.072966	
		21.5					
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	Infiltration Rate (mm/hr)	Infiltration Rate (m^3/yr)	
0	24						
10	22	Topped 24	2	20	120.00	76.70	
20	23.1		1.9	19	114.00	72.87	
30	21.8		1.3	13	78.00	49.86	
40	20.6		1.2	12	72.00	46.02	
50	19.6		1	10	60.00	38.35	
60	18.6		1	10	60.00	38.35	
70	18		0.6	6	36.00	23.01	
80	17.2		0.8	8	48.00	30.68	
90	16.4		0.8	8	48.00	30.68	
100	15.8		0.6	6	36.00	23.01	
110	15		0.8	8	48.00	30.68	
120	14.4		0.6	6	36.00	23.01	
							STDev
				Average Infiltration Rate (mm/hr)		42.00	6.57
				Average Infiltration Rate (m^3/yr)		26.85	4.20
					Time (min)		
					0	42	
					120	42	



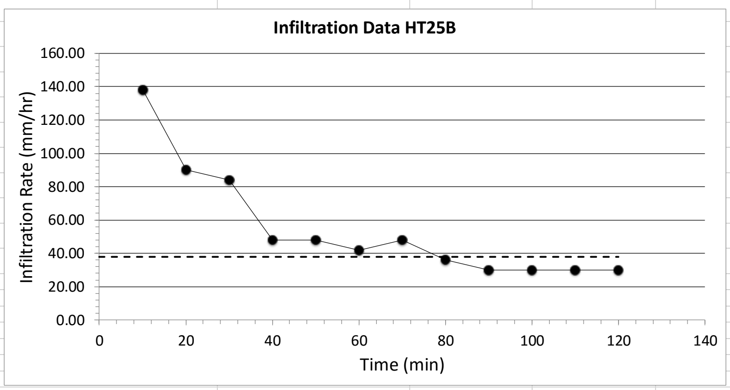
Double Ring Infiltrometer Test and Soil Moisture Measurements: <u>Heinz Terrace HT-25A</u>

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				5.5	1.29		
Project Identification:	West Valley Demonstration Project	3.5					
Test Location:	HT-25A	6.8					
Soil Type:		6.4					
Tested By:	JZ, CI	5.1			Ring area (mm^2)	72966	
Date:	6/29/2016	5.7			Ring area (m^2)	0.072966	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	Infiltration Rate (mm/hr)	Infiltration Rate (m^3/yr)	
0	25						
10	18.7	Topped 25.3	6.3	63	378.00	241.61	
20	20.8	Topped 28	4.5	45	270.00	172.58	
30	24.8		3.2	32	192.00	122.72	
40	21.7		3.1	31	186.00	118.89	
50	19	Topped 25	2.7	27	162.00	103.55	
60	22.5		2.5	25	150.00	95.88	
70	20		2.5	25	150.00	95.88	
80	17.5	Topped 25	2.5	25	150.00	95.88	
90	23		2	20	120.00	76.70	
100	20.4		2.6	26	156.00	99.71	
110	18.4		2	20	120.00	76.70	
120	16		2.4	24	144.00	92.04	
							STDev
				Average Infiltration Rate (mm/hr)		141.43	15.04
				Average Infiltration Rate (m^3/yr)		90.40	9.62
					Time (min)		
					0	141.43	
					120	141.43	



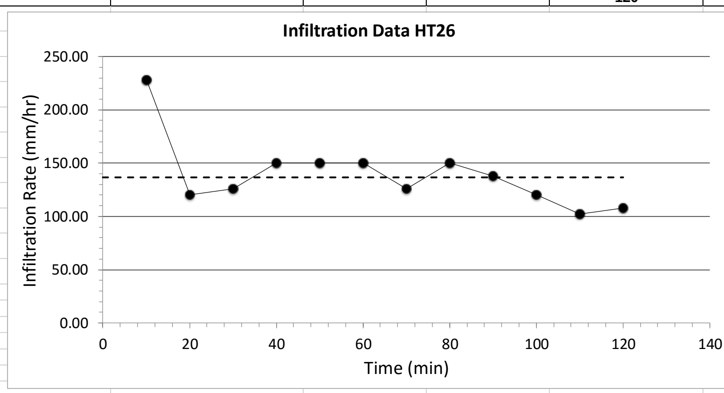
Double Ring Infiltrometer Test and Soil Moisture Measurements: Heinz Terrace HT-25B

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				9.6	2.58		
Project Identification:	West Valley Demonstration Project	14.5					
Test Location:	HT-25B	9.9					
Soil Type:		8.8					
Tested By:	CI, JZ	7.1			Ring area (mm^2)	72966	
Date:	6/30/2016	9.4			Ring area (m^2)	0.072966	
		8.1					
					Infiltration Rate	Infiltration Rate	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	(mm/hr)	(m^3/yr)	
0	28						
10	25.7	Topped 28	2.3	23	138.00	88.21	
20	26.5		1.5	15	90.00	57.53	
30	25.1		1.4	14	84.00	53.69	
40	24.3		0.8	8	48.00	30.68	
50	23.5		0.8	8	48.00	30.68	
60	22.8		0.7	7	42.00	26.85	
70	22		0.8	8	48.00	30.68	
80	21.4		0.6	6	36.00	23.01	
90	20.9		0.5	5	30.00	19.18	
100	20.4		0.5	5	30.00	19.18	
110	19.9		0.5	5	30.00	19.18	
120	18.4		0.5	5	30.00	19.18	
							STDev
				Average Infiltration Rate (mm/hr)		38.00	8.49
				Average Infiltration Rate (m^3/yr)		24.29	5.42
					Time (min)		
					0	38	
					120	38	



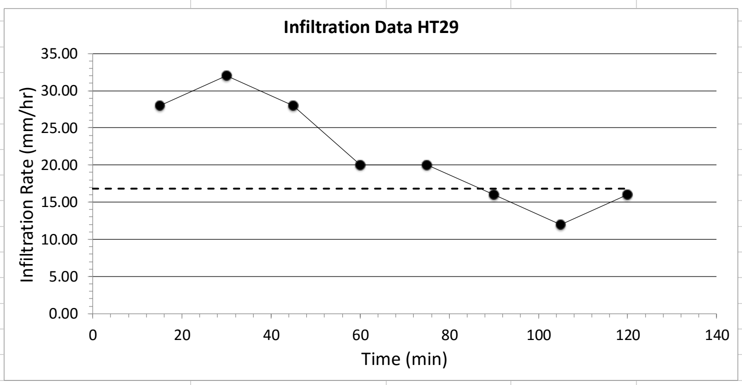
Double Ring Infiltrometer Test and Soil Moisture Measurements: <u>Heinz Terrace HT-26</u>

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				13.1	6.51		
Project Identification:	West Valley Demonstration Project	24.4					
Test Location:	HT-26	8.9					
Soil Type:		8.4					
Tested By:	CI, JZ	9.6			Ring area (mm^2)	72966	
Date:	6/29/2016	9.5			Ring area (m^2)	0.072966	
		17.5					
					Infiltration Rate	Infiltration Rate	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	(mm/hr)	(m^3/yr)	
0	27.5						
10	23.7	Topped 27.5	3.8	38	228.00	145.73	
20	25.5	Topped 26.5	2	20	120.00	76.70	
30	24.4	Topped 29	2.1	21	126.00	80.54	
40	26.5	Topped 28	2.5	25	150.00	95.88	
50	25.5		2.5	25	150.00	95.88	
60	23	Topped 27	2.5	25	150.00	95.88	
70	24.9	Topped 27.5	2.1	21	126.00	80.54	
80	25	Topped 27	2.5	25	150.00	95.88	
90	24.7		2.3	23	138.00	88.21	
100	22.7		2	20	120.00	76.70	
110	21		1.7	17	102.00	65.20	
120	19.2		1.8	18	108.00	69.03	
							STDev
				Average Infiltration Rate (mm/hr)		136.67	13.67
				Average Infiltration Rate (m^3/yr)		87.35	8.74
					Time (min)		
					0	136.67	
					120	136.67	



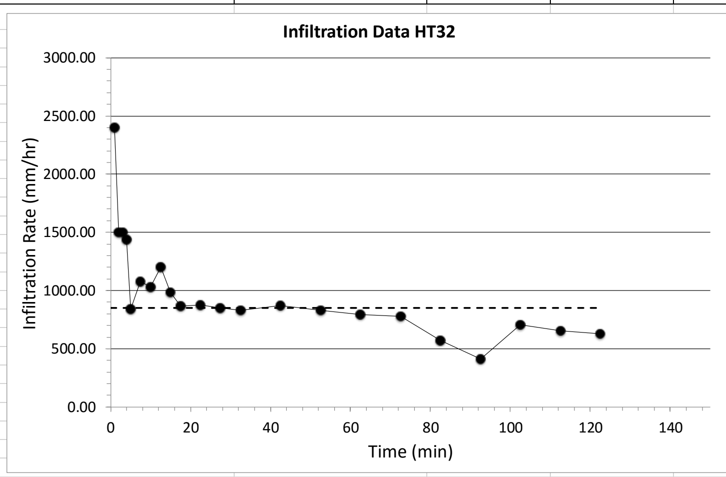
Double Ring Infiltrometer Test and Soil Moisture Measurements: <u>Heinz Terrace HT-29</u>

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				17.1	4.53		
Project Identification:	West Valley Demonstration Project	14.1					
Test Location:	HT-29	14.2					
Soil Type:		14.8					
Tested By:	CI, JZ	24.8			Ring area (mm^2)	72966	
Date:	6/28/2016	17.4			Ring area (m^2)	0.072966	
					Infiltration Rate	Infiltration Rate	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	(mm/hr)	(m^3/yr)	
0	28.2						
15	27.5		0.7	7	28.00	17.90	
30	26.7		0.8	8	32.00	20.45	
45	26		0.7	7	28.00	17.90	
60	25.5		0.5	5	20.00	12.78	
75	25		0.5	5	20.00	12.78	
90	24.6		0.4	4	16.00	10.23	
105	24.3		0.3	3	12.00	7.67	
120	23.9		0.4	4	16.00	10.23	
							STDev
				Average Infiltration Rate (mm/hr)		16.80	3.35
				Average Infiltration Rate (m^3/yr)		10.74	2.14
					Time (min)		
					0	16.8	
					120	16.8	



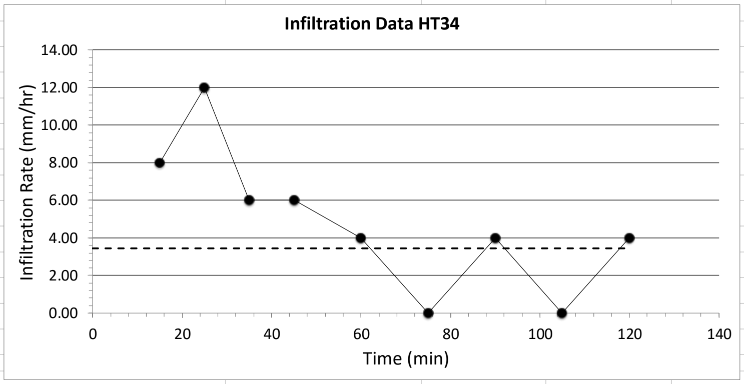
Double Ring Infiltrometer Test and Soil Moisture Measurements: <u>Heinz Terrace HT-32</u>

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				3.0	0.37		
Project Identification:	West Valley Demonstration Project	3.5					
Test Location:	HT-32	3.1					
Soil Type:		3.1					
Tested By:	CI, JZ	2.8			Ring area (mm^2)	72966	
Date:	6/30/2016	2.5			Ring area (m^2)	0.072966	
					Infiltration Rate	Infiltration Rate	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	(mm/hr)	(m^3/yr)	
0	18.7						
1	14.7	Topped 19	4	40	2400.00	1534.04	
2	16.5	Topped 20	2.5	25	1500.00	958.77	
3	17.5		2.5	25	1500.00	958.77	
4	15.1	Topped 20	2.4	24	1440.00	920.42	
5	18.6		1.4	14	840.00	536.91	
7.5	14.1	Topped 20	4.5	45	1080.00	690.32	
10	15.7	Topped 20	4.3	43	1032.00	659.64	
12.5	15	Topped 20	5	50	1200.00	767.02	
15	15.9	Topped 20	4.1	41	984.00	628.96	
17.5	16.4	Topped 20.2	3.6	36	864.00	552.25	
22.5	12.9	Topped 20.1	7.3	73	876.00	559.92	
27.5	13	Topped 20.4	7.1	71	852.00	544.58	
32.5	13.5	Topped 25.1	6.9	69	828.00	529.24	
42.5	10.6	Topped 25.3	14.5	145	870.00	556.09	
52.5	11.5	Topped 25.2	13.8	138	828.00	529.24	
62.5	12	Topped 25	13.2	132	792.00	506.23	
72.5	12	Topped 24.4	13	130	780.00	498.56	
82.5	14.9		9.5	95	570.00	364.33	
92.5	8	Topped 20.7	6.9	69	414.00	264.62	
102.5	8.9	Topped 18.2	11.8	118	708.00	452.54	
112.5	7.3	Topped 20.3	10.9	109	654.00	418.03	
122.5	9.8		10.5	105	630.00	402.68	
							STDev
				Average Infiltration Rate (mm/hr)		852.67	59.58
				Average Infiltration Rate (m^3/yr)		545.01	38.08
					Time (min)		
					0	852.67	
					122.5	852.67	



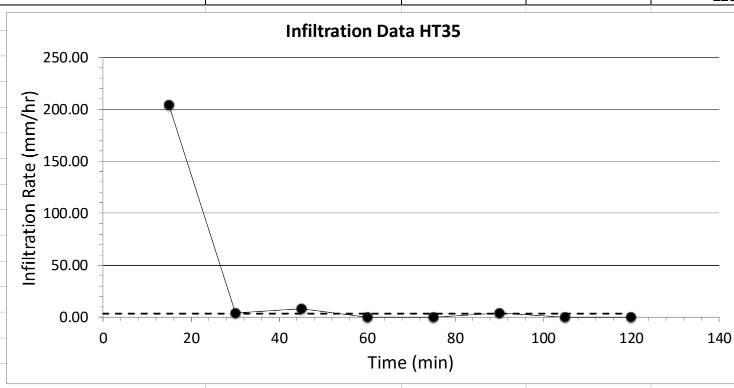
Double Ring Infiltrometer Test and Soil Moisture Measurements: Heinz Terrace HT-34

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				11.5	2.12		
Project Identification:	West Valley Demonstration Project	15.2					
Test Location:	HT-34	9.9					
Soil Type:		10.9					
Tested By:	KR, CA	10.9			Ring area (mm^2)	72966	
Date:	7/5/2016	10.5			Ring area (m^2)	0.072966	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	Infiltration Rate (mm/hr)	Infiltration Rate (m^3/yr)	
0	25						
15	24.8		0.2	2	8.00	5.11	
25	24.6		0.2	2	12.00	7.67	
35	24.5		0.1	1	6.00	3.84	
45	24.4		0.1	1	6.00	3.84	
60	24.3		0.1	1	4.00	2.56	
75	24.3		0	0	0.00	0.00	
90	24.2		0.1	1	4.00	2.56	
105	24.2		0	0	0.00	0.00	
120	24.1		0.1	1	4.00	2.56	
							STDev
				Average Infiltration Rate (mm/hr)		3.43	2.51
				Average Infiltration Rate (m^3/yr)		2.19	1.60
					Time (min)		
					0	3.43	
					120	3.43	



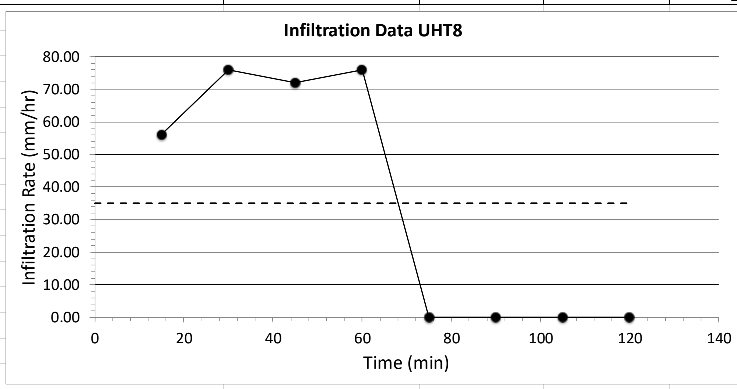
Double Ring Infiltrometer Test and Soil Moisture Measurements: Heinz Terrace HT-35

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				16.1	1.70		
Project Identification:	West Valley Demonstration Project	17.2					
Test Location:	HT-35	18.3					
Soil Type:		14.9					
Tested By:	KR, CA	15.9			Ring area (mm^2)	72966	
Date:	7/5/2016	14.1			Ring area (m^2)	0.072966	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	Infiltration Rate (mm/hr)	Infiltration Rate (m^3/yr)	
0	26.9						
15	21.8		5.1	51	204.00	130.39	
30	21.7		0.1	1	4.00	2.56	
45	21.5		0.2	2	8.00	5.11	
60	21.5		0	0	0.00	0.00	
75	21.5		0	0	0.00	0.00	
90	21.4		0.1	1	4.00	2.56	
105	21.4		0	0	0.00	0.00	
120	21.4		0	0	0.00	0.00	
							STDev
				Average Infiltration Rate (mm/hr)		3.20	3.35
				Average Infiltration Rate (m^3/yr)		2.05	2.14
					Time (min)		
					0	3.2	
					120	3.2	



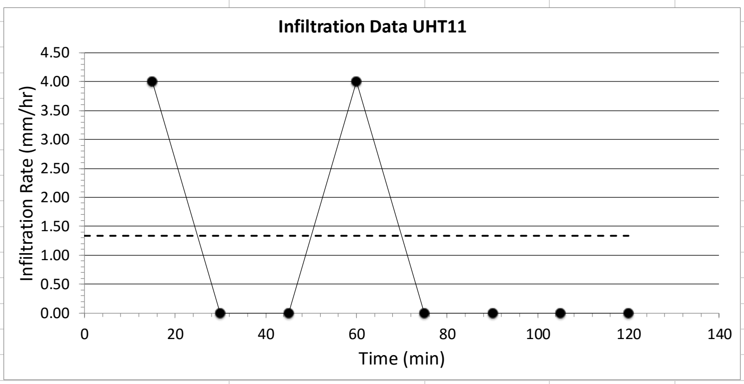
Double Ring Infiltrometer Test and Soil Moisture Measurements: Upper Heinz Terrace UHT-8

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				19.1	5.69		
Project Identification:	West Valley Demonstration Project	9.7					
Test Location:	UHT-8	22.1					
Soil Type:		18.5					
Tested By:	CI, KR, CA	21			Ring area (mm^2)	72966	
Date:	7/11/2016	24.4			Ring area (m^2)	0.072966	
					Infiltration Rate	Infiltration Rate	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	(mm/hr)	(m^3/yr)	
0	22						
15	20.6		1.4	14	56.00	35.79	
30	18.7	Topped 23.5	1.9	19	76.00	48.58	
45	21.7		1.8	18	72.00	46.02	
60	19.8		1.9	19	76.00	48.58	
75	19.8		0	0	0.00	0.00	
90	19.8		0	0	0.00	0.00	
105	19.8		0	0	0.00	0.00	
120	19.8		0	0	0.00	0.00	
							STDev
				Average Infiltration Rate (mm/hr)		35.00	37.93
				Average Infiltration Rate (m^3/yr)		22.37	24.25
					Time (min)		
					0	35	
					120	35	



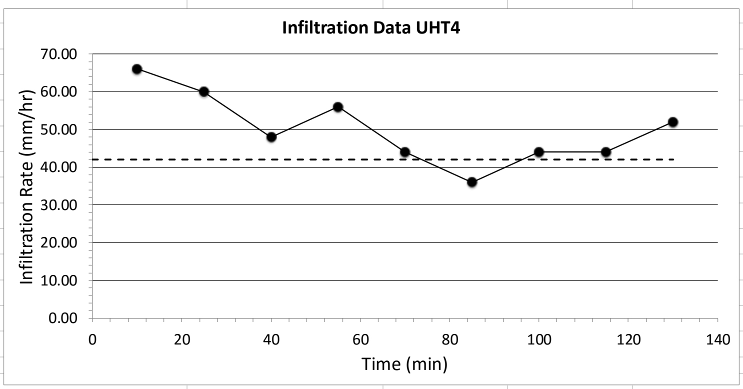
Double Ring Infiltrometer Test and Soil Moisture Measurements: Upper Heinz Terrace UHT-11

Double Ring Infiltrometer Test (12" & 24" Rings)		**Soil Moisture (%)**	**Average Soil Moisture (%)**		**StDev**		
				21.4	**4.86**		
Project Identification:	**West Valley Demonstration Project**	**25.8**					
Test Location:	**UHT-11**	**25.5**					
Soil Type:		**16.9**					
Tested By:	**CI, JZ**	**15.5**			**Ring area (mm^2)**	**72966**	
Date:	**7/6/2016**	**23.2**			**Ring area (m^2)**	**0.072966**	
					Infiltration Rate	**Infiltration Rate**	
Elapsed Time (min)	**Inner Ring Reading (cm)**	**Topped (new start height)**	**Difference (cm)**	**Difference (mm)**	**(mm/hr)**	**(m^3/yr)**	
0	**24.6**						
15	**24.5**		**0.1**	**1**	**4.00**	**2.56**	
30	**24.5**		**0**	**0**	**0.00**	**0.00**	
45	**24.5**		**0**	**0**	**0.00**	**0.00**	
60	**24.4**		**0.1**	**1**	**4.00**	**2.56**	
75	**24.4**		**0**	**0**	**0.00**	**0.00**	
90	**24.4**		**0**	**0**	**0.00**	**0.00**	
105	**24.4**		**0**	**0**	**0.00**	**0.00**	
120	**24.4**		**0**	**0**	**0.00**	**0.00**	
							STDev
				Average Infiltration Rate (mm/hr)		**1.33**	**2.07**
				Average Infiltration Rate (m^3/yr)		**0.85**	**1.32**
					Time (min)		
					0	**1.33**	
					120	**1.33**	



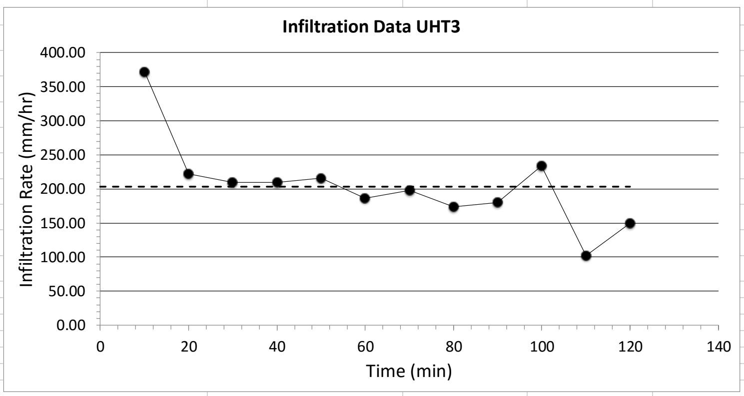
Double Ring Infiltrometer Test and Soil Moisture Measurements: Upper Heinz Terrace UHT-4

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				10.3	2.39		
Project Identification:	West Valley Demonstration Project	10.2					
Test Location:	UHT-4	13.4					
Soil Type:		6.7					
Tested By:	CI, JZ	10.7			Ring area (mm^2)	72966	
Date:	7/7/2016	10.7			Ring area (m^2)	0.072966	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	Infiltration Rate (mm/hr)	Infiltration Rate (m^3/yr)	
0	19.5						
10	18.4		1.1	11	66.00	42.19	
25	16.9		1.5	15	60.00	38.35	
40	15.7		1.2	12	48.00	30.68	
55	14.3		1.4	14	56.00	35.79	
70	13.2	Topped 18.4	1.1	11	44.00	28.12	
85	17.5		0.9	9	36.00	23.01	
100	16.4		1.1	11	44.00	28.12	
115	15.3		1.1	11	44.00	28.12	
130	14		1.3	13	52.00	33.24	
							STDev
				Average Infiltration Rate (mm/hr)		42.00	4.00
				Average Infiltration Rate (m^3/yr)		26.85	2.56
					Time (min)		
					0	42	
					130	42	



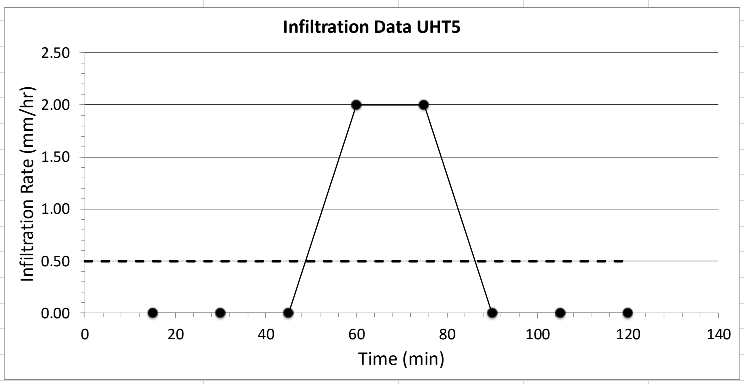
Double Ring Infiltrometer Test and Soil Moisture Measurements: Upper Heinz Terrace UHT-3

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				2.2	0.50		
Project Identification:	West Valley Demonstration Project	2.6					
Test Location:	UHT-3	1.5					
Soil Type:		1.8					
Tested By:	KR, CA	2.5			Ring area (mm^2)	72966	
Date:	7/7/2016	2.5			Ring area (m^2)	0.072966	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	Infiltration Rate (mm/hr)	Infiltration Rate (m^3/yr)	
0	17.3						
10	11.1	Topped 17.8	6.2	62	372.00	237.78	
20	14.1	Topped 17.5	3.7	37	222.00	141.90	
30	13	Topped 18	3.5	35	210.00	134.23	
40	14.5	Topped 17	3.5	35	210.00	134.23	
50	13.4	Topped 18.5	3.6	36	216.00	138.06	
60	15.4	Topped 19.2	3.1	31	186.00	118.89	
70	15.9	Topped 17.9	3.3	33	198.00	126.56	
80	15	Topped 17	2.9	29	174.00	111.22	
90	14	Topped 16.6	3	30	180.00	115.05	
100	12.7		3.9	39	234.00	149.57	
110	11		1.7	17	102.00	65.20	
120	8.5		2.5	25	150.00	95.88	
							STDev
				Average Infiltration Rate (mm/hr)		203.33	20.22
				Average Infiltration Rate (m^3/yr)		129.97	12.93
					Time (min)		
					0	203.33	
					120	203.33	



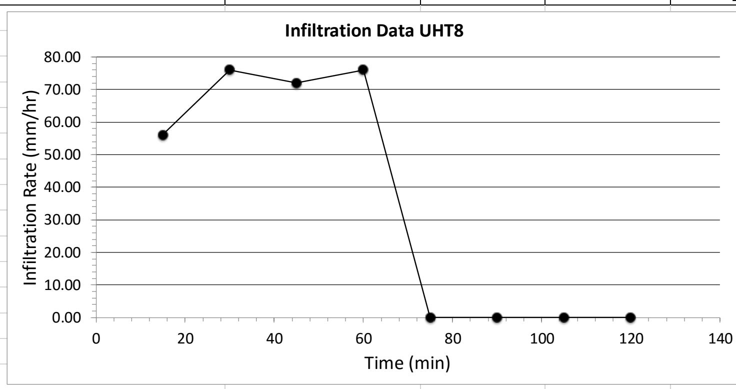
Double Ring Infiltrometer Test and Soil Moisture Measurements: Upper Heinz Terrace UHT-5

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				8.4	2.48		
Project Identification:	West Valley Demonstration Project	4.6					
Test Location:	UHT-5	8.6					
Soil Type:		10.6					
Tested By:	CI, KR, CA	10.6			Ring area (mm^2)	72966	
Date:	7/11/2016	7.7			Ring area (m^2)	0.072966	
					Infiltration Rate	Infiltration Rate	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	(mm/hr)	(m^3/yr)	
0	23						
15	23		0	0.00	0.00	0.00	
30	23		0	0.00	0.00	0.00	
45	23		0	0.00	0.00	0.00	
60	22.95		0.05	0.50	2.00	1.28	
75	22.9		0.05	0.50	2.00	1.28	
90	22.9		0	0.00	0.00	0.00	
105	22.9		0	0.00	0.00	0.00	
120	22.9		0	0.00	0.00	0.00	
							STDev
				Average Infiltration Rate (mm/hr)		0.50	0.93
				Average Infiltration Rate (m^3/yr)		0.32	0.59
					Time (min)		
					0	0.5	
					120	0.5	



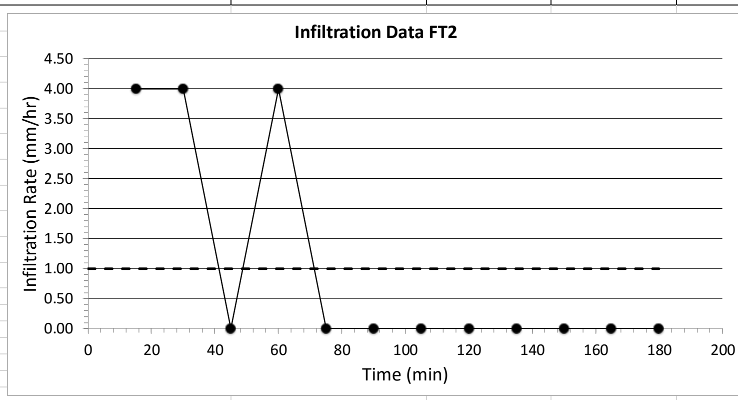
Double Ring Infiltrometer Test and Soil Moisture Measurements: Upper Heinz Terrace UHT-8

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				19.1	5.69		
Project Identification:	West Valley Demonstration Project	9.7					
Test Location:	UHT-8	22.1					
Soil Type:		18.5					
Tested By:	CI, KR, CA	21			Ring area (mm^2)	72966	
Date:	7/11/2016	24.4			Ring area (m^2)	0.072966	
					Infiltration Rate	Infiltration Rate	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	(mm/hr)	(m^3/yr)	
0	22						
15	20.6		1.4	14	56.00	35.79	
30	18.7	Topped 23.5	1.9	19	76.00	48.58	
45	21.7		1.8	18	72.00	46.02	
60	19.8		1.9	19	76.00	48.58	
75	19.8		0	0	0.00	0.00	
90	19.8		0	0	0.00	0.00	
105	19.8		0	0	0.00	0.00	
120	19.8		0	0	0.00	0.00	
							STDev
				Average Infiltration Rate (mm/hr)			
				Average Infiltration Rate (m^3/yr)			
					Time (min)		
					0		
					120		



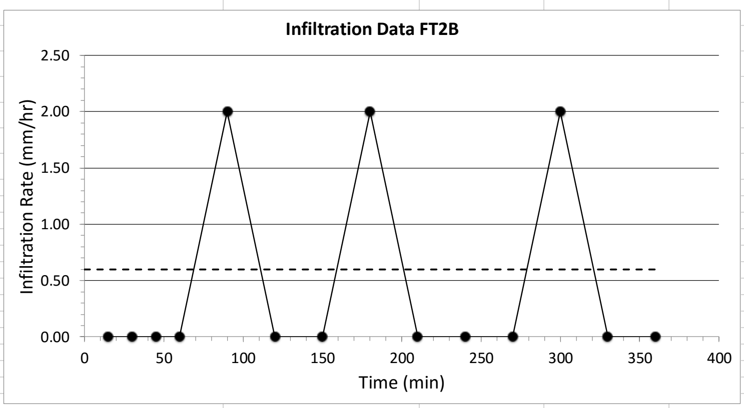
Double Ring Infiltrometer Test and Soil Moisture Measurements: Tree Farm FT-2

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				23.9	1.80		
Project Identification:	West Valley Demonstration Project 2	26.7					
Test Location:	FT-2	22.2					
Soil Type:		24.5					
Tested By:	CI, CA	22.8			Ring area (mm^2)	72966	
Date:	7/14/2016	23.1			Ring area (m^2)	0.072966	
					Infiltration Rate	Infiltration Rate	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	(mm/hr)	(m^3/yr)	
0	22.2						
15	22.1		0.1	1	4.00	2.56	
30	22		0.1	1	4.00	2.56	
45	22		0	0	0.00	0.00	
60	21.9		0.1	1	4.00	2.56	
75	21.9		0	0	0.00	0.00	
90	21.9		0	0	0.00	0.00	
105	21.9		0	0	0.00	0.00	
120	21.9		0	0	0.00	0.00	
135	21.9		0	0	0.00	0.00	
150	21.9		0	0	0.00	0.00	
165	21.9		0	0	0.00	0.00	
180	21.9		0	0	0.00	0.00	
							STDev
				Average Infiltration Rate (mm/hr)		1.00	1.81
				Average Infiltration Rate (m^3/yr)		0.64	1.16
					Time (min)		
					0	1	
					180	1	



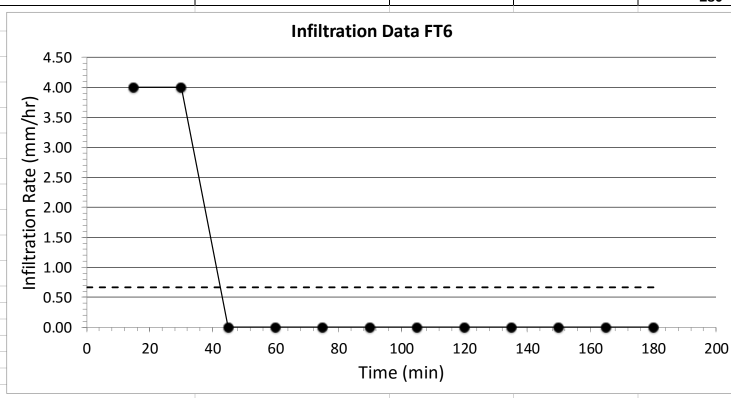
Double Ring Infiltrometer Test and Soil Moisture Measurements: Tree Farm FT-2B

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				26.2	2.38		
Project Identification:		26.6					
Test Location:	FT-2	27.5					
Soil Type:		23.6					
Tested By:	JZ	29.3			Ring area (mm^2)	72966	
Date:	7/26/2016	24.1			Ring area (m^2)	0.072966	
Note:	Re-test of FT-2						
					Infiltration Rate	Infiltration Rate	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	(mm/hr)	(m^3/yr)	
0	23.7						
15	23.7		0	0	0.00	0.00	
30	23.7		0	0	0.00	0.00	
45	23.7		0	0	0.00	0.00	
60	23.7		0	0	0.00	0.00	
90	23.6		0.1	1	2.00	1.28	
120	23.6		0	0	0.00	0.00	
150	23.6		0	0	0.00	0.00	
180	23.5		0.1	1	2.00	1.28	
210	23.5		0	0	0.00	0.00	
240	23.5		0	0	0.00	0.00	
270	23.5		0	0	0.00	0.00	
300	23.4		0.1	1	2.00	1.28	
330	23.4		0	0	0.00	0.00	
360	23.4		0	0	0.00	0.00	
							STDev
				Average Infiltration Rate (mm/hr)		0.60	0.97
				Average Infiltration Rate (m^3/yr)		0.38	0.62
					Time (min)		
					0	0.60	
					360	0.60	



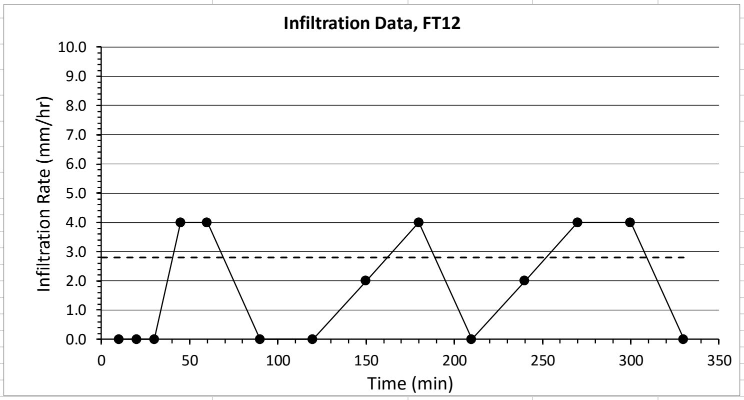
Double Ring Infiltrometer Test and Soil Moisture Measurements: Tree Farm FT-6

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				27.7	4.77		
Project Identification:	West Valley Demonstration Project 2	29.1					
Test Location:	FT-6	27.9					
Soil Type:		19.8					
Tested By:	CI, CA	28.9			Ring area (mm^2)	72966	
Date:	7/14/2016	32.7			Ring area (m^2)	0.072966	
					Infiltration Rate	Infiltration Rate	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	(mm/hr)	(m^3/yr)	
0	26.1						
15	26		0.1	1	4.00	2.56	
30	25.9		0.1	1	4.00	2.56	
45	25.9		0	0	0.00	0.00	
60	25.9		0	0	0.00	0.00	
75	25.9		0	0	0.00	0.00	
90	25.9		0	0	0.00	0.00	
105	25.9		0	0	0.00	0.00	
120	25.9		0	0	0.00	0.00	
135	25.9		0	0	0.00	0.00	
150	25.9		0	0	0.00	0.00	
165	25.9		0	0	0.00	0.00	
180	25.9		0	0	0.00	0.00	
							STDev
				Average Infiltration Rate (mm/hr)		0.67	1.56
				Average Infiltration Rate (m^3/yr)		0.43	1.00
					Time (min)		
					0	0.67	
					180	0.67	



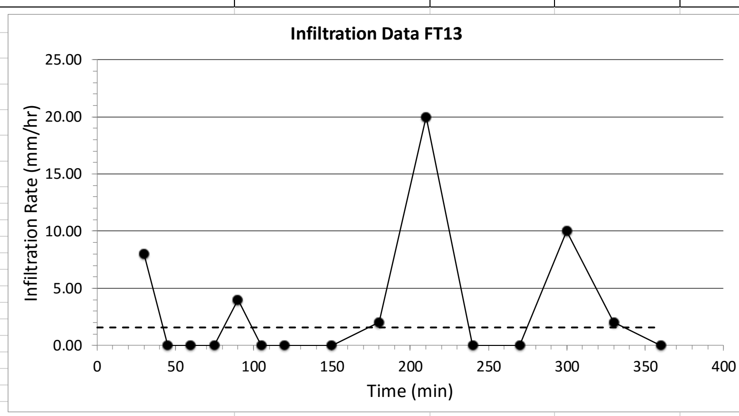
Double Ring Infiltrometer Test and Soil Moisture Measurements: Tree Farm FT-12

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				16.4	3.14		
Project Identification:	West Valley Demonstration Project	18.3					
Test Location:	FT-12	19.5					
Soil Type:		12.4					
Tested By:	JZ, KR	18.1			Ring area (mm^2)	72966	
Date:	7/18/2016	13.7			Ring area (m^2)	0.072966	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	Infiltration Rate (mm/hr)	Infiltration Rate (m^3/yr)	
0	20						
10	20		0	0	0.00	0.00	
20	20		0	0	0.00	0.00	
30	20		0	0	0.00	0.00	
45	19.9		0.1	1	4.00	2.56	
60	19.8		0.1	1	4.00	2.56	
90	19.8		0	0	0.00	0.00	
120	19.8		0	0	0.00	0.00	
150	19.7		0.1	1	2.00	1.28	
180	19.5		0.2	2	4.00	2.56	
210	19.5		0	0	0.00	0.00	
240	19.4		0.1	1	2.00	1.28	
270	19.2		0.2	2	4.00	2.56	
300	19		0.2	2	4.00	2.56	
330	19		0	0	0.00	0.00	
960	17		2	20	1.90	1.22	
							STDev
				Average Infiltration Rate (mm/hr)		2.80	1.79
				Average Infiltration Rate (m^3/yr)		1.79	1.14
					Time (min)		
					0	2.8	
					330	2.8	



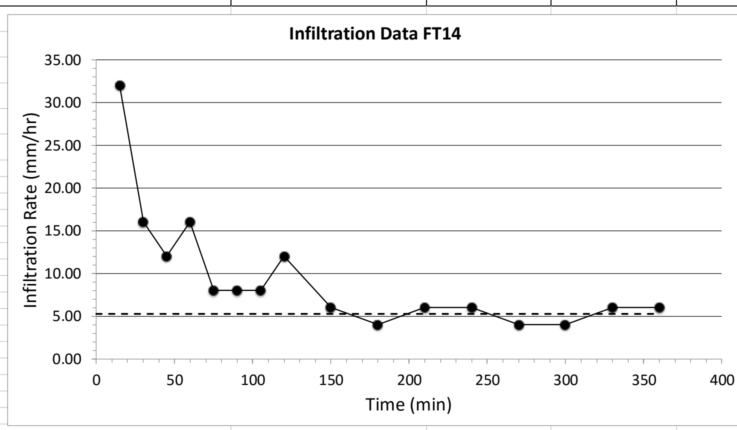
Double Ring Infiltrometer Test and Soil Moisture Measurements: Tree Farm FT-13

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				24.8	2.26		
Project Identification:	West Valley Demonstration Project	26.9					
Test Location:	FT-13	27.6					
Soil Type:		23.7					
Tested By:	JZ, CA	22.7			Ring area (mm^2)	72966	
Date:	7/27/2016	23.2			Ring area (m^2)	0.072966	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	Infiltration Rate (mm/hr)	Infiltration Rate (m^3/yr)	
0	19.5						
15	19		0.5	5		0.00	
30	18.8		0.2	2	8.00	5.11	
45	18.8		0	0	0.00	0.00	
60	18.8	Topped 19.5	0	0	0.00	0.00	
75	19.5		0	0	0.00	0.00	
90	19.4		0.1	1	4.00	2.56	
105	19.4		0	0	0.00	0.00	
120	19.4		0	0	0.00	0.00	
150	19.4		0	0	0.00	0.00	
180	19.3		0.1	1	2.00	1.28	
210	18.3		1	10	20.00	12.78	
240	18.3		0	0	0.00	0.00	
270	18.3		0	0	0.00	0.00	
300	17.6		0.5	5	10.00	6.39	
330	17.5		0.1	1	2.00	1.28	
360	17.5		0	0	0.00	0.00	
							STDev
				Average Infiltration Rate (mm/hr)		1.56	2.79
				Average Infiltration Rate (m^3/yr)		0.99	1.78
					Time (min)		
					0	1.56	
					360	1.56	



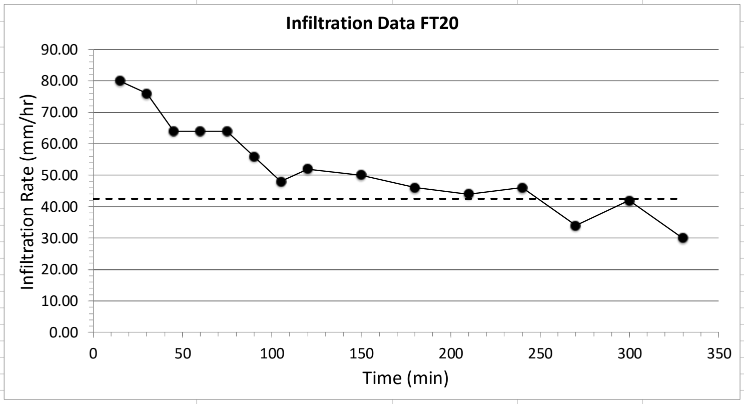
Double Ring Infiltrometer Test and Soil Moisture Measurements: <u>Tree Farm FT-14</u>

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				20.0	3.64		
Project Identification:	West Valley Demonstration Project	22					
Test Location:	FT-14	19.2					
Soil Type:		23.5					
Tested By:	CI, JZ	14.1			Ring area (mm^2)	72966	
Date:	7/20/2016	21.2			Ring area (m^2)	0.072966	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	Infiltration Rate (mm/hr)	Infiltration Rate (m^3/yr)	
0	21						
15	20.2		0.8	8	32.00	20.45	
30	19.8		0.4	4	16.00	10.23	
45	19.5		0.3	3	12.00	7.67	
60	19.1		0.4	4	16.00	10.23	
75	18.9		0.2	2	8.00	5.11	
90	18.7		0.2	2	8.00	5.11	
105	18.5		0.2	2	8.00	5.11	
120	18.2		0.3	3	12.00	7.67	
150	17.9		0.3	3	6.00	3.84	
180	17.7		0.2	2	4.00	2.56	
210	17.4		0.3	3	6.00	3.84	
240	17.1		0.3	3	6.00	3.84	
270	16.9		0.2	2	4.00	2.56	
300	16.7		0.2	2	4.00	2.56	
330	16.4		0.3	3	6.00	3.84	
360	16.1		0.3	3	6.00	3.84	
1080	9.7		6.4	64	5.33	3.41	
							STDev
				Average Infiltration Rate (mm/hr)		5.25	1.04
				Average Infiltration Rate (m^3/yr)		3.36	0.66
					Time (min)		
					0	5.25	
					360	5.25	



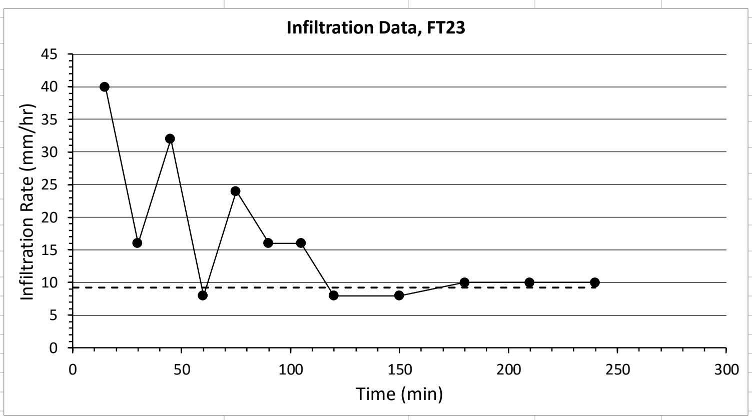
Double Ring Infiltrometer Test and Soil Moisture Measurements: Tree Farm FT-20

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				47.8	2.28		
Project Identification:	West Valley Demonstration Project	45.8					
Test Location:	FT-20	45.7					
Soil Type:		49.3					
Tested By:	CI	47.1			Ring area (mm^2)	72966	
Date:	7/26/2016	50.9			Ring area (m^2)	0.072966	
					Infiltration Rate	Infiltration Rate	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	(mm/hr)	(m^3/yr)	
0	21.9						
15	19.9	Topped 24	2	20	80.00	51.13	
30	18		1.9	19	76.00	48.58	
45	22.4		1.6	16	64.00	40.91	
60	20.8		1.6	16	64.00	40.91	
75	19.2		1.6	16	64.00	40.91	
90	17.8	Topped 22	1.4	14	56.00	35.79	
105	20.8		1.2	12	48.00	30.68	
120	19.5		1.3	13	52.00	33.24	
150	17	Topped 20.5	2.5	25	50.00	31.96	
180	18.2		2.3	23	46.00	29.40	
210	15.9	Topped 22.5	2.2	22	44.00	28.12	
240	20.3		2.3	23	46.00	29.40	
270	18.6		1.7	17	34.00	21.73	
300	16.5		2.1	21	42.00	26.85	
330	15		1.5	15	30.00	19.18	
							STDev
				Average Infiltration Rate (mm/hr)		42.40	4.98
				Average Infiltration Rate (m^3/yr)		27.10	3.18
					Time (min)		
					0	42.40	
					330	42.40	



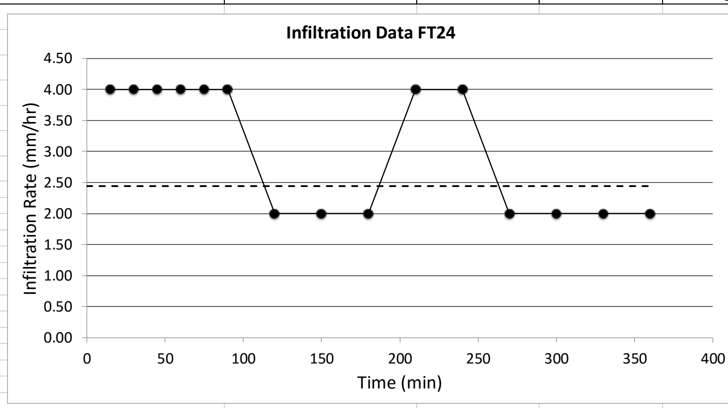
Double Ring Infiltrometer Test and Soil Moisture Measurements: <u>Tree Farm FT-23</u>

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				10.8	3.09		
Project Identification:	West Valley Demonstration Project	12.4					
Test Location:	FT-23	11.4					
Soil Type:		8.6					
Tested By:	CI, CA	5.7			Ring area (mm^2)	72966	
Date:	7/21/2016	13.2			Ring area (m^2)	0.072966	
		13.7					
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	Infiltration Rate (mm/hr)	Infiltration Rate (m^3/yr)	
0	23.9						
15	22.9		1	10	40.00	25.57	
30	22.5		0.4	4	16.00	10.23	
45	21.7		0.8	8	32.00	20.45	
60	21.5		0.2	2	8.00	5.11	
75	20.9		0.6	6	24.00	15.34	
90	20.5		0.4	4	16.00	10.23	
105	20.1		0.4	4	16.00	10.23	
120	19.9		0.2	2	8.00	5.11	
150	19.5		0.4	4	8.00	5.11	
180	19		0.5	5	10.00	6.39	
210	18.5		0.5	5	10.00	6.39	
240	18		0.5	5	10.00	6.39	
							STDev
				Average Infiltration Rate (mm/hr)		9.20	1.10
				Average Infiltration Rate (m^3/yr)		5.88	0.70
					Time (min)		
					0	9.20	
					240.00	9.20	



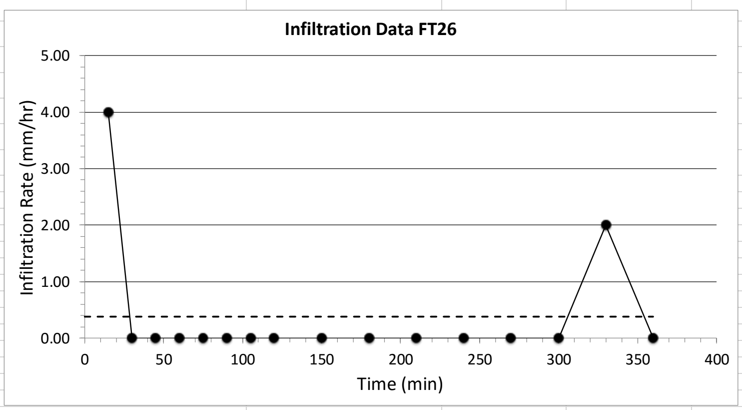
Double Ring Infiltrometer Test and Soil Moisture Measurements: Tree Farm FT-24

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				33.4	5.98		
Project Identification:	West Valley Demonstration Project	35.9					
Test Location:	FT-24	38.1					
Soil Type:		33.6					
Tested By:	CI, JZ	23.1			Ring area (mm^2)	72966	
Date:	7/19/2016	36.3			Ring area (m^2)	0.072966	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	Infiltration Rate (mm/hr)	Infiltration Rate (m^3/yr)	
0	20.4						
15	20.3		0.1	1	4.00	2.56	
30	20.2		0.1	1	4.00	2.56	
45	20.1		0.1	1	4.00	2.56	
60	20		0.1	1	4.00	2.56	
75	19.9		0.1	1	4.00	2.56	
90	19.8		0.1	1	4.00	2.56	
120	19.7		0.1	1	2.00	1.28	
150	19.6		0.1	1	2.00	1.28	
180	19.5		0.1	1	2.00	1.28	
210	19.3		0.2	2	4.00	2.56	
240	19.1		0.2	2	4.00	2.56	
270	19		0.1	1	2.00	1.28	
300	18.9		0.1	1	2.00	1.28	
330	18.8		0.1	1	2.00	1.28	
360	18.7		0.1	1	2.00	1.28	
1020	14		4.7	47	4.27	2.73	
							STDev
				Average Infiltration Rate (mm/hr)		2.44	0.56
				Average Infiltration Rate (m^3/yr)		1.56	0.56
					Time (min)		
					0	2.44	
					360	2.44	



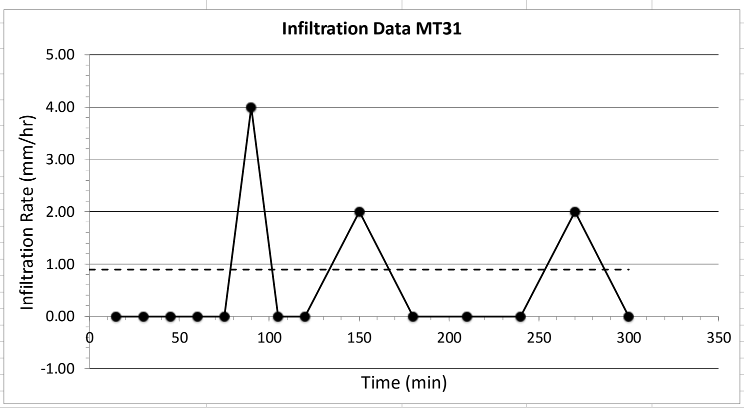
Double Ring Infiltrometer Test and Soil Moisture Measurements: <u>Tree Farm FT-26</u>

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				41.1	6.93		
Project Identification:	West Valley Demonstration Project	32.3					
Test Location:	FT-26	46.9					
Soil Type:		41.4					
Tested By:	CI, KR	48.7			Ring area (mm^2)	72966	
Date:	7/27/2016	36.3			Ring area (m^2)	0.072966	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	Infiltration Rate (mm/hr)	Infiltration Rate (m^3/yr)	
0	26						
15	25.9		0.1	1	4.00	2.56	
30	25.9		0	0	0.00	0.00	
45	25.9		0	0	0.00	0.00	
60	25.9		0	0	0.00	0.00	
75	25.9		0	0	0.00	0.00	
90	25.9		0	0	0.00	0.00	
105	25.9		0	0	0.00	0.00	
120	25.9		0	0	0.00	0.00	
150	25.9		0	0	0.00	0.00	
180	25.9		0	0	0.00	0.00	
210	25.9		0	0	0.00	0.00	
240	25.9		0	0	0.00	0.00	
270	25.9		0	0	0.00	0.00	
300	25.9		0	0	0.00	0.00	
330	25.8		0.1	1	2.00	1.28	
360	25.8		0	0	0.00	0.00	
							STDev
				Average Infiltration Rate (mm/hr)		0.38	1.09
				Average Infiltration Rate (m^3/yr)		0.24	0.70
					Time (min)		
					0	0.38	
					360	0.38	



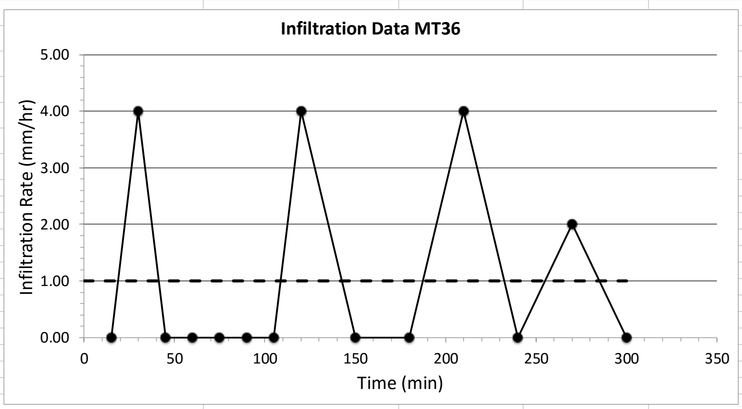
Double Ring Infiltrometer Test and Soil Moisture Measurements: <u>Abandoned Meander MT-31</u>

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				33.5	3.71		
Project Identification:	West Valley Demonstration Project	32.1					
Test Location:	MT-31	36.7					
Soil Type:		33.5					
Tested By:	JZ, KR	28.1			Ring area (mm^2)	72966	
Date:	8/9/2016	37.2			Ring area (m^2)	0.072966	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	Infiltration Rate (mm/hr)	Infiltration Rate (m^3/yr)	
0	22.5						
15	22.5		0	0	0.00	0.00	
30	22.5		0	0	0.00	0.00	
45	22.5		0	0	0.00	0.00	
60	22.5		0	0	0.00	0.00	
75	22.5		0	0	0.00	0.00	
90	22.4		0.1	1	4.00	2.56	
105	22.4		0	0	0.00	0.00	
120	22.4		0	0	0.00	0.00	
150	22.3		0.1	1	2.00	1.28	
180	22.3		0	0	0.00	0.00	
210	22.3		0	0	0.00	0.00	
240	22.3		0	0	0.00	0.00	
270	22.2		0.1	1	2.00	1.28	
300	22.2		0	0	0.00	0.00	
							STDev
				Average Infiltration Rate (mm/hr)		0.89	1.45
				Average Infiltration Rate (m^3/yr)		0.57	0.93
					Time (min)		
					0	0.89	
					300	0.89	



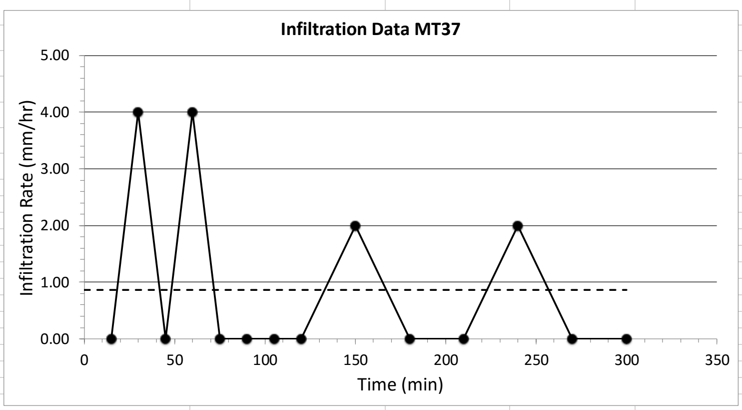
Double Ring Infiltrometer Test and Soil Moisture Measurements: Abandoned Meander MT-36

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				31.1	8.46		
Project Identification:	West Valley Demonstration Project	45.8					
Test Location:	MT-36	25.8					
Soil Type:		27.7					
Tested By:	CI	25.6			Ring area (mm^2)	72966	
Date:	8/8/2016	30.4			Ring area (m^2)	0.072966	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	Infiltration Rate (mm/hr)	Infiltration Rate (m^3/yr)	
0	26.4						
15	26.4		0	0	0.00	0.00	
30	26.3		0.1	1	4.00	2.56	
45	26.3		0	0	0.00	0.00	
60	26.3		0	0	0.00	0.00	
75	26.3		0	0	0.00	0.00	
90	26.3		0	0	0.00	0.00	
105	26.3		0	0	0.00	0.00	
120	26.2		0.1	1	4.00	2.56	
150	26.2		0	0	0.00	0.00	
180	26.2		0	0	0.00	0.00	
210	26		0.2	2	4.00	2.56	
240	26		0	0	0.00	0.00	
270	25.9		0.1	1	2.00	1.28	
300	25.9		0	0	0.00	0.00	
							STDev
				Average Infiltration Rate (mm/hr)		1.00	1.71
				Average Infiltration Rate (m^3/yr)		0.64	1.09
					Time (min)		
					0	1	
					300	1	



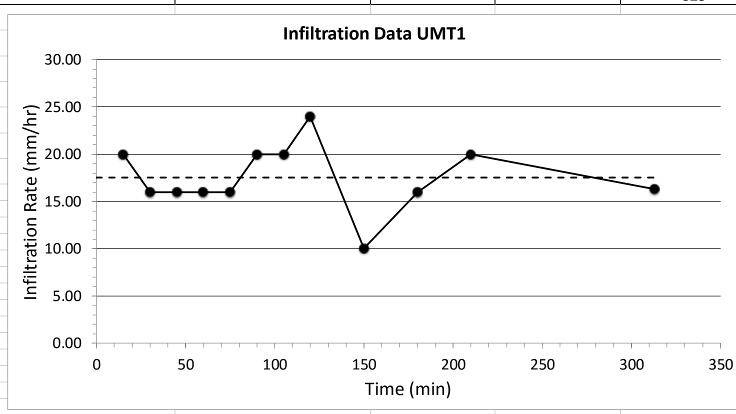
Double Ring Infiltrometer Test and Soil Moisture Measurements: <u>Abandoned Meander MT-37</u>

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				45.2	3.44		
Project Identification:	West Valley Demonstration Project	47.5					
Test Location:	MT-37	44.7					
Soil Type:		47.5					
Tested By:	JZ, KR, CA	39.4			Ring area (mm^2)	72966	
Date:	8/8/2016	46.9			Ring area (m^2)	0.072966	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	Infiltration Rate (mm/hr)	Infiltration Rate (m^3/yr)	
0	27						
15	27		0	0	0.00	0.00	
30	26.9		0.1	1	4.00	2.56	
45	26.9		0	0	0.00	0.00	
60	26.8		0.1	1	4.00	2.56	
75	26.8		0	0	0.00	0.00	
90	26.8		0	0	0.00	0.00	
105	26.8		0	0	0.00	0.00	
120	26.8		0	0	0.00	0.00	
150	26.7		0.1	1	2.00	1.28	
180	26.7		0	0	0.00	0.00	
210	26.7		0	0	0.00	0.00	
240	26.6		0.1	1	2.00	1.28	
270	26.6		0	0	0.00	0.00	
300	26.6		0	0	0.00	0.00	
							STDev
				Average Infiltration Rate (mm/hr)		0.86	1.51
				Average Infiltration Rate (m^3/yr)		0.55	0.97
					Time (min)		
					0	0.86	
					300	0.86	



Double Ring Infiltrometer Test and Soil Moisture Measurements: <u>Upper Abandoned Meander UMT-1</u>

Double Ring Infiltrometer Test (12" & 24" Rings)		Soil Moisture (%)	Average Soil Moisture (%)		StDev		
				14.7	1.32		
Project Identification:	West Valley Demonstration Project	12.4					
Test Location:	UMT-1	15.2					
Soil Type:		15.2					
Tested By:	CI	15.6			Ring area (mm^2)	72966	
Date:	8/11/2016	15.3			Ring area (m^2)	0.072966	
Elapsed Time (min)	Inner Ring Reading (cm)	Topped (new start height)	Difference (cm)	Difference (mm)	Infiltration Rate (mm/hr)	Infiltration Rate (m^3/yr)	
0	19.5						
15	19		0.5	5	20.00	12.78	
30	18.6		0.4	4	16.00	10.23	
45	18.2		0.4	4	16.00	10.23	
60	17.8		0.4	4	16.00	10.23	
75	17.4		0.4	4	16.00	10.23	
90	16.9		0.5	5	20.00	12.78	
105	16.4		0.5	5	20.00	12.78	
120	15.8	19.4	0.6	6	24.00	15.34	
150	18.9		0.5	5	10.00	6.39	
180	18.1		0.8	8	16.00	10.23	
210	17.1	20	1	10	20.00	12.78	
313	17.2		2.8	28	16.31	10.43	
							STDev
				Average Infiltration Rate (mm/hr)		17.53	3.52
				Average Infiltration Rate (m^3/yr)		11.20	2.25
					Time (min)		
					0	17.53	
					313	17.53	



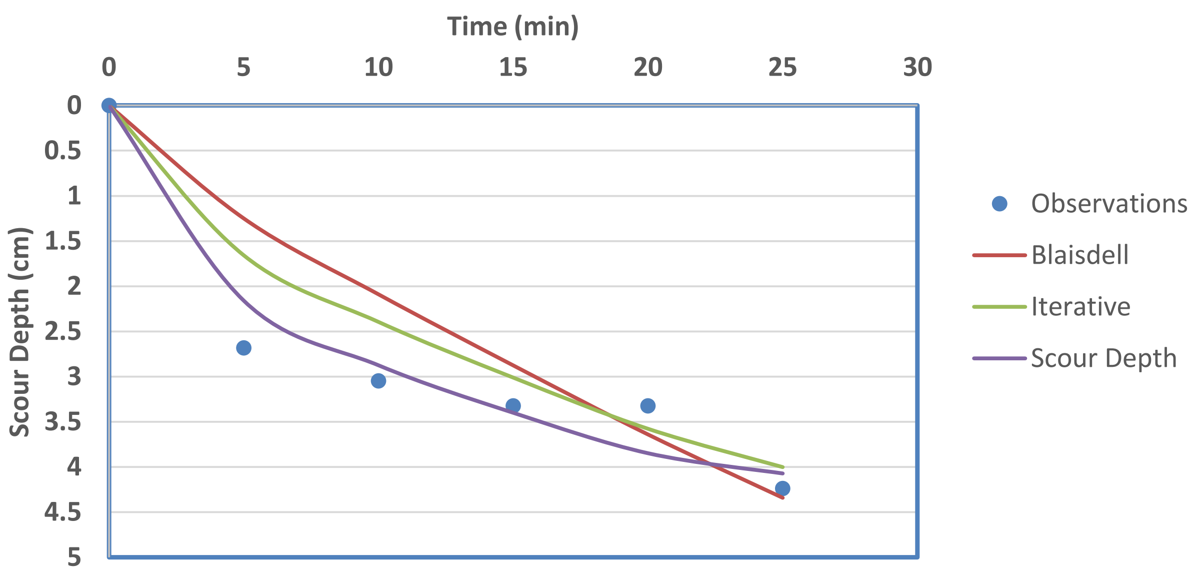
Appendix 3. Summary of jet erosion tests obtained at the following trench locations (numbered by trench): Heinz Terrace (HT), Upper Heinz Terrace (UHT), Tree Farm (FT), Abandoned Meander (MT), and Upper Abandoned Meander (UMT). Tables and plots could include all of the collected data, designated as "raw," or with outliers removed, designate as "modified."

Jet Erosion Test: Heinz Terrace HT-3 (raw)

LOCATION	HT-3 r
DATE	6/21/2016
HEAD (IN)	85.6693376
PT GAGE H (FT)	1.605
NOZZLE H (FT)	0.276

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	1.329	0.000
5	5	1.241	0.088
10	5	1.229	0.100
15	5	1.220	0.109
20	5	1.220	0.109
25	5	1.190	0.139

SOLUTIONS	*Blaisdell*	*Iterative*	*Scour Depth*
τ_c (Pa)	6.93	31.54	37.54
k_d (cm^3/N·s)	0.694	1.563	2.453

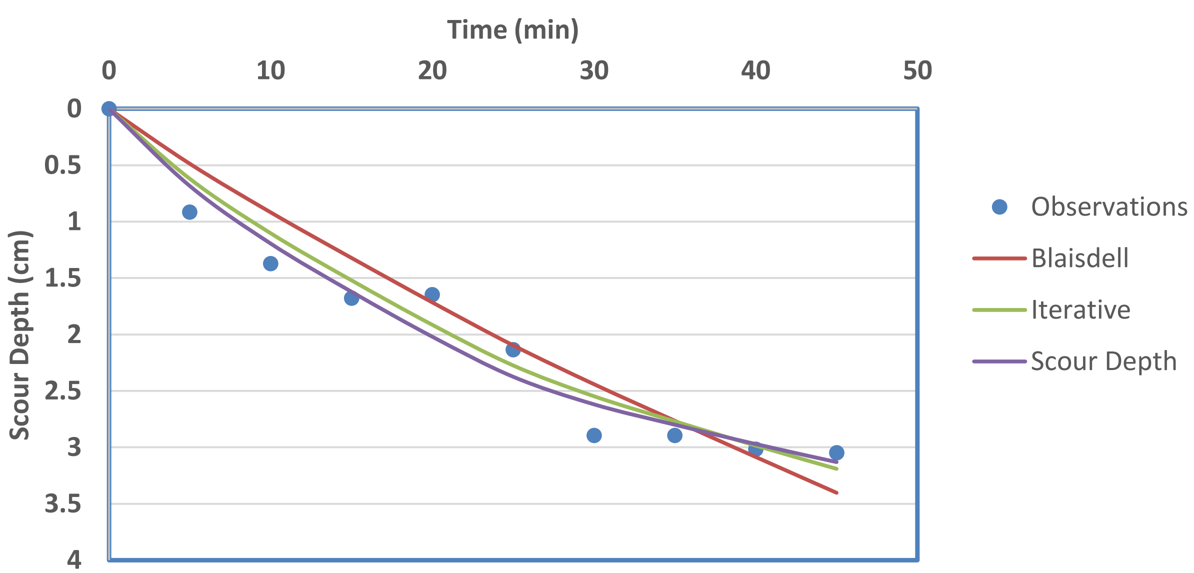


Jet Erosion Test: <u>Heinz Terrace HT-5 (raw)</u>

LOCATION	HT-5 r
DATE	6/21/2016
HEAD (IN)	82.6378399
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.390

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.445	0.000
5	5	2.415	0.030
10	5	2.400	0.045
15	5	2.390	0.055
20	5	2.391	0.054
25	5	2.375	0.070
30	5	2.350	0.095
35	5	2.350	0.095
40	5	2.346	0.099
45	5	2.345	0.100

SOLUTIONS			
	Blaisdell	***Iterative***	***Scour Depth***
τ_c (Pa)	3.31	19.95	22.28
k_d (cm^3/N·s)	0.466	1.138	1.441

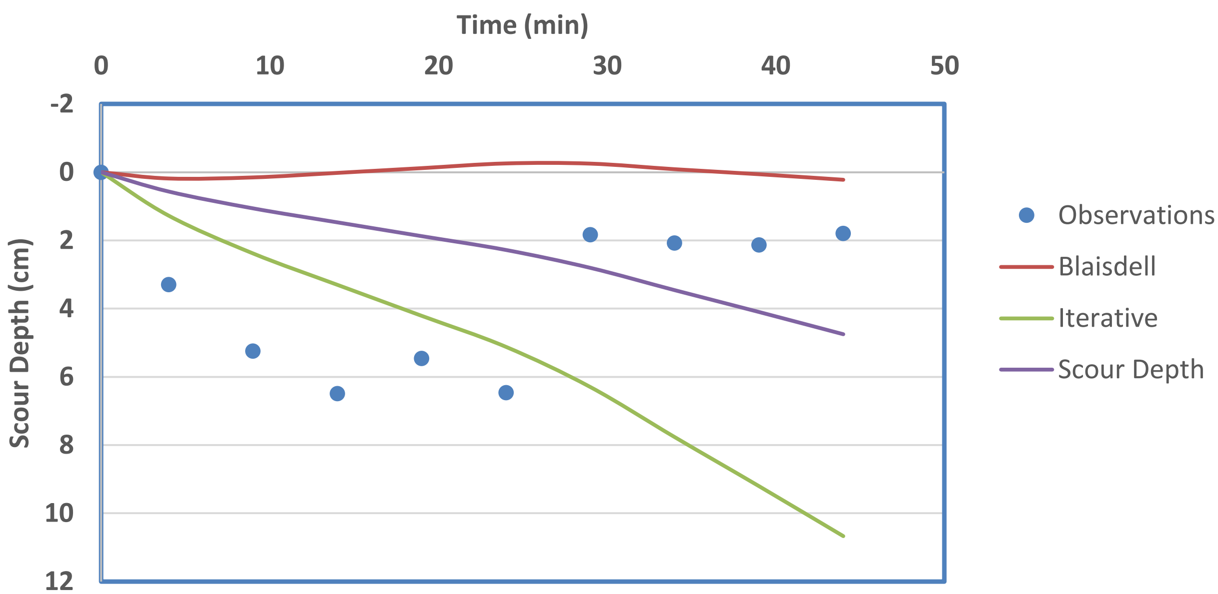


Jet Erosion Test: Heinz Terrace HT-8 (raw)

LOCATION	HT-8 r
DATE	6/22/2016
HEAD (IN)	83.1890213
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.422

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.413	0.000
4	4	2.305	0.108
9	5	2.241	0.172
14	5	2.200	0.213
19	5	2.234	0.179
24	5	2.201	0.212
29	5	2.353	0.060
34	5	2.345	0.068
39	5	2.343	0.070
44	5	2.354	0.059

SOLUTIONS			
	Blaisdell	*Iterative*	*Scour Depth*
τ_c (Pa)	21.08	0.06	0.00
k_d (cm^3/N·s)	1.000	1.850	0.821

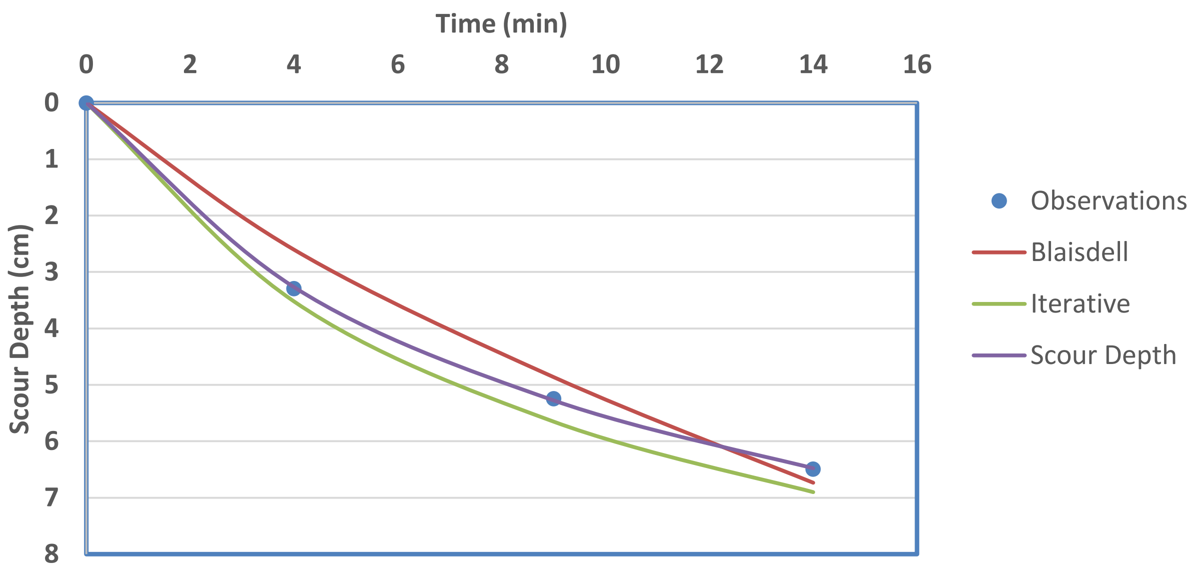


Jet Erosion Test: Heinz Terrace HT-8 (modified)

LOCATION	HT-8 m
DATE	6/22/2016
HEAD (IN)	83.1890213
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.422

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.413	0.000
4	4	2.305	0.108
9	5	2.241	0.172
14	5	2.200	0.213

SOLUTIONS			
	Blaisdell	***Iterative***	***Scour Depth***
τ_c (Pa)	0.25	11.85	11.59
k_d (cm^3/N·s)	3.806	8.680	7.935

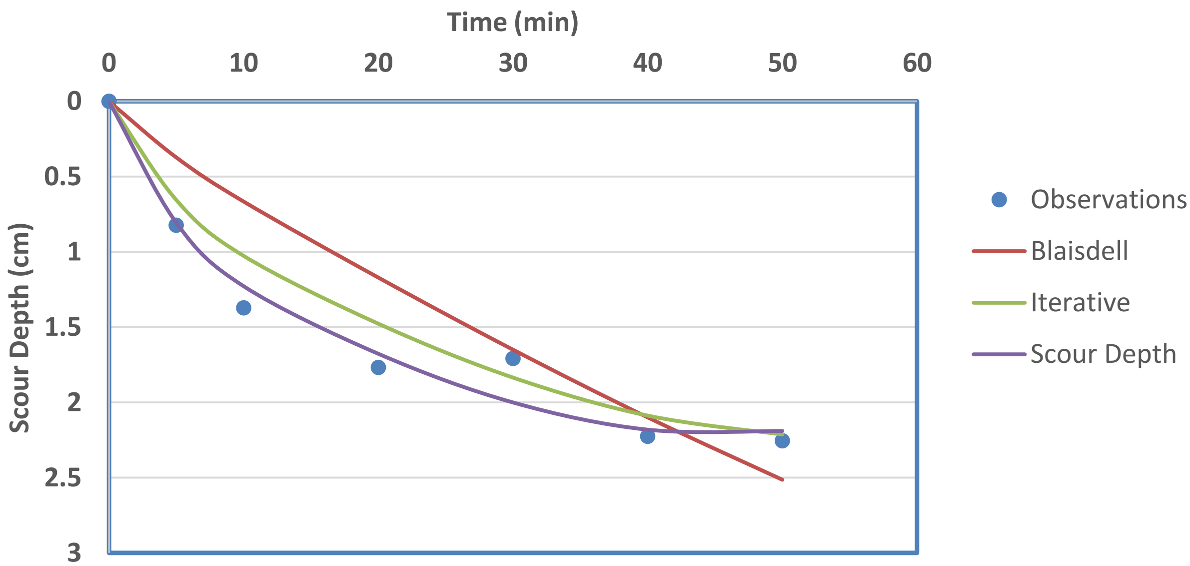


Jet Erosion Test: Heinz Terrace HT-11 (raw)

LOCATION	HT-11 r
DATE	6/22/2016
HEAD (IN)	82.1791782
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.186

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.649	0.000
5	5	2.622	0.027
10	5	2.604	0.045
20	10	2.591	0.058
30	10	2.593	0.056
40	10	2.576	0.073
50	10	2.575	0.074

SOLUTIONS			
	Blaisdell	***Iterative***	***Scour Depth***
τ_c (Pa)	9.44	84.95	91.56
k_d (cm^3/N·s)	0.084	0.300	0.406

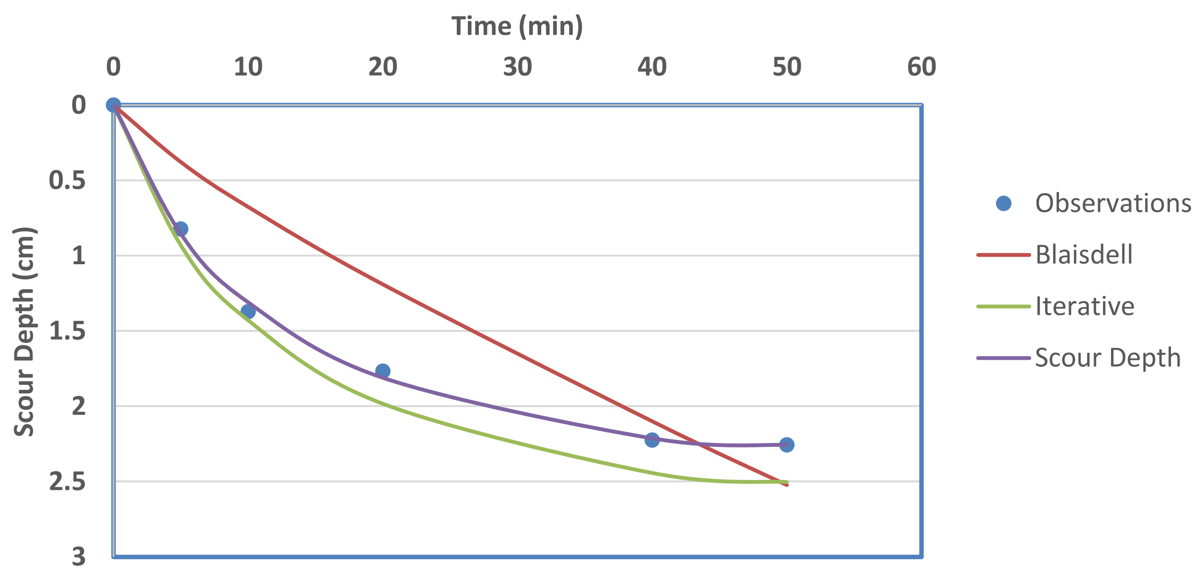


Jet Erosion Test: <u>Heinz Terrace HT-11 (modified)</u>

LOCATION	HT-11 m
DATE	6/22/2016
HEAD (IN)	82.1791782
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.186

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.649	0.000
5	5	2.622	0.027
10	5	2.604	0.045
20	10	2.591	0.058
40	20	2.576	0.073
50	10	2.575	0.074

SOLUTIONS	*Blaisdell*	*Iterative*	*Scour Depth*
τ_c (Pa)	7.97	89.71	90.16
k_d (cm^3/N·s)	0.084	0.456	0.422

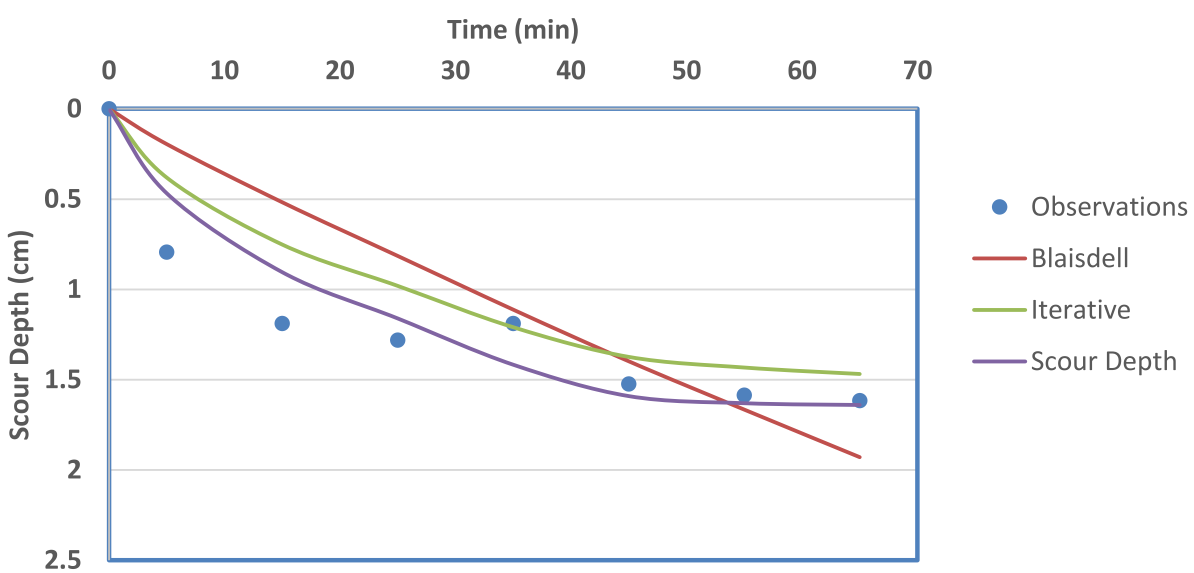


Jet Erosion Test: Heinz Terrace HT-15 (raw)

LOCATION	HT-15 r
DATE	6/22/2016
HEAD (IN)	93.292
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.347

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.488	0.000
5	5	2.462	0.026
15	10	2.449	0.039
25	10	2.446	0.042
35	10	2.449	0.039
45	10	2.438	0.050
55	10	2.436	0.052
65	10	2.435	0.053

SOLUTIONS	Blaisdell	Iterative	Scour Depth
τ_c (Pa)	22.46	43.51	43.92
k_d (cm^3/N·s)	0.204	1.163	1.483

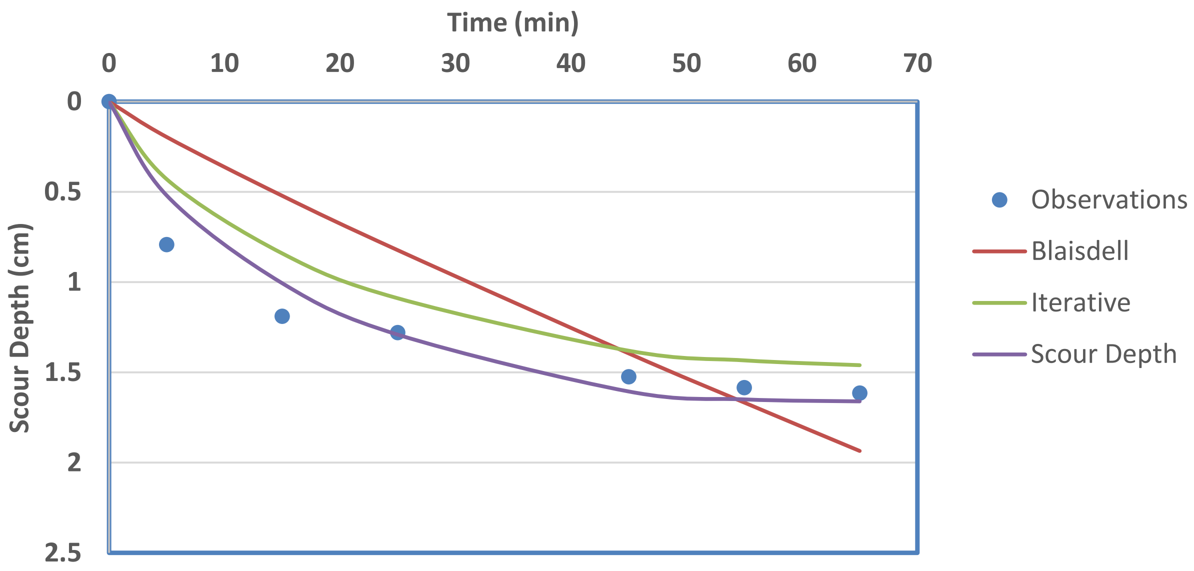


Jet Erosion Test: <u>Heinz Terrace HT-15 (modified)</u>

LOCATION	HT-15 m
DATE	6/22/2016
HEAD (IN)	93.292
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.347

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.488	0.000
5	5	2.462	0.026
15	10	2.449	0.039
25	10	2.446	0.042
45	20	2.438	0.050
55	10	2.436	0.052
65	10	2.435	0.053

SOLUTIONS	*Blaisdell*	*Iterative*	*Scour Depth*
τ_c (Pa)	21.51	43.69	43.92
k_d (cm^3/N·s)	0.199	1.334	1.648



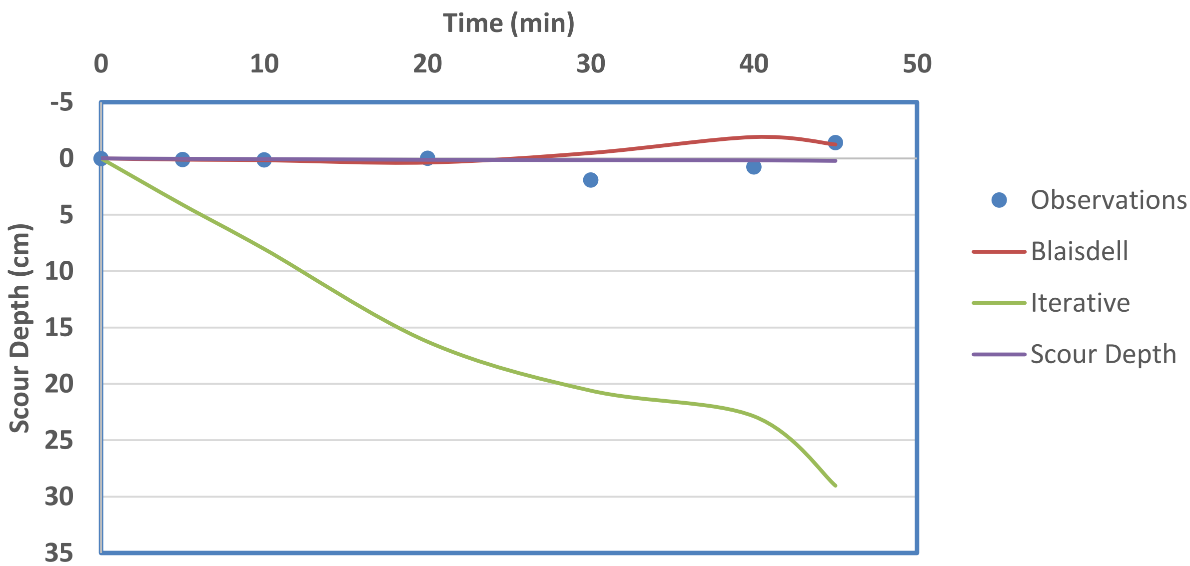
Jet Erosion Test: Heinz Terrace HT-16 (raw)

LOCATION	HT-16 r
DATE	6/21/2016
HEAD (IN)	100.669
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.261

A reasonable solution could not be found due to insignificant erosion

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.574	0.000
5	5	2.571	0.003
10	5	2.57	0.004
20	10	2.575	-0.001
30	10	2.512	0.062
40	10	2.55	0.024
45	5	2.62	-0.046

SOLUTIONS			
	Blaisdell	***Iterative***	***Scour Depth***
τ_c (Pa)	106.58	72.67	72.68
k_d (cm^3/N·s)	1.000	3.665	0.027

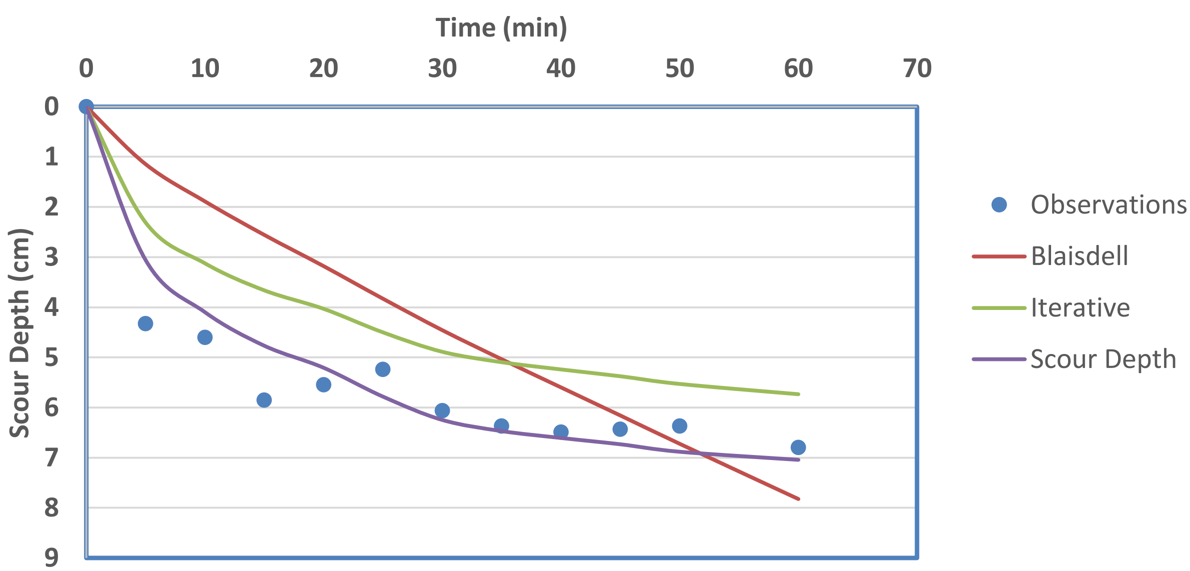


Jet Erosion Test: <u>Heinz Terrace HT-20 (raw)</u>

LOCATION	HT-20 r
DATE	6/28/2016
HEAD (IN)	101
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.392

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.443	0.000
5	5	2.301	0.142
10	5	2.292	0.151
15	5	2.251	0.192
20	5	2.261	0.182
25	5	2.271	0.172
30	5	2.244	0.199
35	5	2.234	0.209
40	5	2.230	0.213
45	5	2.232	0.211
50	5	2.234	0.209
60	10	2.22	0.223

SOLUTIONS			
	Blaisdell	***Iterative***	***Scour Depth***
τ_c (Pa)	4.37	19.77	20.11
k_d (cm^3/N·s)	1.132	4.201	5.666

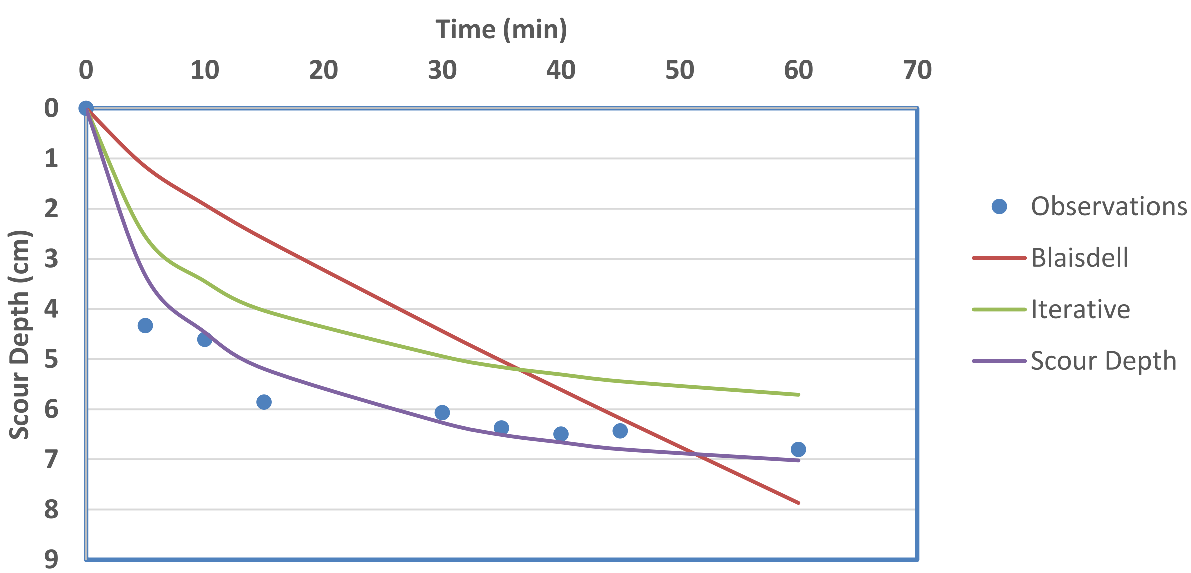


Jet Erosion Test: Heinz Terrace HT-20 (modified)

LOCATION	HT-20 m
DATE	6/28/2016
HEAD (IN)	101
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.392

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.443	0.000
5	5	2.301	0.142
10	5	2.292	0.151
15	5	2.251	0.192
30	15	2.244	0.199
35	5	2.234	0.209
40	5	2.23	0.213
45	5	2.232	0.211
60	15	2.22	0.223

SOLUTIONS			
	Blaisdell	***Iterative***	***Scour Depth***
τ_c (Pa)	4.07	19.88	20.11
k_d (cm^3/N·s)	1.138	4.678	6.175

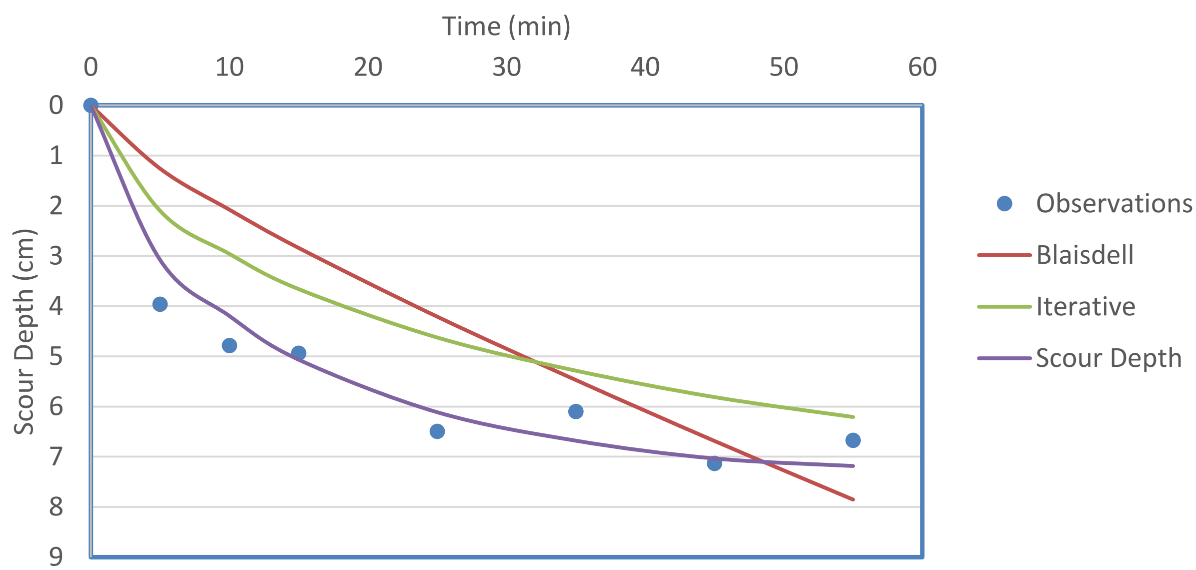


Jet Erosion Test: Heinz Terrace HT-23 (raw)

LOCATION	HT-23 r
DATE	6/27/2016
HEAD (IN)	91.25
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.368

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.467	0.000
5	5	2.337	0.130
10	5	2.310	0.157
15	5	2.305	0.162
25	10	2.254	0.213
35	10	2.267	0.200
45	10	2.233	0.234
55	10	2.248	0.219

SOLUTIONS			
	Blaisdell	*Iterative*	*Scour Depth*
τ_c (Pa)	2.35	17.40	18.96
k_d (cm^3/N·s)	1.138	3.205	5.061

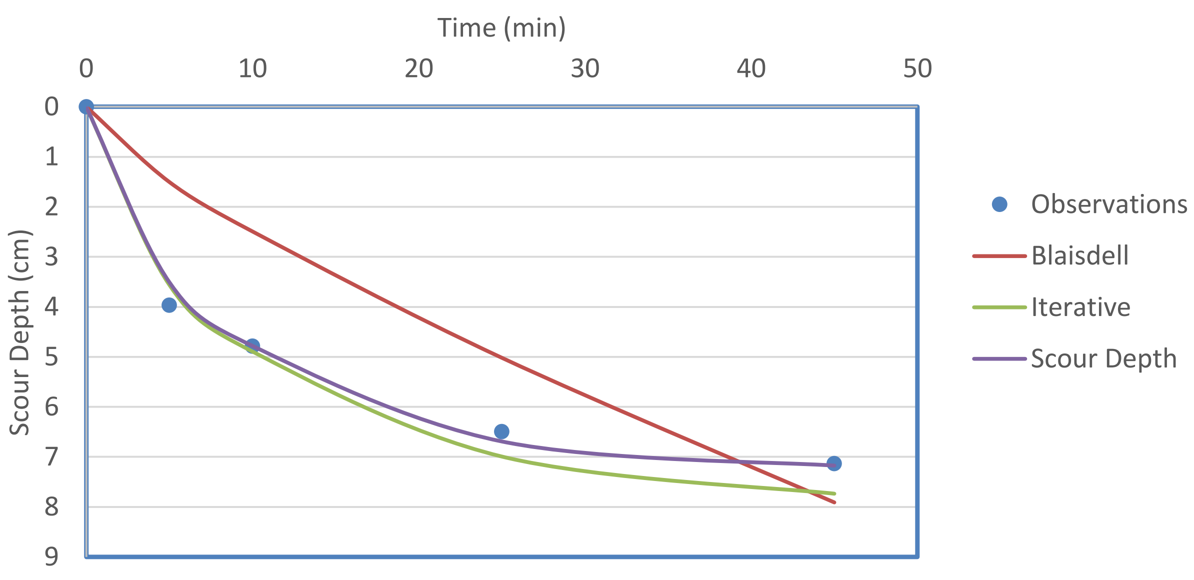


Jet Erosion Test: <u>Heinz Terrace HT-23 (modified)</u>

LOCATION	HT-23 m
DATE	6/27/2016
HEAD (IN)	91.25
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.368

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.467	0.000
5	5	2.337	0.130
10	5	2.310	0.157
25	15	2.254	0.213
45	20	2.233	0.234

SOLUTIONS			
	Blaisdell	***Iterative***	***Scour Depth***
τ_c (Pa)	1.54	18.59	18.96
k_d (cm^3/N·s)	1.330	5.746	5.767



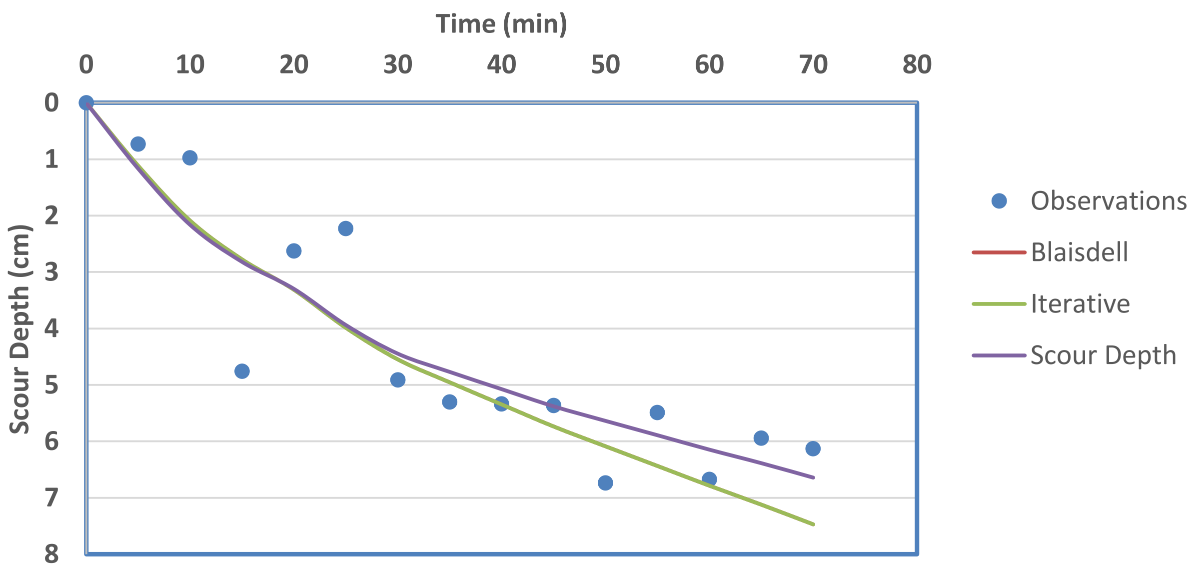
Jet Erosion Test: <u>Heinz Terrace HT-24 (raw)</u>

LOCATION	HT-24 r
DATE	6/29/2016
HEAD (IN)	95
PT GAGE H (FT)	2.663
NOZZLE H (FT)	0.227

A reasonable solution could not be found. Bad test not included in study.

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.436	0.000
5	5	2.412	0.024
10	5	2.404	0.032
15	5	2.280	0.156
20	5	2.350	0.086
25	5	2.363	0.073
30	5	2.275	0.161
35	5	2.262	0.174
40	5	2.261	0.175
45	5	2.260	0.176
50	5	2.215	0.221
55	5	2.256	0.18
60	5	2.217	0.219
65	5	2.241	0.195
70	5	2.235	0.201

SOLUTIONS			
	Blaisdell	***Iterative***	***Scour Depth***
τ_c (Pa)	0.04	0.06	15.25
k_d (cm^3/N·s)	0.295	0.295	0.350

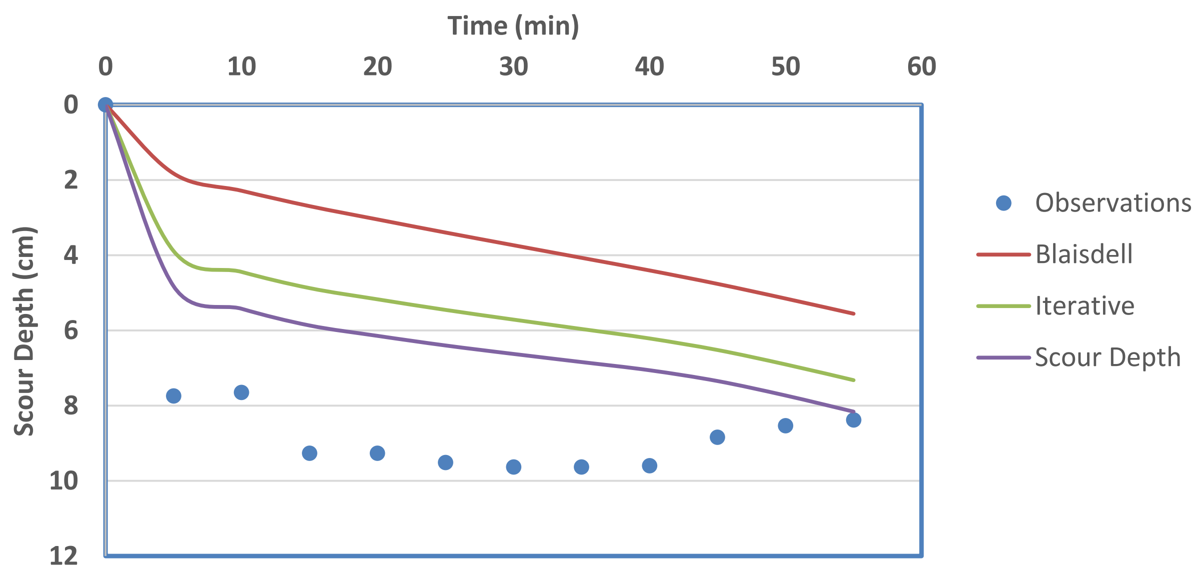


Jet Erosion Test: <u>Heinz Terrace HT-25A (raw)</u>

LOCATION	HT-25A r
DATE	6/29/2016
HEAD (IN)	83.75
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.165

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.67	0.000
5	5	2.416	0.254
10	5	2.419	0.251
15	5	2.366	0.304
20	5	2.366	0.304
25	5	2.358	0.312
30	5	2.354	0.316
35	5	2.354	0.316
40	5	2.355	0.315
45	5	2.38	0.290
50	5	2.39	0.280
55	5	2.395	0.275

SOLUTIONS			
	Blaisdell	***Iterative***	***Scour Depth***
τ_c (Pa)	11.20	0.06	27.26
k_d (cm^3/N·s)	1.107	0.828	2.425

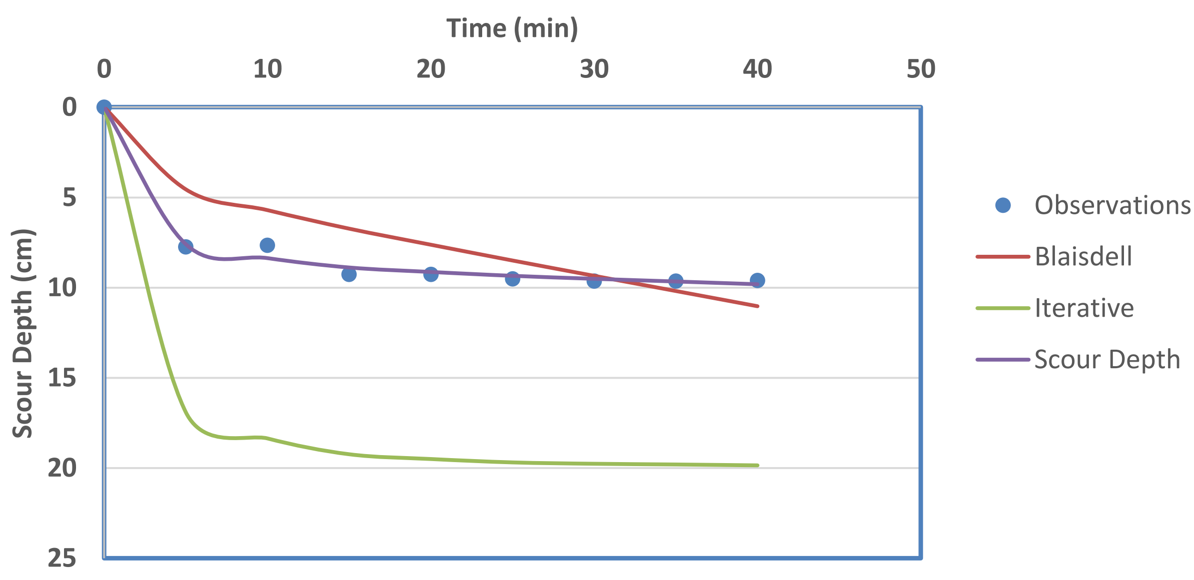


Jet Erosion Test: <u>Heinz Terrace HT-25A (modified)</u>

LOCATION	HT-25A m
DATE	6/29/2016
HEAD (IN)	83.75
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.165

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.67	0.000
5	5	2.416	0.254
10	5	2.419	0.251
15	5	2.366	0.304
20	5	2.366	0.304
25	5	2.358	0.312
30	5	2.354	0.316
35	5	2.354	0.316
40	5	2.355	0.315

SOLUTIONS	*Blaisdell*	*Iterative*	*Scour Depth*
τ_c (Pa)	3.11	27.01	25.13
k_d (cm^3/N·s)	1.161	5.278	2.329

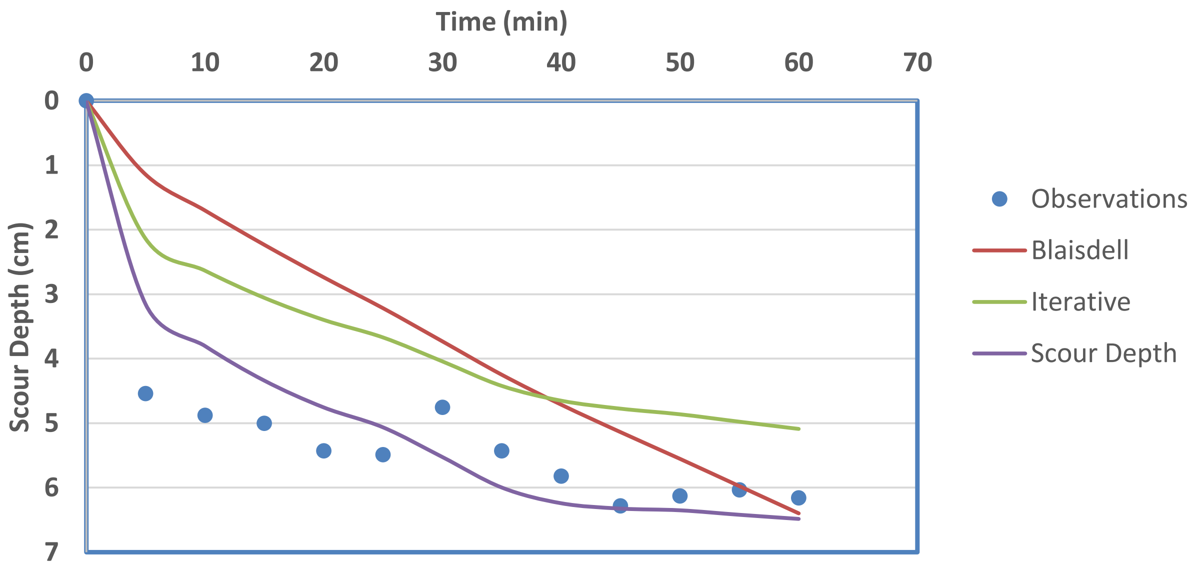


Jet Erosion Test: Heinz Terrace HT-25B (raw)

LOCATION	HT-25B r
DATE	6/29/2016
HEAD (IN)	97.5
PT GAGE H (FT)	2.675
NOZZLE H (FT)	0.248

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.427	0.000
5	5	2.278	0.149
10	5	2.267	0.160
15	5	2.263	0.164
20	5	2.249	0.178
25	5	2.247	0.180
30	5	2.271	0.156
35	5	2.249	0.178
40	5	2.236	0.191
45	5	2.221	0.206
50	5	2.226	0.201
55	5	2.229	0.198
60	5	2.225	0.202

SOLUTIONS			
	Blaisdell	*Iterative*	*Scour Depth*
τ_c (Pa)	9.41	34.04	35.63
k_d (cm^3/N·s)	0.518	1.457	2.220

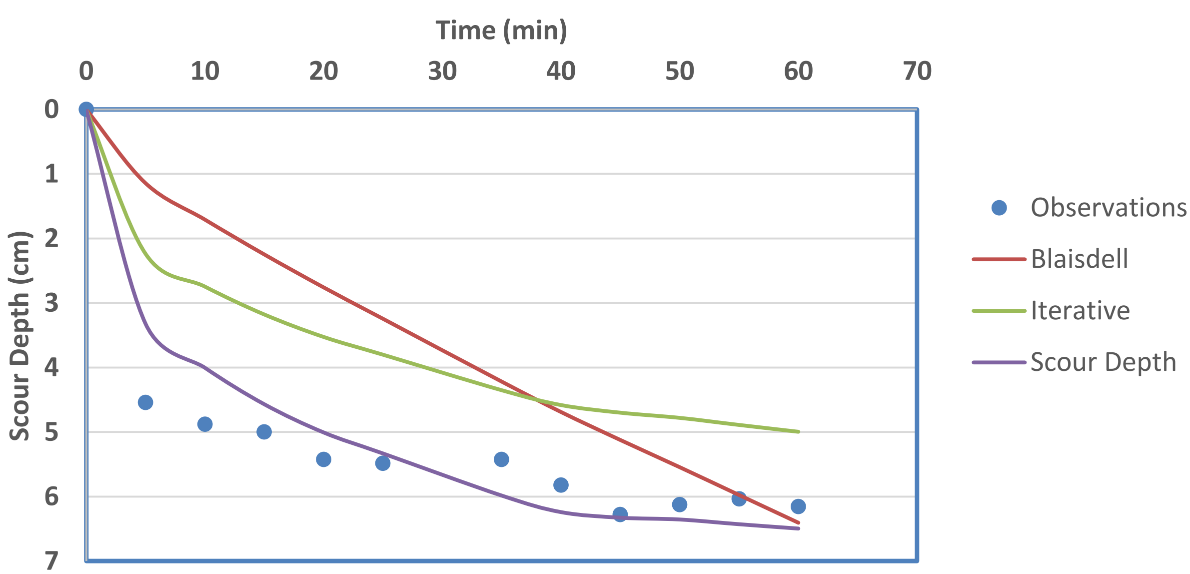


Jet Erosion Test: <u>Heinz Terrace HT-25B (modified)</u>

LOCATION	HT-25B m
DATE	6/29/2016
HEAD (IN)	97.5
PT GAGE H (FT)	2.675
NOZZLE H (FT)	0.248

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.427	0.000
5	5	2.278	0.149
10	5	2.267	0.160
15	5	2.263	0.164
20	5	2.249	0.178
25	5	2.247	0.180
35	10	2.249	0.178
40	5	2.236	0.191
45	5	2.221	0.206

SOLUTIONS			
	Blaisdell	*Iterative*	*Scour Depth*
τ_c (Pa)	9.35	33.92	35.63
k_d ($cm^3/N{\cdot}s$)	0.655	1.703	2.404

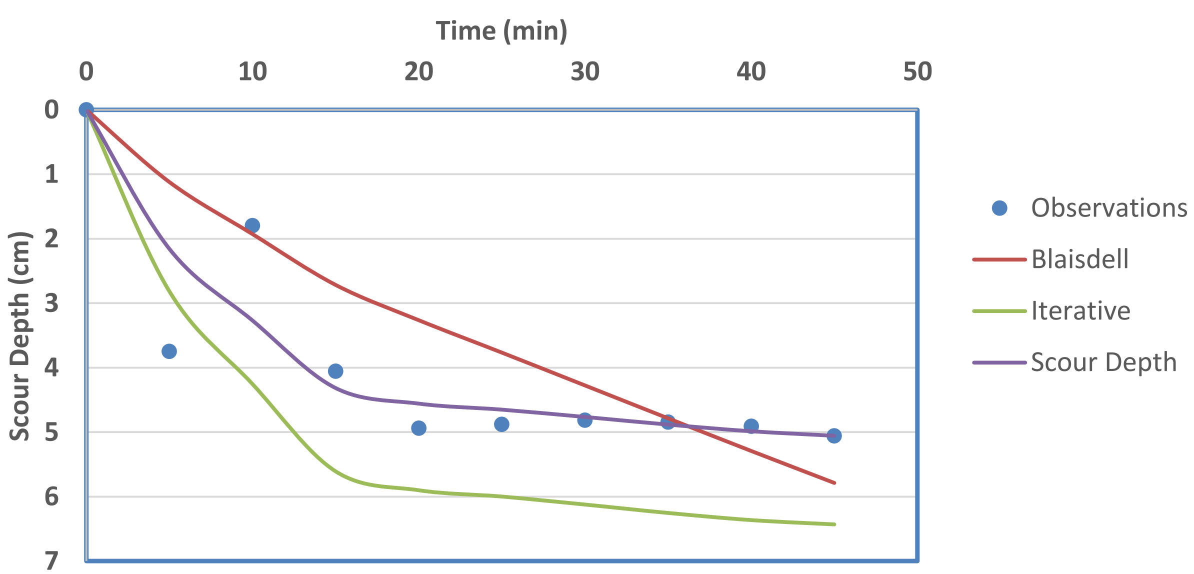


Jet Erosion Test: Heinz Terrace HT-26 (raw)

LOCATION	HT-26 r
DATE	6/29/2016
HEAD (IN)	112.25
PT GAGE H (FT)	2.675
NOZZLE H (FT)	0.222

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.453	0.000
5	5	2.33	0.123
10	5	2.394	0.059
15	5	2.32	0.133
20	5	2.291	0.162
25	5	2.293	0.160
30	5	2.295	0.158
35	5	2.294	0.159
40	5	2.292	0.161
45	5	2.287	0.166

SOLUTIONS			
	Blaisdell	***Iterative***	***Scour Depth***
τ_c (Pa)	5.72	55.34	54.74
k_d (cm^3/N·s)	0.323	1.423	1.080

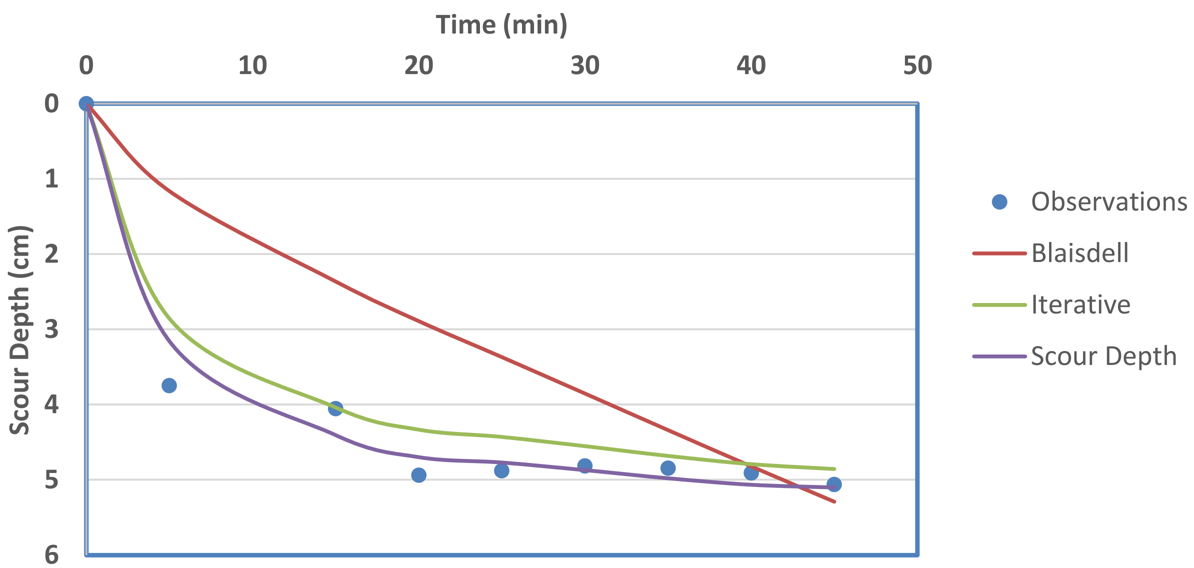


Jet Erosion Test: <u>Heinz Terrace HT-26 (modified)</u>

LOCATION	HT-26 m
DATE	6/29/2016
HEAD (IN)	112.25
PT GAGE H (FT)	2.675
NOZZLE H (FT)	0.222

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.453	0.000
5	5	2.33	0.123
15	10	2.32	0.133
20	5	2.291	0.162
25	5	2.293	0.160
30	5	2.295	0.158
35	5	2.294	0.159
40	5	2.292	0.161
45	5	2.287	0.166

SOLUTIONS			
	Blaisdell	*Iterative*	*Scour Depth*
τ_c (Pa)	13.09	55.41	56.16
k_d (cm^3/N·s)	0.358	1.445	1.615

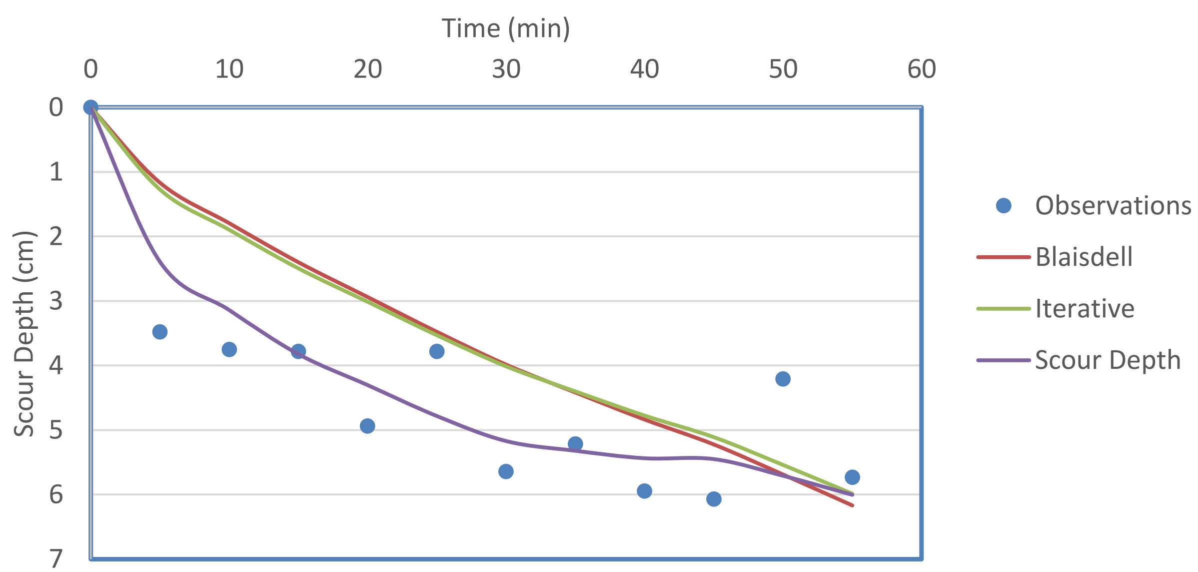


Jet Erosion Test: <u>Heinz Terrace HT-29 (raw)</u>

LOCATION	HT-29 r
DATE	6/28/2016
HEAD (IN)	103.25
PT GAGE H (FT)	2.674
NOZZLE H (FT)	0.195

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.479	0.000
5	5	2.365	0.114
10	5	2.356	0.123
15	5	2.355	0.124
20	5	2.317	0.162
25	5	2.355	0.124
30	5	2.294	0.185
35	5	2.308	0.171
40	5	2.284	0.195
45	5	2.28	0.199
50	5	2.341	0.138
55	5	2.291	0.188

SOLUTIONS			
	Blaisdell	***Iterative***	***Scour Depth***
τ_c (Pa)	4.95	17.66	50.10
k_d (cm^3/N·s)	0.282	0.338	0.858

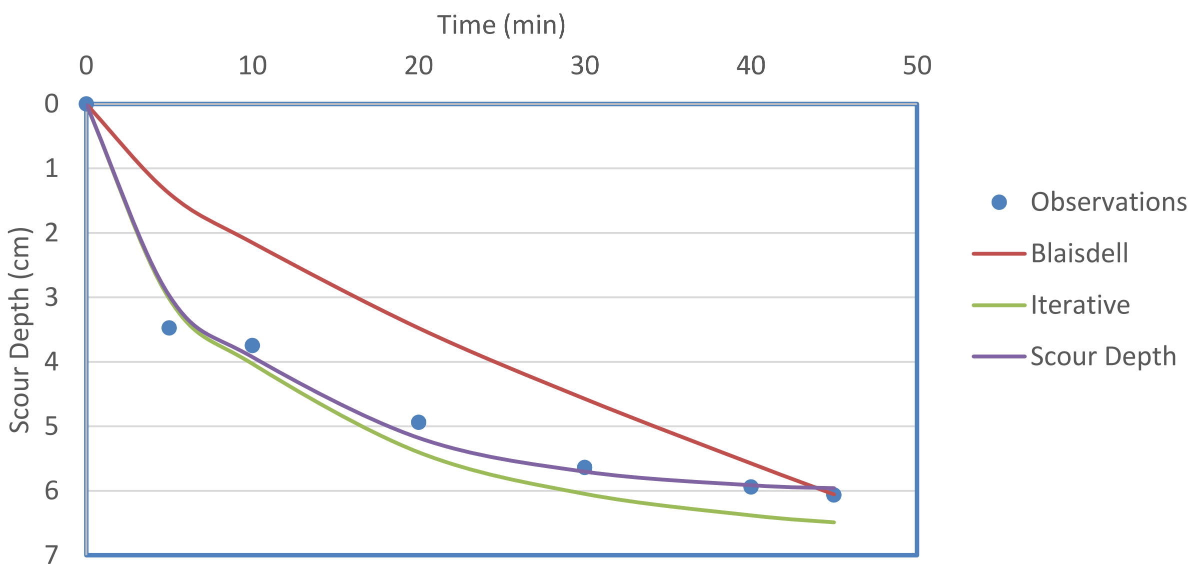


Jet Erosion Test: Heinz Terrace HT-29 (modified)

LOCATION	HT-29 m
DATE	6/28/2016
HEAD (IN)	103.25
PT GAGE H (FT)	2.674
NOZZLE H (FT)	0.195

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.479	0.000
5	5	2.365	0.114
10	5	2.356	0.123
20	10	2.317	0.162
30	10	2.294	0.185
40	10	2.284	0.195
45	5	2.28	0.199

SOLUTIONS	*Blaisdell*	*Iterative*	*Scour Depth*
τ_c (Pa)	1.57	47.20	49.17
k_d (cm^3/N·s)	0.327	1.051	1.057

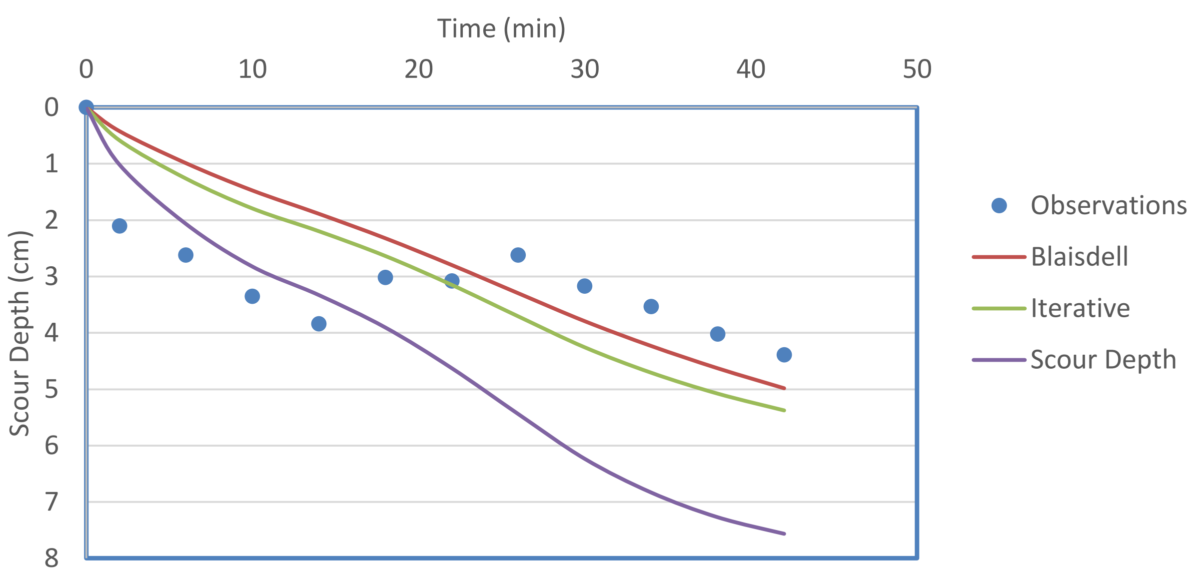


Jet Erosion Test: Heinz Terrace HT-32 (raw)

LOCATION	HT-32 r
DATE	6/30/2016
HEAD (IN)	92.5
PT GAGE H (FT)	2.675
NOZZLE H (FT)	0.265

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.41	0.000
2	2	2.341	0.069
6	4	2.324	0.086
10	4	2.3	0.110
14	4	2.284	0.126
18	4	2.311	0.099
22	4	2.309	0.101
26	4	2.324	0.086
30	4	2.306	0.104
34	4	2.294	0.116
38	4	2.278	0.132
42	4	2.266	0.144

SOLUTIONS	Blaisdell	Iterative	Scour Depth
τ_c (Pa)	15.36	34.16	41.65
k_d (cm^3/N·s)	0.470	0.839	1.673

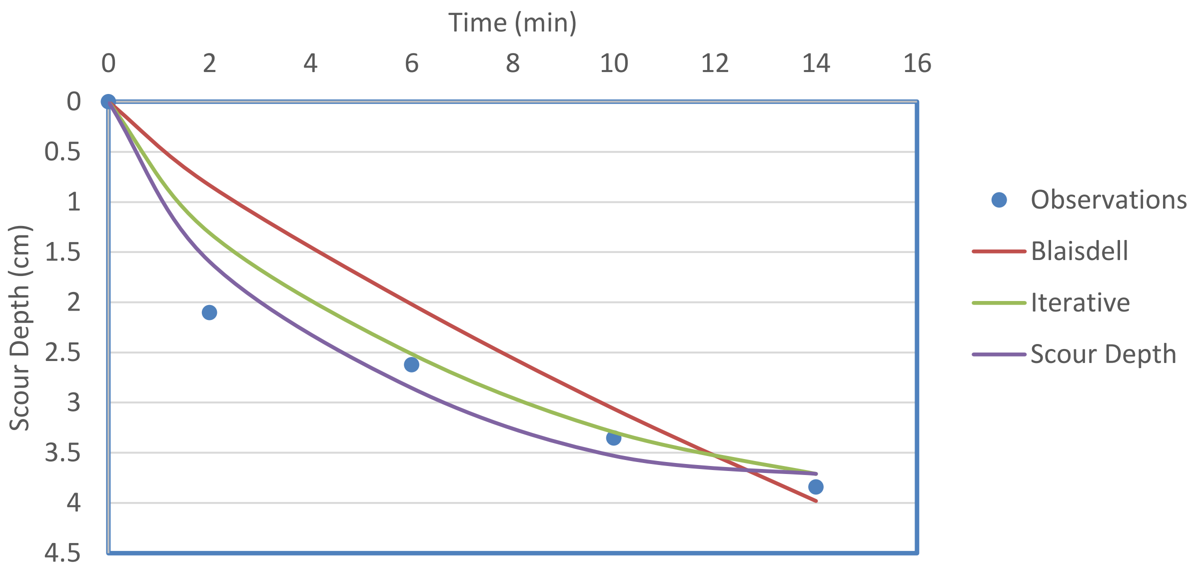


Jet Erosion Test: <u>Heinz Terrace HT-32 (modified)</u>

LOCATION	HT-32 m
DATE	6/30/2016
HEAD (IN)	92.5
PT GAGE H (FT)	2.675
NOZZLE H (FT)	0.265

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.41	0.000
2	2	2.341	0.069
6	4	2.324	0.086
10	4	2.3	0.110
14	4	2.284	0.126

SOLUTIONS			
	Blaisdell	***Iterative***	***Scour Depth***
τ_c (Pa)	7.46	47.05	51.98
k_d (cm^3/N·s)	0.819	2.416	3.304

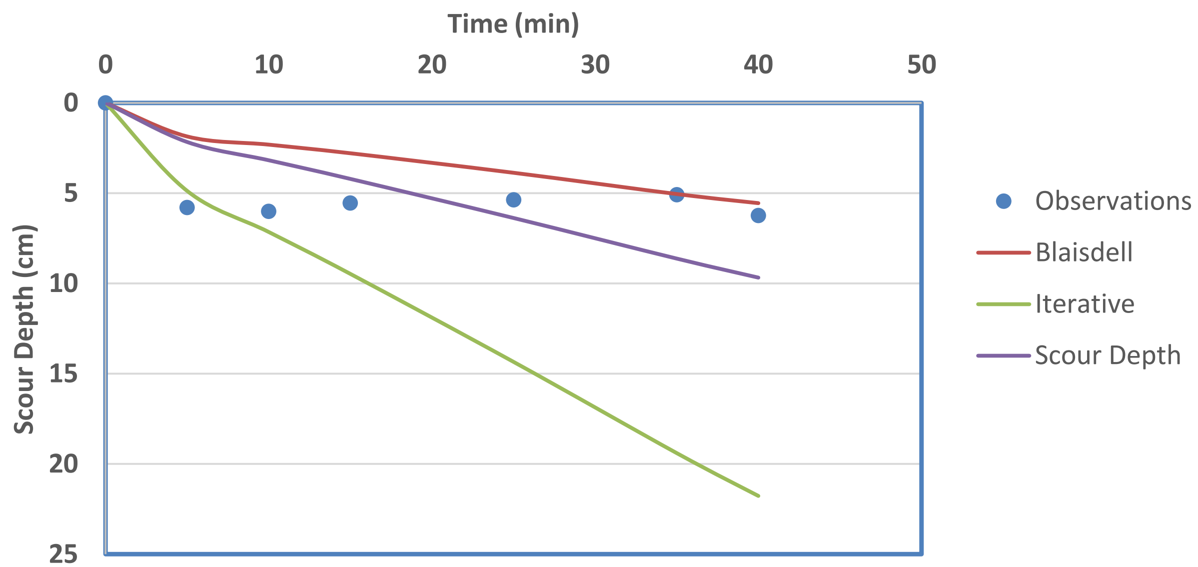


Jet Erosion Test: Heinz Terrace HT-34 (raw)

LOCATION	HT-34 r
DATE	6/30/2016
HEAD (IN)	102.5
PT GAGE H (FT)	2.662
NOZZLE H (FT)	0.240

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.422	0.000
5	5	2.232	0.190
10	5	2.225	0.197
15	5	2.24	0.182
25	10	2.246	0.176
35	10	2.255	0.167
40	5	2.217	0.205

SOLUTIONS			
	Blaisdell	*Iterative*	*Scour Depth*
τ_c (Pa)	42.55	0.06	38.99
k_d (cm^3/N·s)	1.000	0.658	2.899

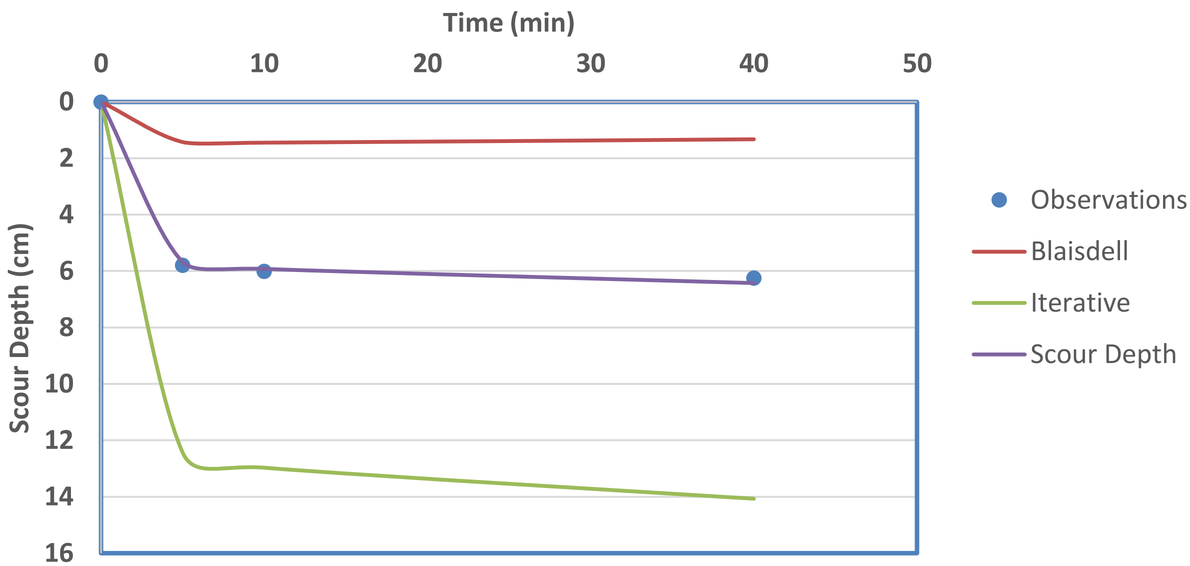


Jet Erosion Test: Heinz Terrace HT-34 (modified)

LOCATION	HT-34 m
DATE	6/30/2016
HEAD (IN)	102.5
PT GAGE H (FT)	2.662
NOZZLE H (FT)	0.240

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.422	0.000
5	5	2.232	0.190
10	5	2.225	0.197
40	30	2.217	0.205

SOLUTIONS			
	Blaisdell	***Iterative***	***Scour Depth***
τ_c (Pa)	40.37	38.99	38.99
k_d (cm^3/N·s)	1.000	8.476	3.870

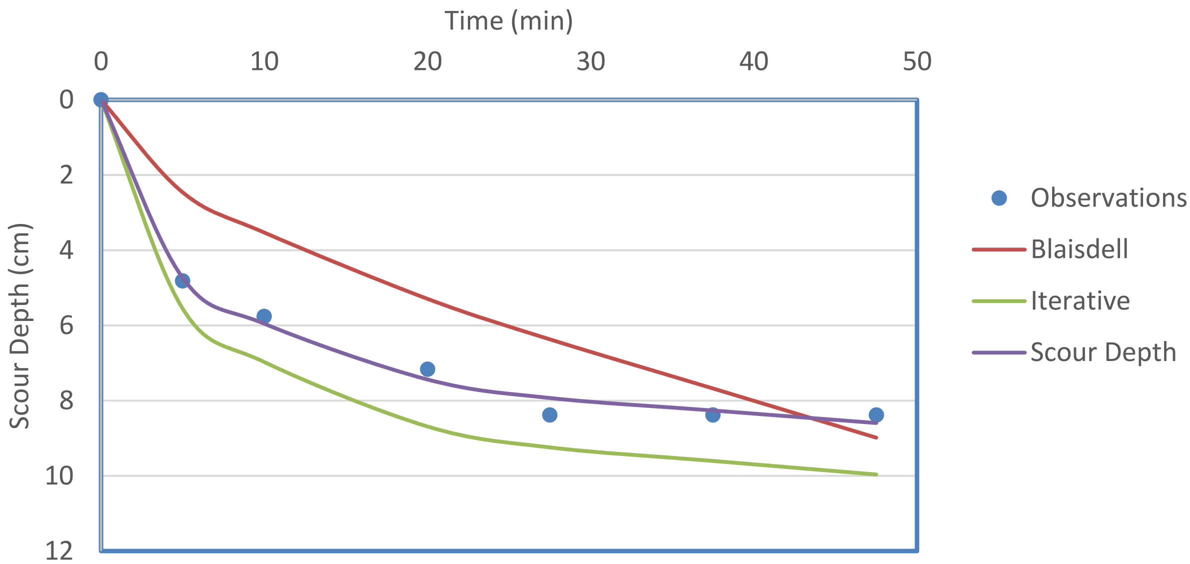


Jet Erosion Test: Heinz Terrace HT-35 (raw)

LOCATION	HT-35 r
DATE	7/5/2016
HEAD (IN)	105.5
PT GAGE H (FT)	2.674
NOZZLE H (FT)	0.199

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.475	0.000
5	5	2.317	0.158
10	5	2.286	0.189
20	10	2.24	0.235
27.5	7.5	2.2	0.275
37.5	10	2.2	0.275
47.5	10	2.2	0.275

SOLUTIONS			
	Blaisdell	***Iterative***	***Scour Depth***
τ_c (Pa)	0.54	32.14	31.87
k_d (cm^3/N·s)	0.626	1.862	1.583

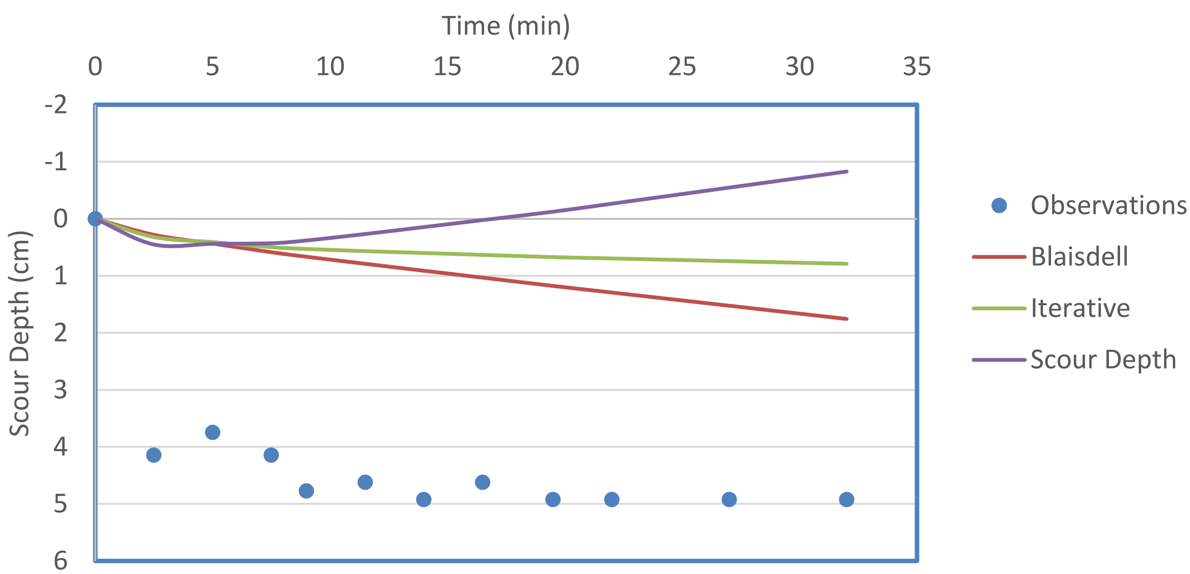


Jet Erosion Test: Heinz Terrace UHT-3 (raw)

LOCATION	UHT-3 r
DATE	7/7/2016
HEAD (IN)	118
PT GAGE H (FT)	2.675
NOZZLE H (FT)	0.335

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.340	0.000
2.5	2.5	2.204	0.136
5	2.5	2.217	0.123
7.5	2.5	2.204	0.136
9	1.5	2.183	0.157
11.5	2.5	2.188	0.152
14	2.5	2.178	0.162
16.5	2.5	2.188	0.152
19.5	3	2.178	0.162
22	2.5	2.178	0.162
27	5	2.178	0.162
32	5	2.178	0.162

SOLUTIONS	Blaisdell	Iterative	Scour Depth
τ_c (Pa)	16.92	35.93	36.03
k_d (cm^3/N·s)	1.437	7.635	8.612

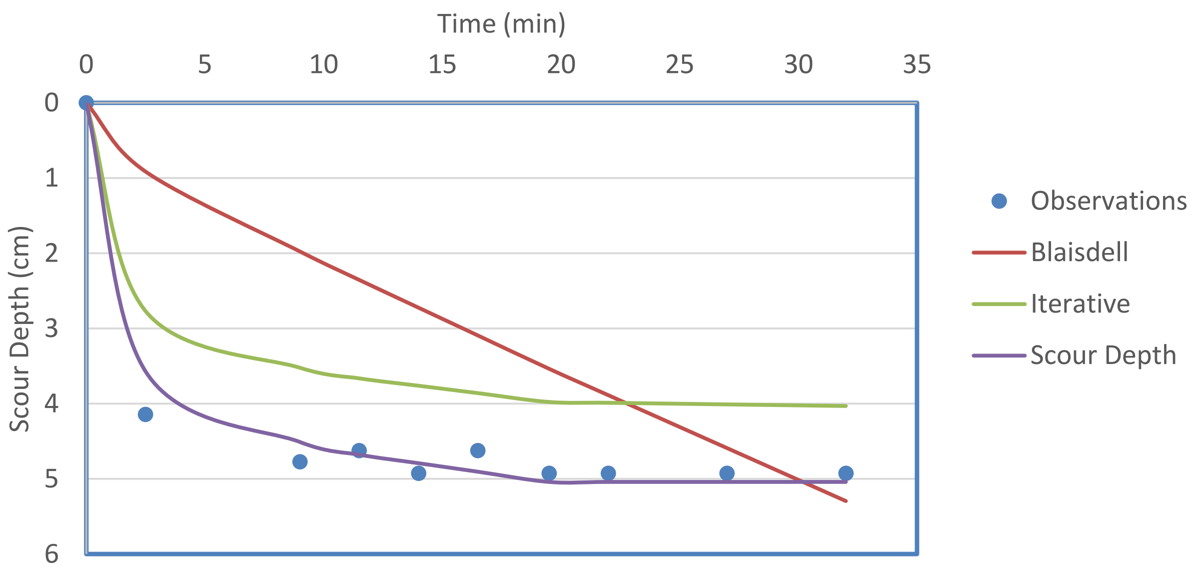


Jet Erosion Test: Heinz Terrace UHT-3 (modified)

LOCATION	UHT-3 m
DATE	7/7/2016
HEAD (IN)	118
PT GAGE H (FT)	2.675
NOZZLE H (FT)	0.335

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.34	0.000
5	5	2.217	0.123
9	4	2.183	0.157
14	5	2.178	0.162
19.5	5.5	2.178	0.162
22	2.5	2.178	0.162
27	5	2.178	0.162
32	5	2.178	0.162

SOLUTIONS			
	Blaisdell	***Iterative***	***Scour Depth***
τ_c (Pa)	12.71	36.02	35.53
k_d (cm^3/N·s)	1.108	10.945	5.403

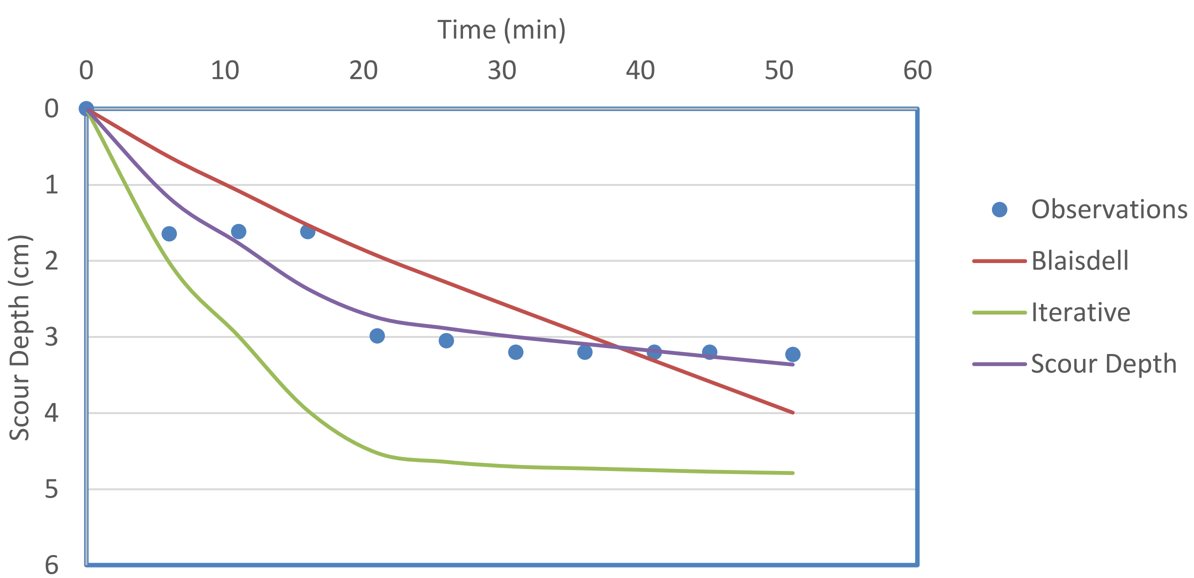


Jet Erosion Test: Heinz Terrace UHT-4 (raw)

LOCATION	UHT-4 r
DATE	7/7/2016
HEAD (IN)	91.5
PT GAGE H (FT)	2.675
NOZZLE H (FT)	0.356

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.319	0.000
6	6	2.265	0.054
11	5	2.266	0.053
16	5	2.266	0.053
21	5	2.221	0.098
26	5	2.219	0.100
31	5	2.214	0.105
36	5	2.214	0.105
41	5	2.214	0.105
45	4	2.214	0.105
51	6	2.213	0.106

SOLUTIONS			
	Blaisdell	***Iterative***	***Scour Depth***
τ_c (Pa)	4.40	32.21	30.84
k_d (cm^3/N·s)	0.406	3.630	1.934

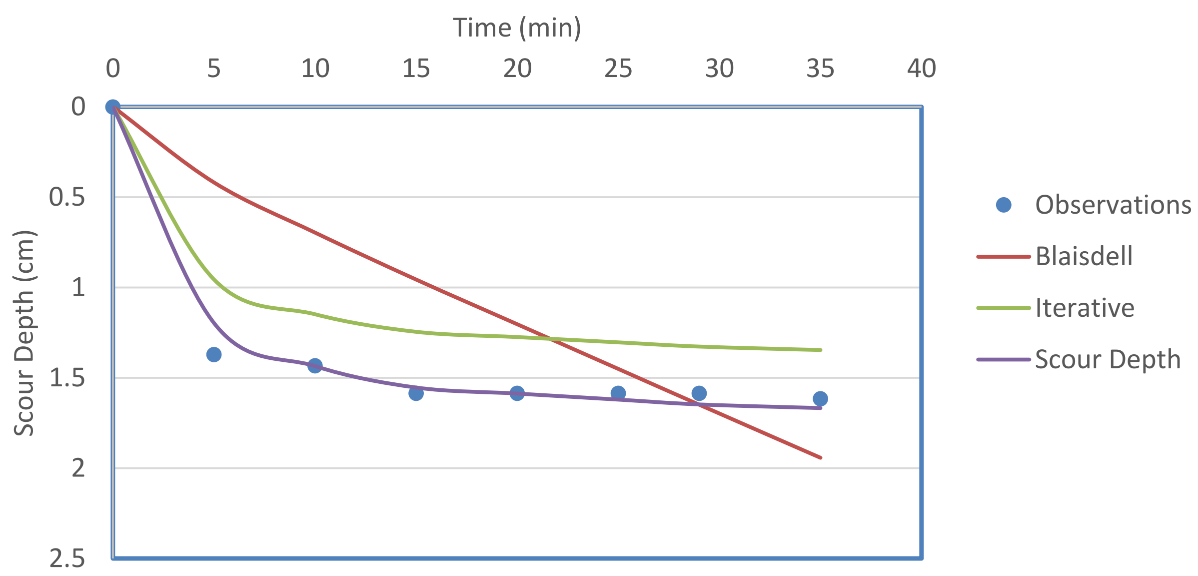


Jet Erosion Test: Heinz Terrace UHT-4 (modified)

LOCATION	UHT-4 m
DATE	7/7/2016
HEAD (IN)	91.5
PT GAGE H (FT)	2.675
NOZZLE H (FT)	0.356

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.319	0.000
6	6	2.265	0.054
21	15	2.221	0.098
26	5	2.219	0.100
31	5	2.214	0.105
36	5	2.214	0.105
41	5	2.214	0.105
45	4	2.214	0.105
51	6	2.213	0.106

SOLUTIONS	*Blaisdell*	*Iterative*	*Scour Depth*
τ_c (Pa)	6.64	32.23	32.15
k_d (cm^3/N·s)	0.430	3.774	2.947

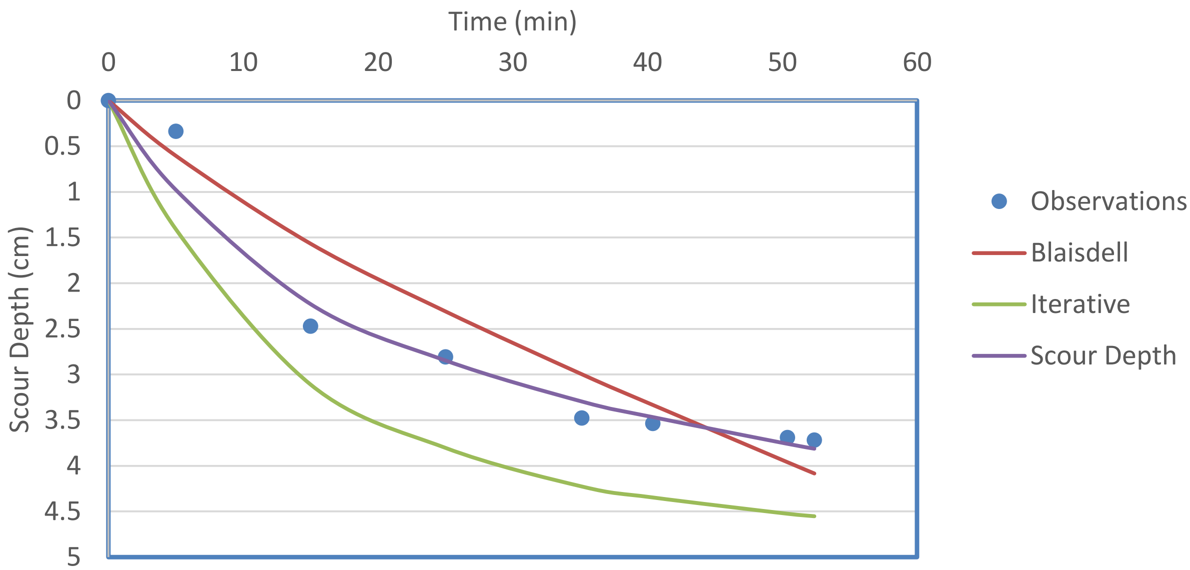


Jet Erosion Test: <u>Heinz Terrace UHT-5 (raw)</u>

LOCATION	UHT-5r
DATE	7/7/2016
HEAD (IN)	96.5
PT GAGE H (FT)	2.675
NOZZLE H (FT)	0.145

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.53	0.000
5	5	2.519	0.011
15	10	2.449	0.081
25	10	2.438	0.092
35.12	10.12	2.416	0.114
40.38	5.26	2.414	0.116
50.38	10	2.409	0.121

SOLUTIONS			
	Blaisdell	***Iterative***	***Scour Depth***
τ_c (Pa)	0.87	40.56	36.29
k_d (cm^3/N·s)	0.247	1.122	0.706

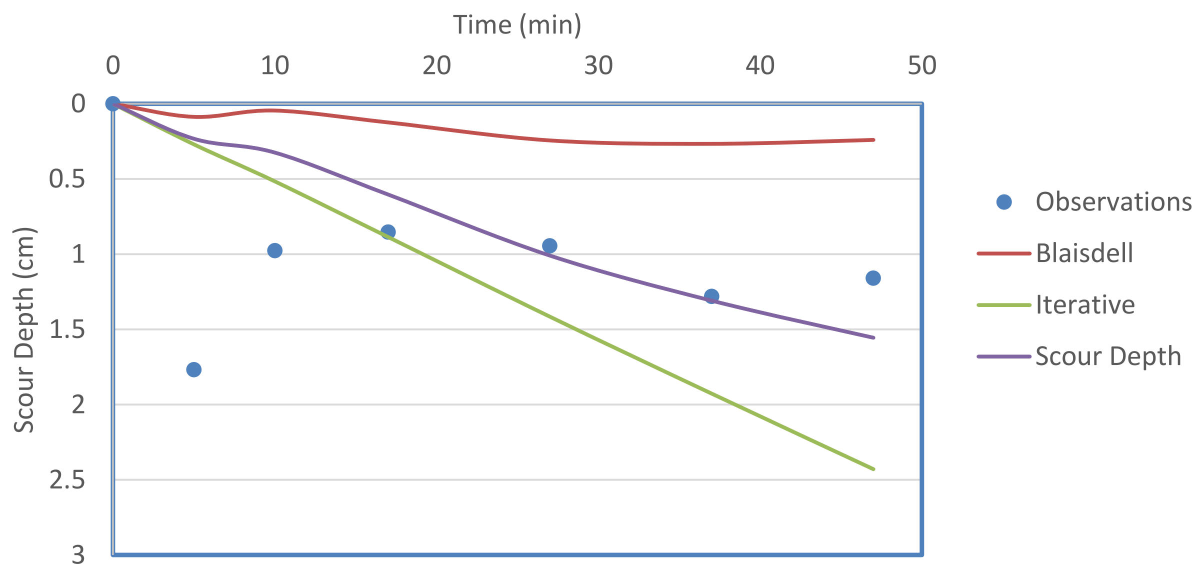


Jet Erosion Test: Heinz Terrace UHT-8 (raw)

LOCATION	UHT-8 r
DATE	7/7/2016
HEAD (IN)	96.79
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.363

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.472	0.000
5	5	2.414	0.058
10	5	2.44	0.032
17	7	2.444	0.028
27	10	2.441	0.031
37	10	2.43	0.042
47	10	2.434	0.038

SOLUTIONS			
	Blaisdell	***Iterative***	***Scour Depth***
τ_c (Pa)	45.33	0.06	41.13
k_d (cm^3/N·s)	1.000	0.187	1.093

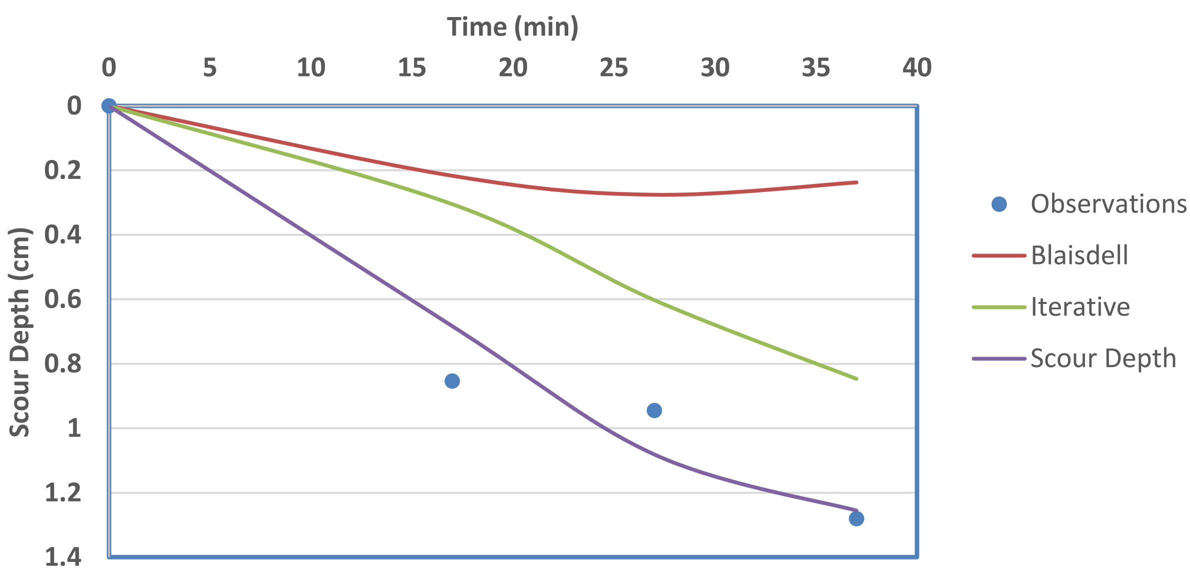


Jet Erosion Test: Heinz Terrace UHT-8 (modified)

LOCATION	UHT-8 m
DATE	7/7/2016
HEAD (IN)	96.79
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.363

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.472	0.000
17	7	2.444	0.028
27	10	2.441	0.031
37	10	2.43	0.042

SOLUTIONS			
	Blaisdell	*Iterative*	*Scour Depth*
τ_c (Pa)	46.34	38.30	44.44
k_d (cm^3/N·s)	1.000	0.550	2.305

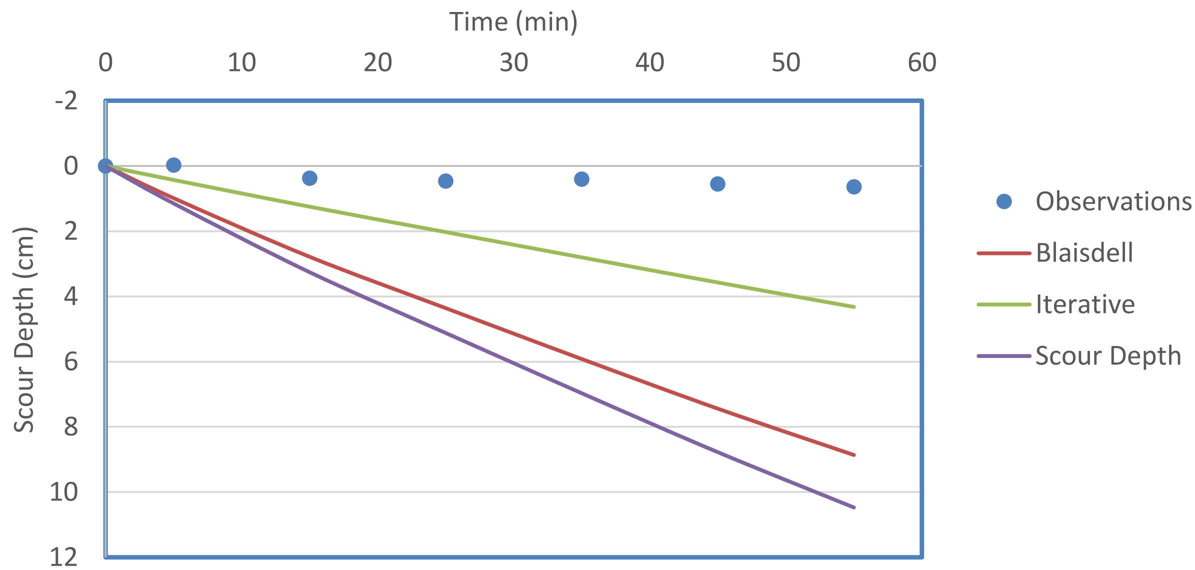


Jet Erosion Test: Heinz Terrace UHT-9 (raw)

LOCATION	UHT-9 r
DATE	7/6/2016
HEAD (IN)	92.5
PT GAGE H (FT)	2.674
NOZZLE H (FT)	0.303

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.371	0.000
5	5	2.372	-0.001
15	10	2.359	0.012
25	10	2.356	0.015
35	10	2.358	0.013
45	10	2.353	0.018
55	10	2.35	0.021

SOLUTIONS	*Blaisdell*	*Iterative*	*Scour Depth*
τ_c (Pa)	69.80	63.42	64.43
k_d (cm^3/N·s)	1.000	0.296	0.324

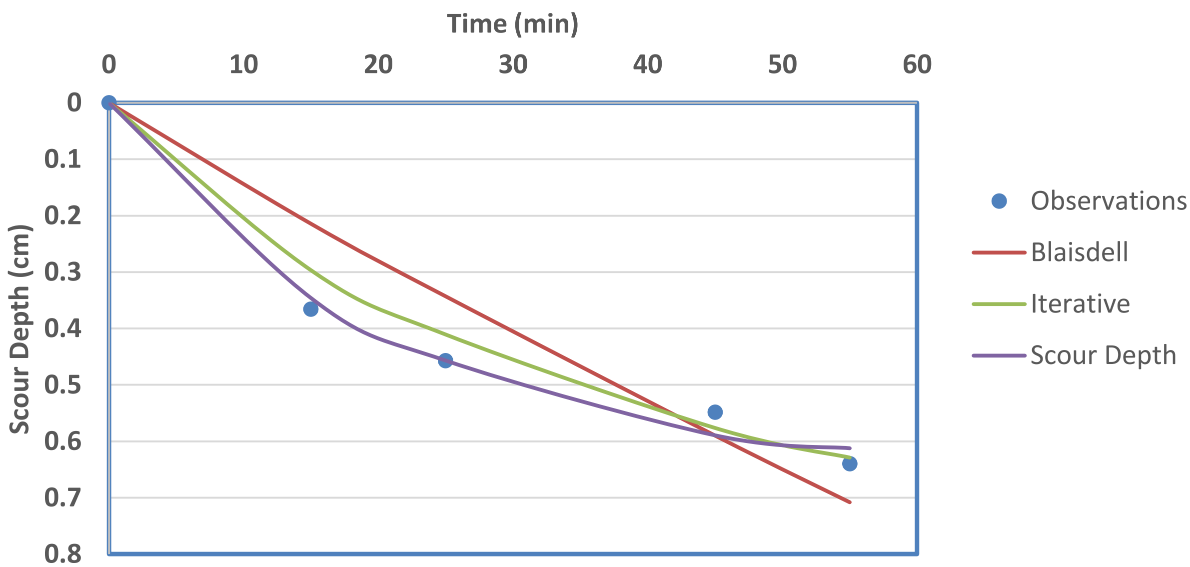


Jet Erosion Test: Heinz Terrace UHT-9 (modified)

LOCATION	UHT-9 m
DATE	7/6/2016
HEAD (IN)	92.5
PT GAGE H (FT)	2.674
NOZZLE H (FT)	0.303

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.371	0.000
15	15	2.359	0.012
25	10	2.356	0.015
45	20	2.353	0.018
55	10	2.35	0.021

SOLUTIONS			
	Blaisdell	***Iterative***	***Scour Depth***
τ_c (Pa)	37.91	64.80	66.32
k_d (cm^3/N·s)	0.068	0.400	0.571

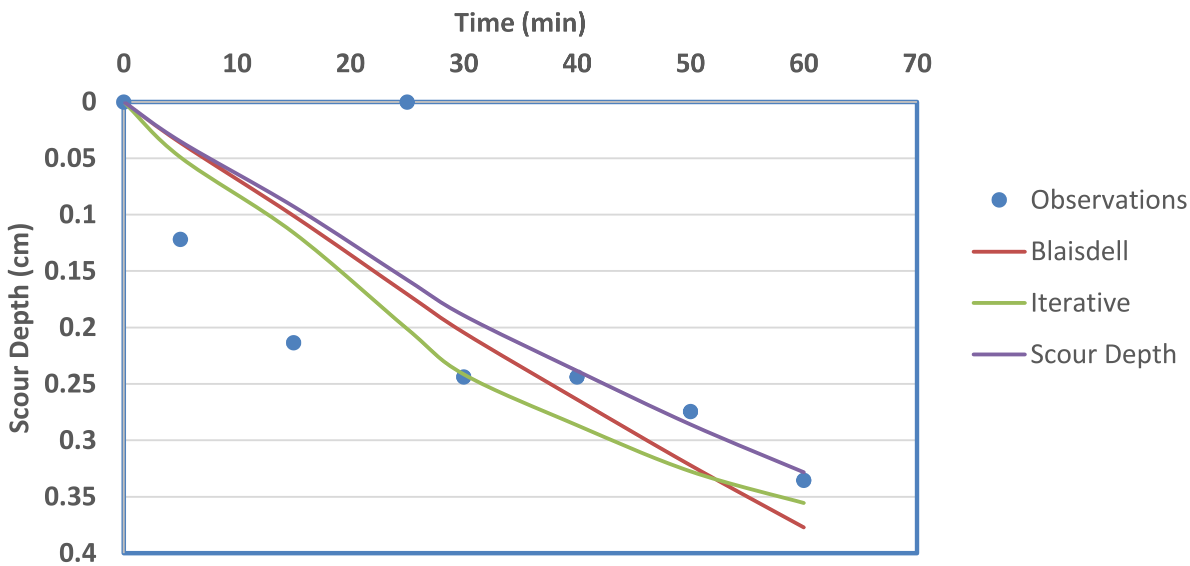


Jet Erosion Test: Heinz Terrace UHT-11 (raw)

LOCATION	UHT-11 r
DATE	7/6/2016
HEAD (IN)	111
PT GAGE H (FT)	2.765
NOZZLE H (FT)	0.436

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.329	0.000
5	5	2.325	0.004
15	10	2.322	0.007
25	10	2.321	0.008
30	5	2.321	0.008
40	10	2.321	0.008
50	10	2.32	0.009
60	10	2.318	0.011

SOLUTIONS	*Blaisdell*	*Iterative*	*Scour Depth*
τ_c (Pa)	37.16	41.41	39.66
k_d (cm^3/N·s)	0.188	0.754	0.298

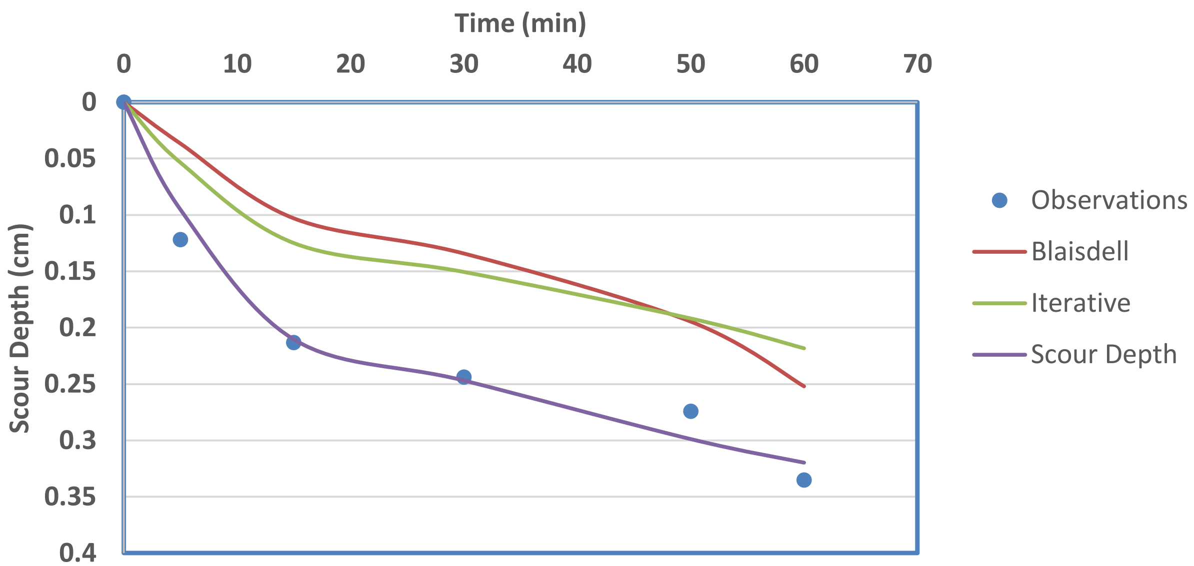


Jet Erosion Test: Heinz Terrace UHT-11 (modified)

LOCATION	UHT-11 m
DATE	7/6/2016
HEAD (IN)	111
PT GAGE H (FT)	2.765
NOZZLE H (FT)	0.436

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.329	0.000
5	5	2.325	0.004
15	10	2.322	0.007
30	5	2.321	0.008
50	10	2.32	0.009
60	10	2.318	0.011

SOLUTIONS			
	Blaisdell	***Iterative***	***Scour Depth***
τ_c (Pa)	36.46	41.52	41.84
k_d (cm^3/N·s)	0.172	0.868	1.823

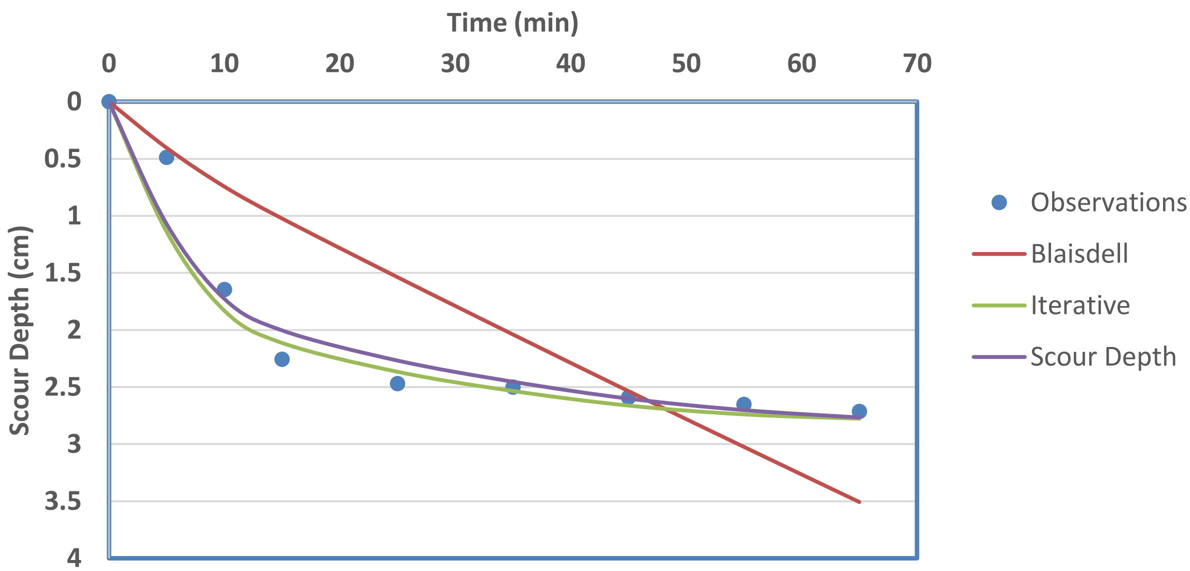


Jet Erosion Test: Heinz Terrace FT-2 (raw)

LOCATION	FT- 2 r
DATE	7/14/2016
HEAD (IN)	117.5
PT GAGE H (FT)	2.836
NOZZLE H (FT)	0.302

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.534	0.000
5	5	2.518	0.016
10	5	2.480	0.054
15	5	2.460	0.074
25	10	2.453	0.081
35	10	2.452	0.082
45	10	2.449	0.085
55	10	2.447	0.087
65	10	2.445	0.089

SOLUTIONS			
	Blaisdell	***Iterative***	***Scour Depth***
τ_c **(Pa)**	7.51	57.61	57.13
k_d **(cm^3/N·s)**	0.159	1.095	1.015

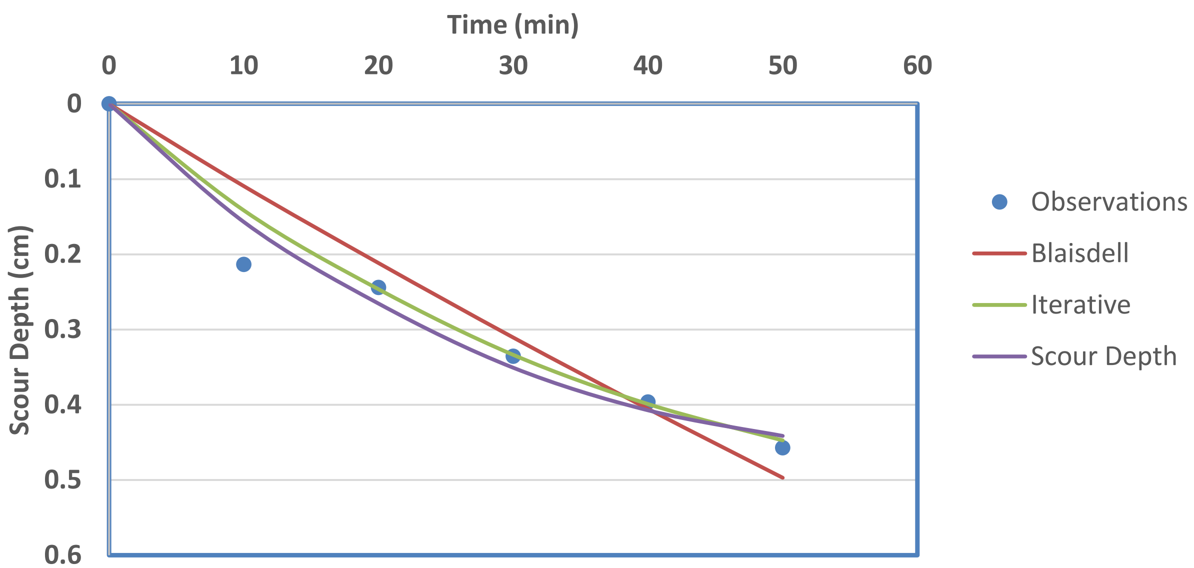


Jet Erosion Test: Heinz Terrace FT-2 (modified)

LOCATION	FT- 2 m
DATE	7/14/2016
HEAD (IN)	117.5
PT GAGE H (FT)	2.836
NOZZLE H (FT)	0.376

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.460	0.000
10	10	2.453	0.007
20	10	2.452	0.008
30	10	2.449	0.011
40	10	2.447	0.013
50	10	2.445	0.015

SOLUTIONS			
	Blaisdell	*Iterative*	*Scour Depth*
τ_c (Pa)	41.20	56.49	57.28
k_d (cm^3/N·s)	0.090	0.474	0.625

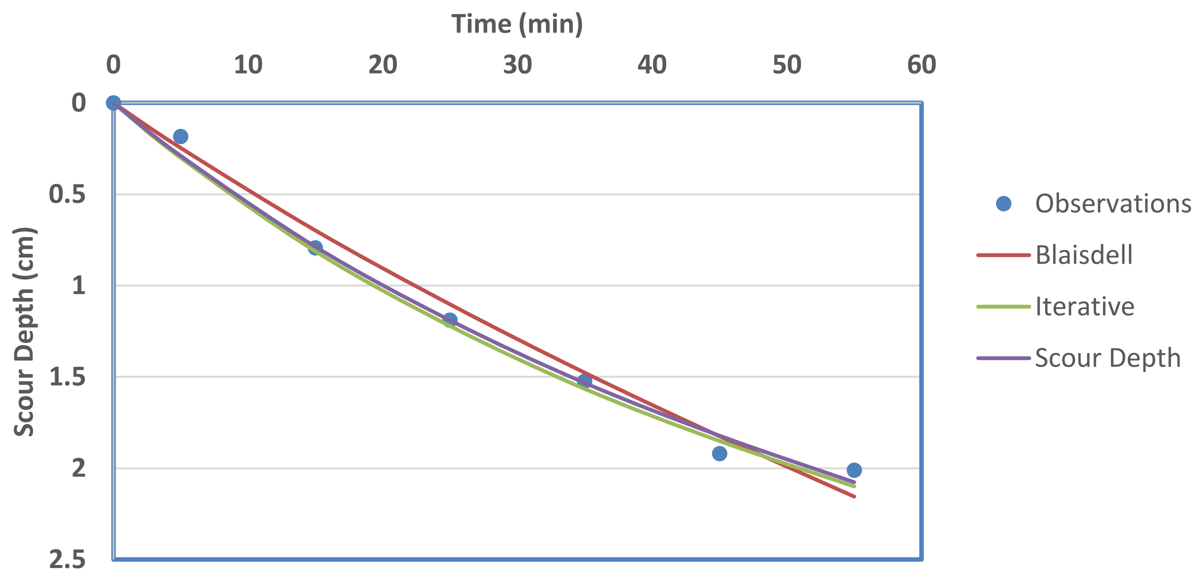


Jet Erosion Test: Heinz Terrace FT-6 (raw)

LOCATION	FT- 6 r
DATE	7/14/2016
HEAD (IN)	120.625
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.316

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.519	0.000
5	5	2.513	0.006
15	10	2.493	0.026
25	10	2.480	0.039
35	10	2.469	0.050
45	10	2.456	0.063
55	10	2.453	0.066

SOLUTIONS	Blaisdell	Iterative	Scour Depth
τ_c (Pa)	8.67	44.02	41.89
k_d (cm^3/N·s)	0.102	0.221	0.204

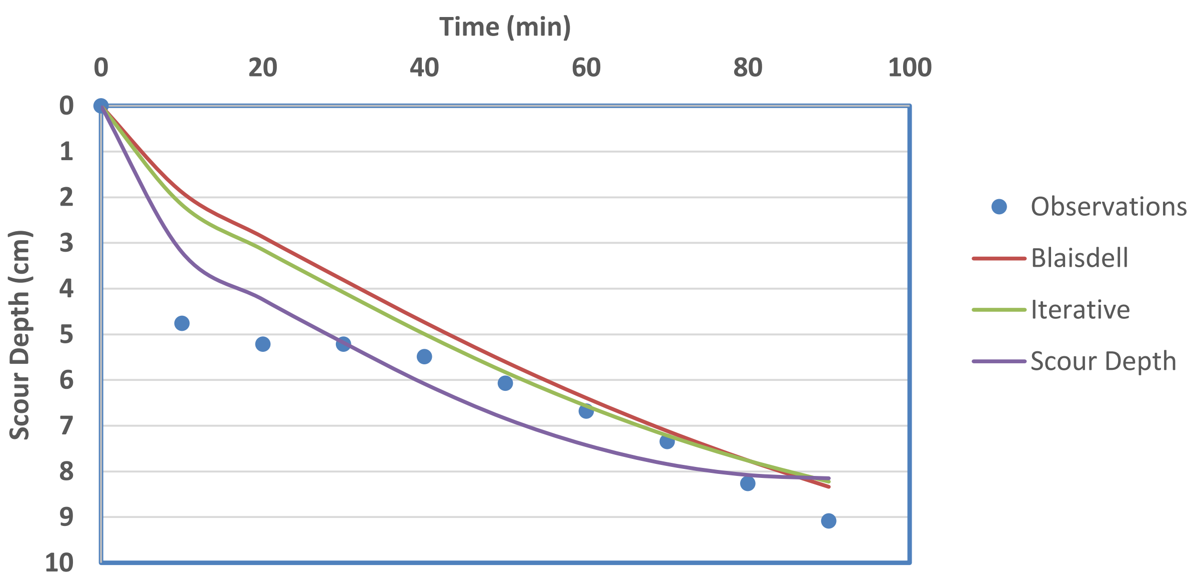


Jet Erosion Test: Heinz Terrace FT-9 (raw)

LOCATION	FT- 9 r
DATE	7/18/2016
HEAD (IN)	132.75
PT GAGE H (FT)	2.834
NOZZLE H (FT)	0.244

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.590	0.000
10	10	2.434	0.156
20	10	2.419	0.171
30	10	2.419	0.171
40	10	2.410	0.180
50	10	2.391	0.199
60	10	2.371	0.219
70	10	2.349	0.241
80	10	2.319	0.271
90	10	2.292	0.298

SOLUTIONS			
	Blaisdell	***Iterative***	***Scour Depth***
τ_c **(Pa)**	0.98	14.44	34.04
k_d **(cm³/N·s)**	0.276	0.358	0.657

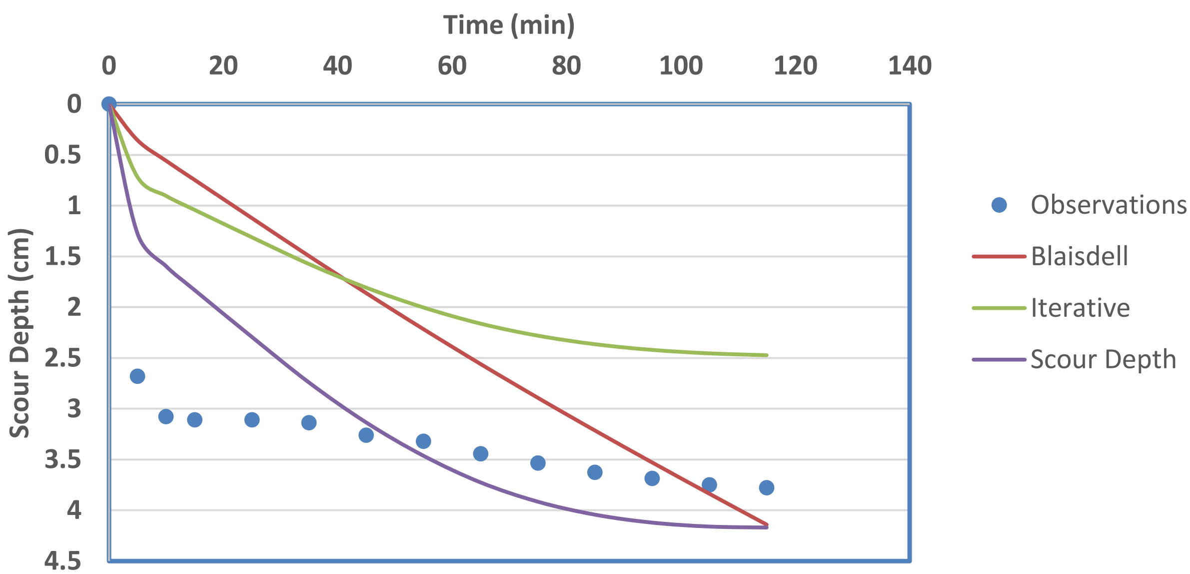


Jet Erosion Test: Heinz Terrace FT-12 (raw)

LOCATION	FT- 12 r
DATE	7/18/2016
HEAD (IN)	100.5
PT GAGE H (FT)	2.833
NOZZLE H (FT)	0.266

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.567	0.000
5	5	2.479	0.088
10	5	2.466	0.101
15	5	2.465	0.102
25	10	2.465	0.102
35	10	2.464	0.103
45	10	2.460	0.107
55	10	2.458	0.109
65	10	2.454	0.113
75	10	2.451	0.116
85	10	2.448	0.119
95	10	2.446	0.121
105	10	2.444	0.123
115	10	2.443	0.124

	Blaisdell	*Iterative*	*Scour Depth*
τ_c (Pa)	24.74	49.47	49.77
k_d (cm^3/N·s)	0.201	0.700	1.253

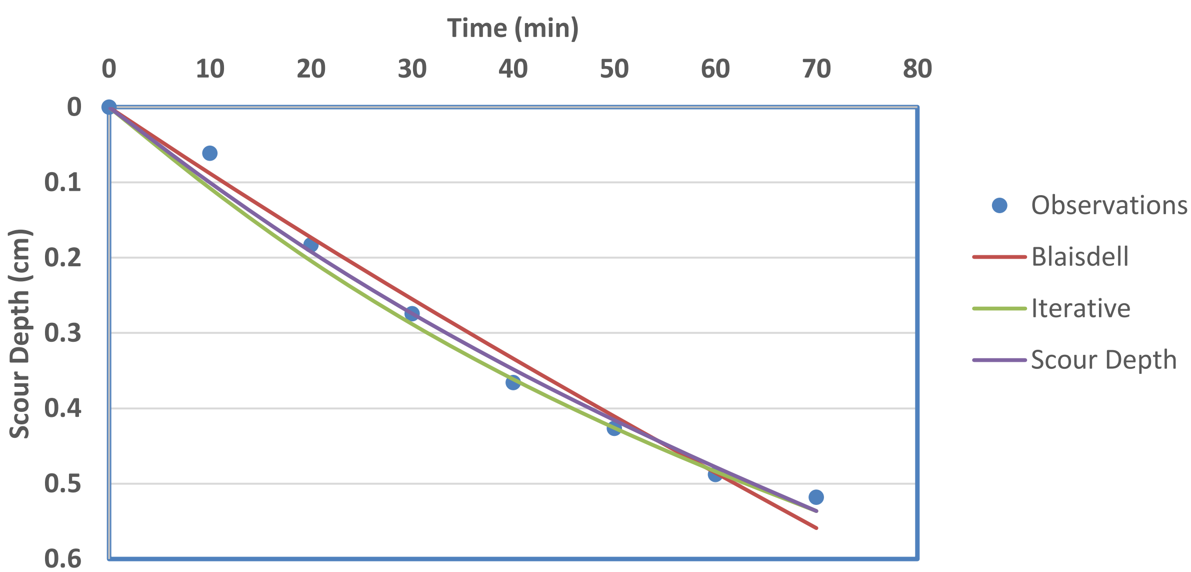


Jet Erosion Test: Heinz Terrace FT-12 (modified)

LOCATION	**FT- 12 m**
DATE	7/18/2016
HEAD (IN)	100.5
PT GAGE H (FT)	2.833
NOZZLE H (FT)	0.373

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.46	0.000
10	10	2.458	0.002
20	10	2.454	0.006
30	10	2.451	0.009
40	10	2.448	0.012
50	10	2.446	0.014
60	10	2.444	0.016
70	10	2.443	0.017

	Blaisdell	*Iterative*	*Scour Depth*
τ_c (Pa)	28.41	45.84	43.98
k_d (cm^3/N·s)	0.057	0.217	0.165

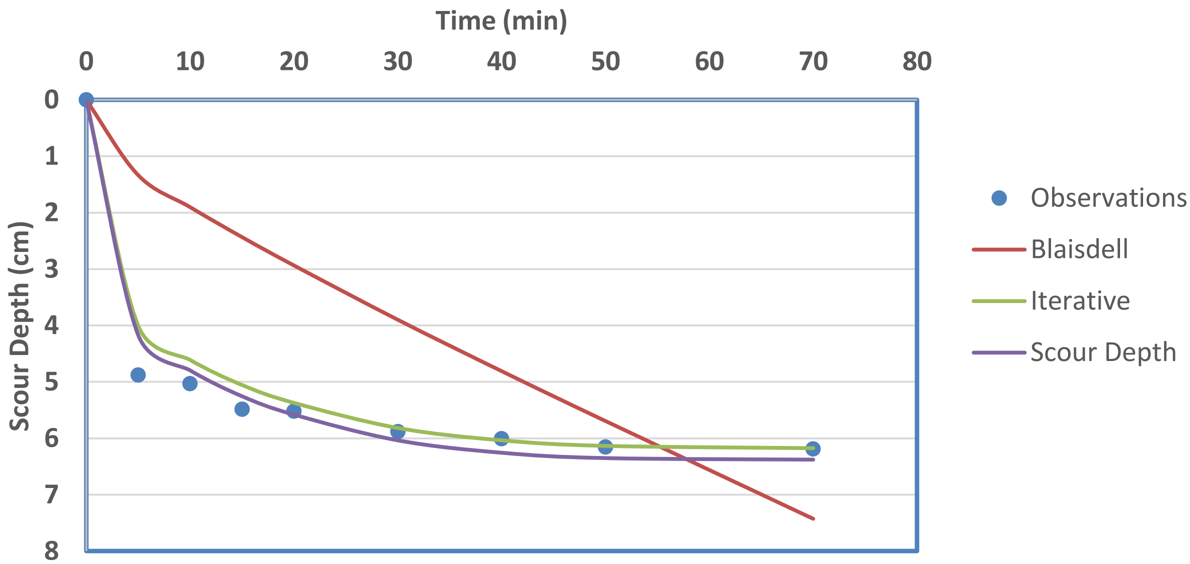


Jet Erosion Test: Heinz Terrace FT-13 (raw)

LOCATION	**FT- 13 r**
DATE	7/26/2016
HEAD (IN)	126.5
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.218

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.617	0.000
5	5	2.457	0.160
10	5	2.452	0.165
15	5	2.437	0.180
20	5	2.436	0.181
30	10	2.424	0.193
40	10	2.420	0.197
50	10	2.415	0.202
70	20	2.414	0.203

SOLUTIONS	***Blaisdell***	***Iterative***	***Scour Depth***
τ_c (Pa)	15.54	53.68	53.76
k_d (cm^3/N·s)	0.377	1.670	1.740

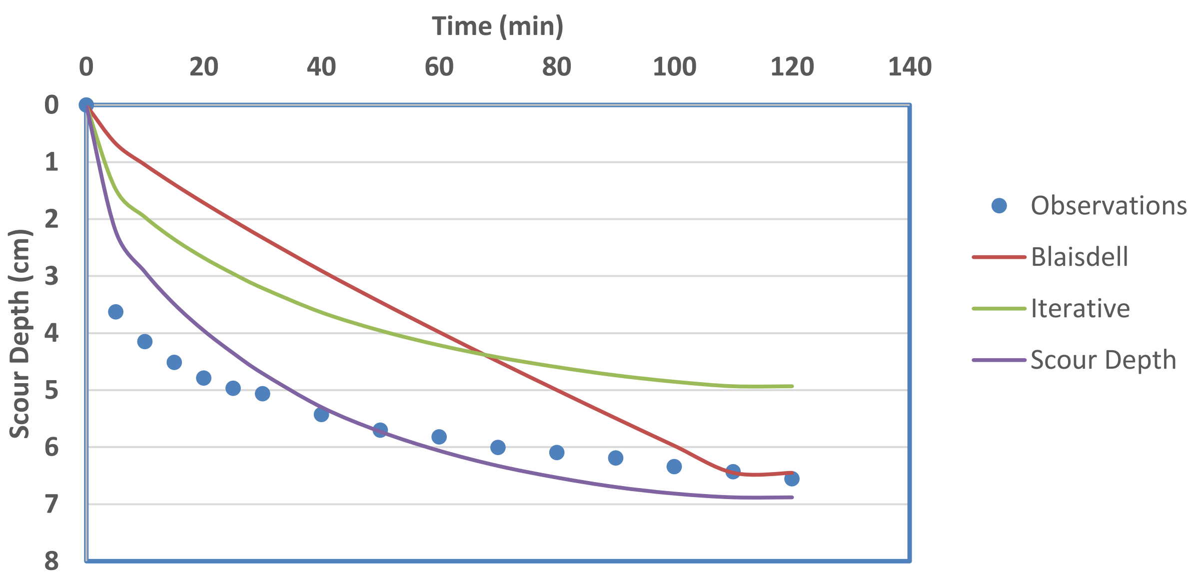


Jet Erosion Test: Heinz Terrace FT-14 (raw)

LOCATION	FT- 14 r
DATE	7/18/2016
HEAD (IN)	91.5
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.229

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.606	0.000
5	5	2.487	0.119
10	5	2.470	0.136
15	5	2.458	0.148
20	5	2.449	0.157
25	5	2.443	0.163
30	5	2.440	0.166
40	10	2.428	0.178
50	10	2.419	0.187
60	10	2.415	0.191
70	10	2.409	0.197
80	10	2.406	0.2
90	10	2.403	0.203
100	10	2.398	0.208
110	10	2.395	0.211
120	10	2.391	0.215

SOLUTIONS	*Blaisdell*	*Iterative*	*Scour Depth*
τ_c (Pa)	4.18	34.23	34.96
k_d (cm^3/N·s)	0.250	0.819	1.242

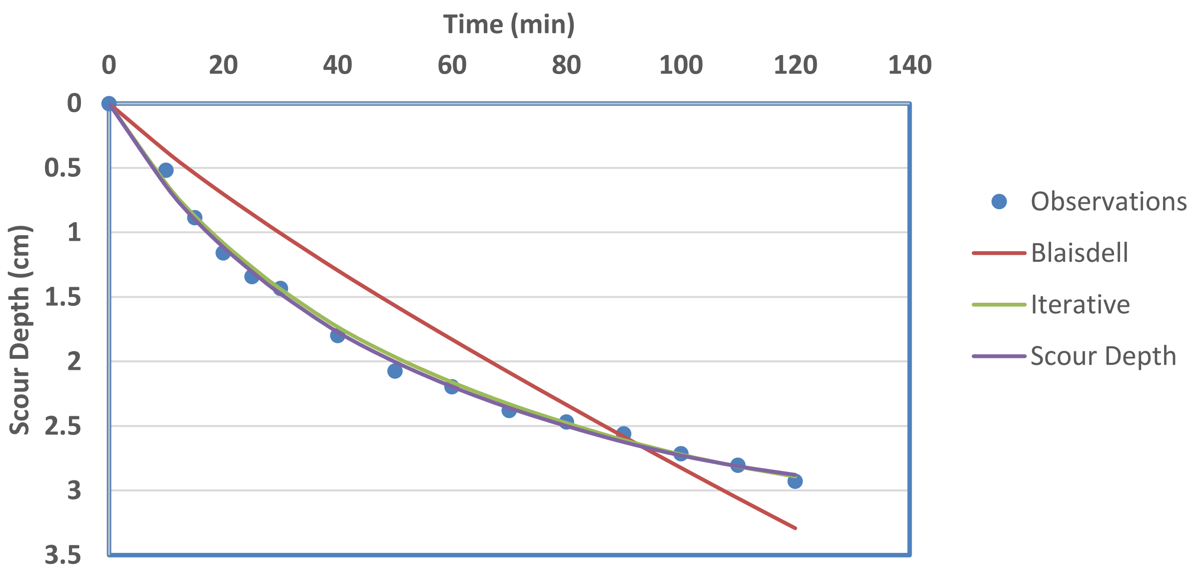


Jet Erosion Test: Heinz Terrace FT-14 (modified)

LOCATION	FT- 14 m
DATE	7/18/2016
HEAD (IN)	91.5
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.348

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.487	0.000
10	5	2.47	0.017
15	5	2.458	0.029
20	5	2.449	0.038
25	5	2.443	0.044
30	5	2.44	0.047
40	10	2.428	0.059
50	10	2.419	0.068
60	10	2.415	0.072
70	10	2.409	0.078
80	10	2.406	0.081
90	10	2.403	0.084
100	10	2.398	0.089
110	10	2.395	0.092
120	10	2.391	0.096

SOLUTIONS			
	Blaisdell	*Iterative*	*Scour Depth*
τ_c (Pa)	3.55	32.58	33.07
k_d (cm^3/N·s)	0.122	0.476	0.503



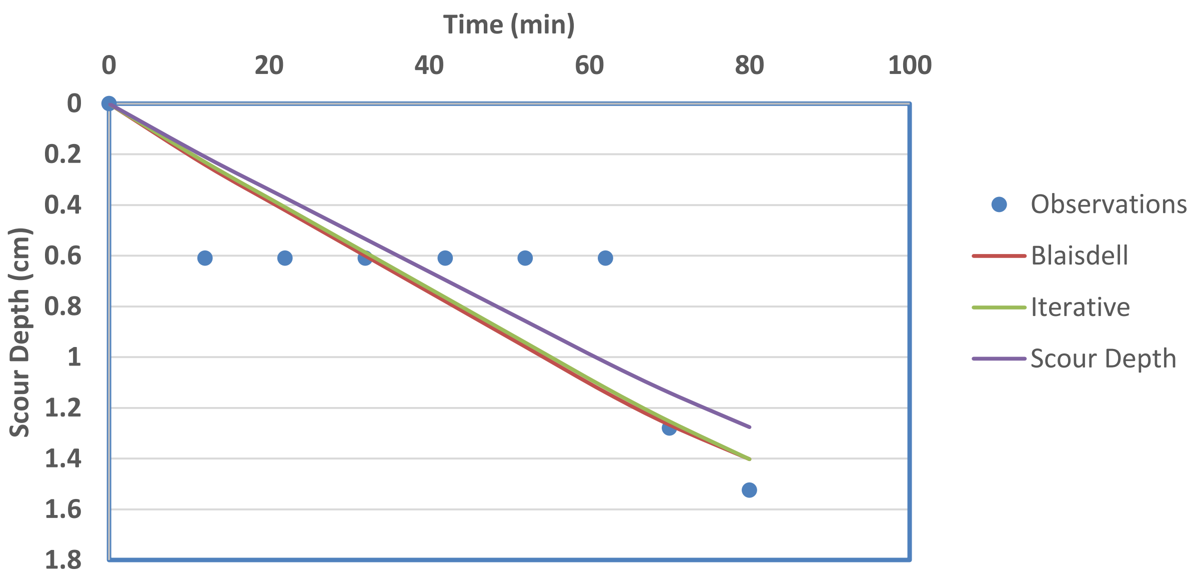
Jet Erosion Test: Heinz Terrace FT-15 (raw)

LOCATION	FT- 15 r
DATE	7/14/2016
HEAD (IN)	127.125
PT GAGE H (FT)	2.833
NOZZLE H (FT)	0.263

Insignificant erosion occurred- test not included in study

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.570	0.000
12	12	2.550	0.020
22	10	2.550	0.020
32	10	2.550	0.020
42	10	2.550	0.020
52	10	2.550	0.020
62	10	2.550	0.020
70	8	2.528	0.042
80	10	2.520	0.050

SOLUTIONS			
	Blaisdell	*Iterative*	*Scour Depth*
τ_c (Pa)	40.96	0.06	0.00
k_d (cm^3/N·s)	0.038	0.025	0.023



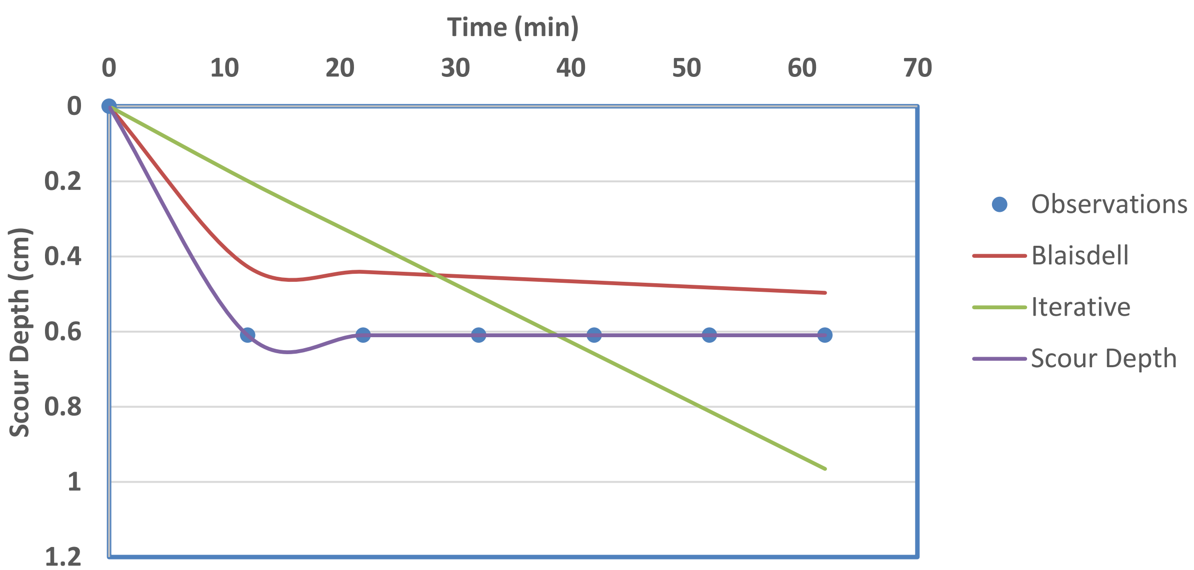
Jet Erosion Test: Heinz Terrace FT-15 (modified)

LOCATION	**FT-15 m**
DATE	7/14/2016
HEAD (IN)	127.125
PT GAGE H (FT)	2.833
NOZZLE H (FT)	0.263

Insignificant erosion occurred-
test not included in study

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.570	0.000
12	12	2.550	0.020
22	10	2.550	0.020
32	10	2.550	0.020
42	10	2.550	0.020
52	10	2.550	0.020
62	10	2.550	0.020

SOLUTIONS			
	Blaisdell	***Iterative***	***Scour Depth***
τ_c (Pa)	119.17	1.01	119.55
k_d (cm^3/N·s)	0.604	0.022	0.897

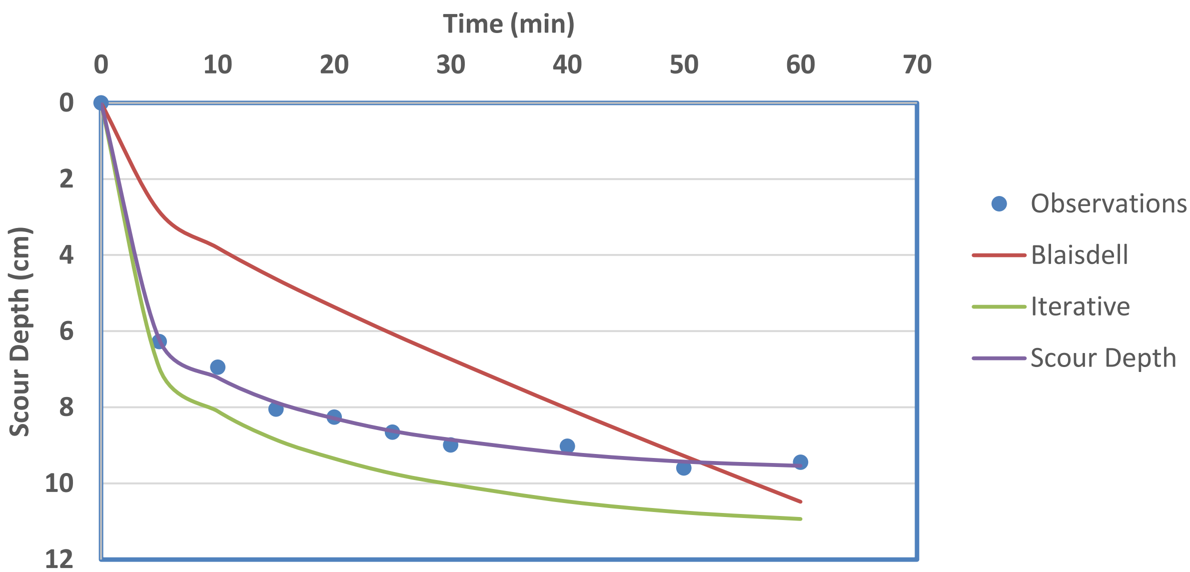


Jet Erosion Test: Heinz Terrace FT-16 (raw)

LOCATION	FT- 16 r
DATE	7/14/2016
HEAD (IN)	104.75
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.180

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.655	0.000
5	5	2.449	0.206
10	5	2.427	0.228
15	5	2.391	0.264
20	5	2.384	0.271
25	5	2.371	0.284
30	5	2.360	0.295
40	10	2.359	0.296
50	10	2.340	0.315
60	10	2.345	0.310

SOLUTIONS			
	Blaisdell	*Iterative*	*Scour Depth*
τ_c (Pa)	1.65	31.09	31.50
k_d (cm^3/N·s)	0.651	1.983	1.777

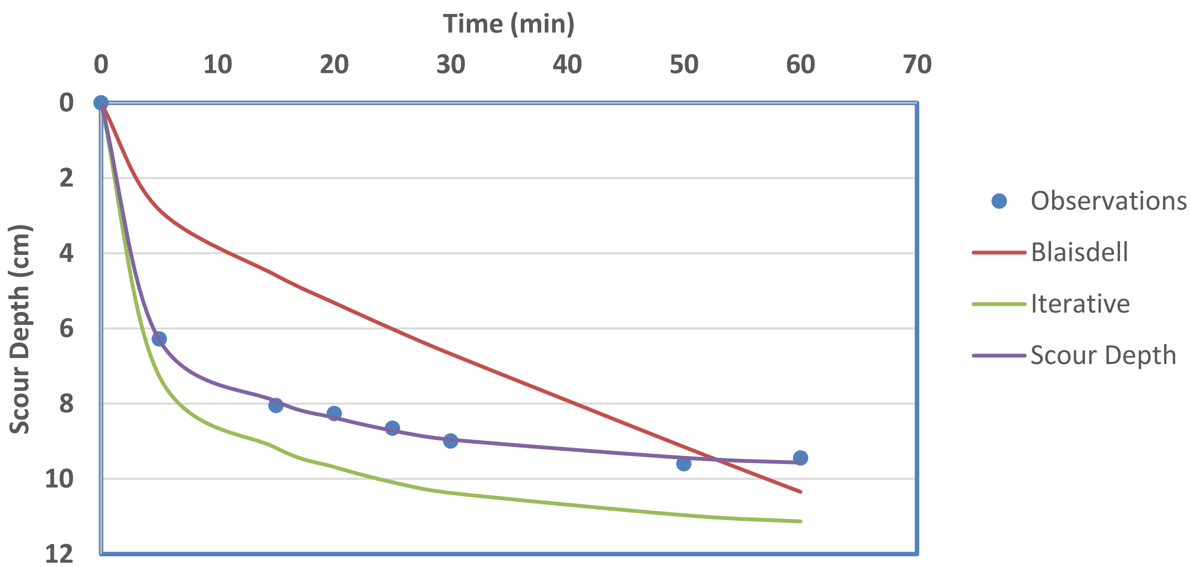


Jet Erosion Test: Heinz Terrace FT-16 (modified)

LOCATION	FT- 16 m
DATE	7/14/2016
HEAD (IN)	104.75
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.180

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.655	0.000
5	5	2.449	0.206
15	10	2.391	0.264
20	5	2.384	0.271
25	5	2.371	0.284
30	5	2.360	0.295
50	20	2.340	0.315
60	10	2.345	0.310

SOLUTIONS			
	Blaisdell	*Iterative*	*Scour Depth*
τ_c (Pa)	1.81	31.21	31.35
k_d (cm^3/N·s)	0.648	2.072	1.798

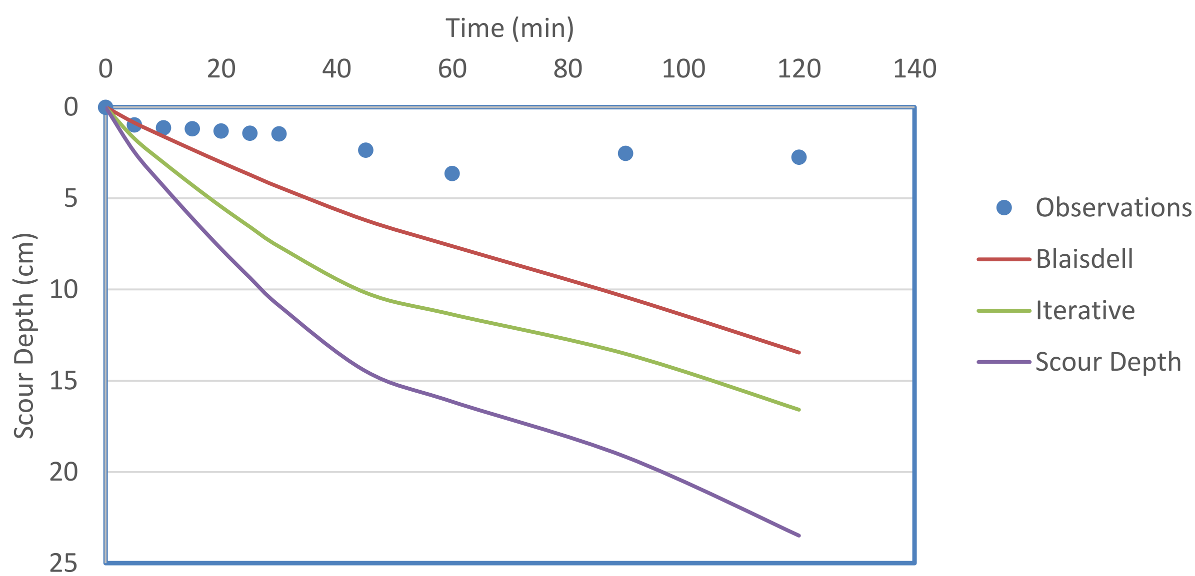


Jet Erosion Test: Heinz Terrace FT-20 (raw)

LOCATION	FT- 20 r
DATE	7/21/2016
HEAD (IN)	104.625
PT GAGE H (FT)	2.830
NOZZLE H (FT)	0.210

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.620	0.000
5	5	2.460	0.160
10	5	2.445	0.175
15	5	2.430	0.190
20	5	2.420	0.200
25	5	2.419	0.201
30	5	2.416	0.204
45	15	2.411	0.209
60	15	2.410	0.210
83	23	2.406	0.214
90	7	2.400	0.220

SOLUTIONS			
	Blaisdell	*Iterative*	*Scour Depth*
τ_c (Pa)	11.44	42.40	42.62
k_d (cm^3/N·s)	0.372	1.274	1.826

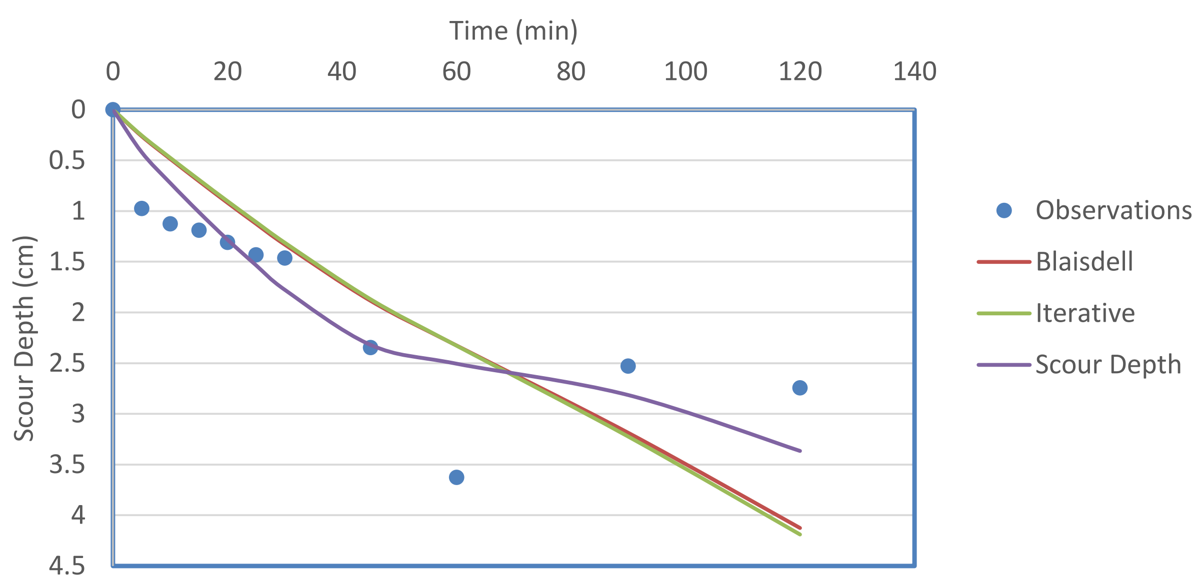


Jet Erosion Test: Heinz Terrace FT-22 (raw)

LOCATION	**FT- 22 r**
DATE	7/21/2016
HEAD (IN)	93
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.268

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.567	0.000
5	5	2.535	0.032
10	5	2.530	0.037
15	5	2.528	0.039
20	5	2.524	0.043
25	5	2.520	0.047
30	5	2.519	0.048
45	15	2.490	0.077
60	15	2.448	0.119
90	30	2.484	0.083
120	30	2.477	0.090

SOLUTIONS			
	Blaisdell	***Iterative***	***Scour Depth***
τ_c (Pa)	7.86	0.06	46.77
k_d (cm^3/N·s)	0.109	0.096	0.341

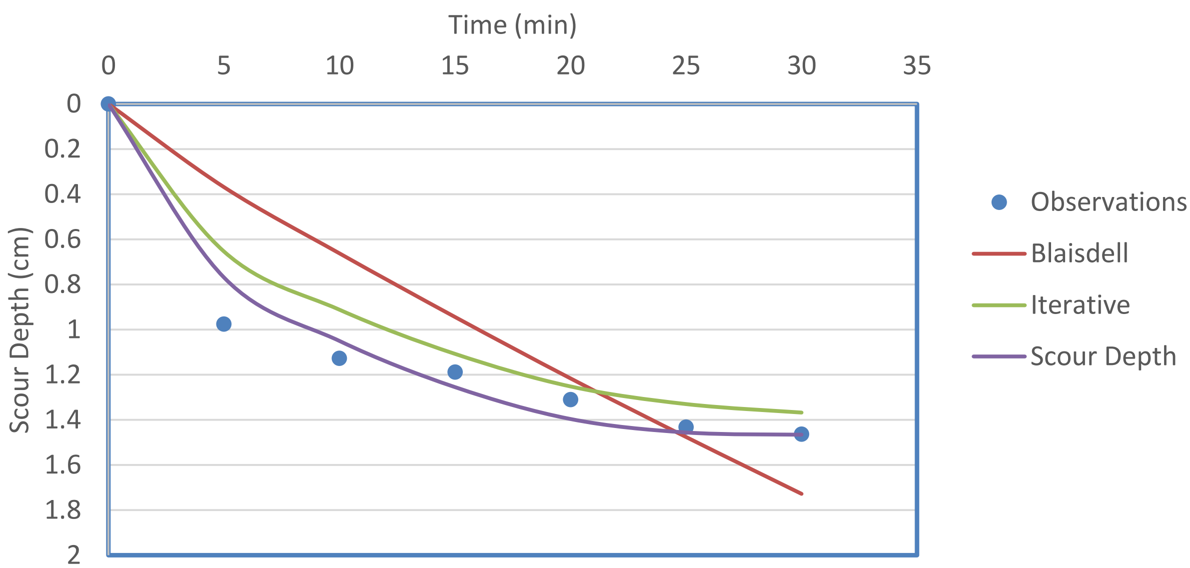


Jet Erosion Test: <u>Heinz Terrace FT-22 (modified)</u>

LOCATION	**FT- 22 m**
DATE	7/21/2016
HEAD (IN)	93
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.268

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.567	0.000
5	5	2.535	0.032
10	5	2.530	0.037
15	5	2.528	0.039
20	5	2.524	0.043
25	5	2.520	0.047
30	5	2.519	0.048

SOLUTIONS			
	Blaisdell	***Iterative***	***Scour Depth***
τ_c (Pa)	32.96	69.31	70.15
k_d (cm^3/N·s)	0.224	1.187	1.462

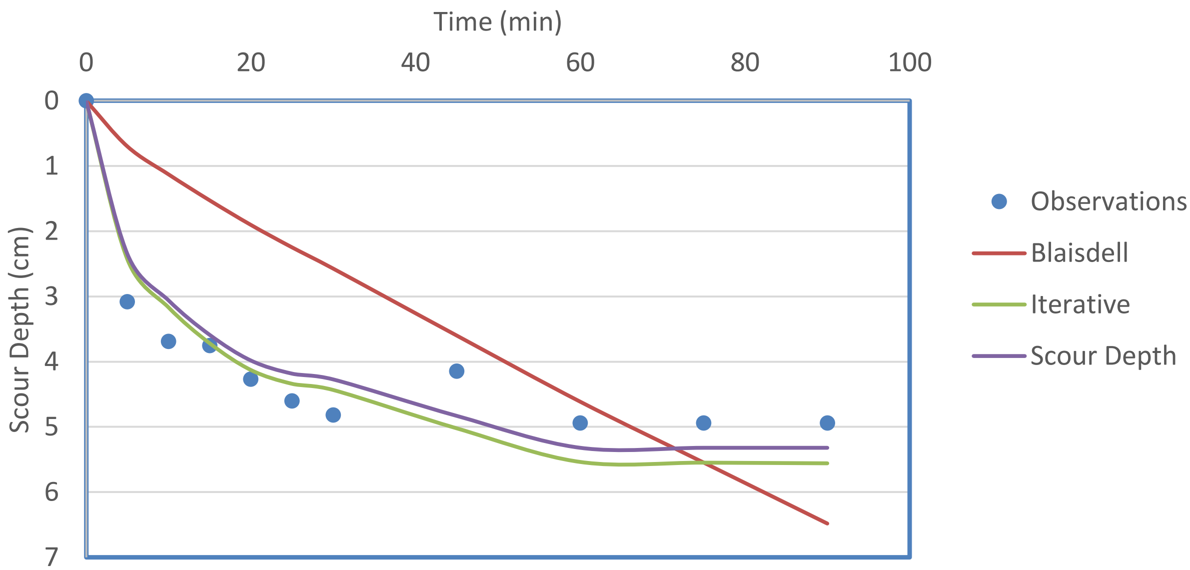


Jet Erosion Test: Heinz Terrace FT-23 (raw)

LOCATION	FT- 23 r
DATE	7/20/2016
HEAD (IN)	108
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.274

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.561	0.000
5	5	2.460	0.101
10	5	2.440	0.121
15	5	2.438	0.123
20	5	2.421	0.140
25	5	2.410	0.151
30	5	2.403	0.158
45	15	2.425	0.136
60	15	2.399	0.162
75	15	2.399	0.162
90	15	2.399	0.162

SOLUTIONS			
	Blaisdell	*Iterative*	*Scour Depth*
τ_c (Pa)	10.46	47.86	42.79
k_d (cm^3/N·s)	0.321	1.792	1.943

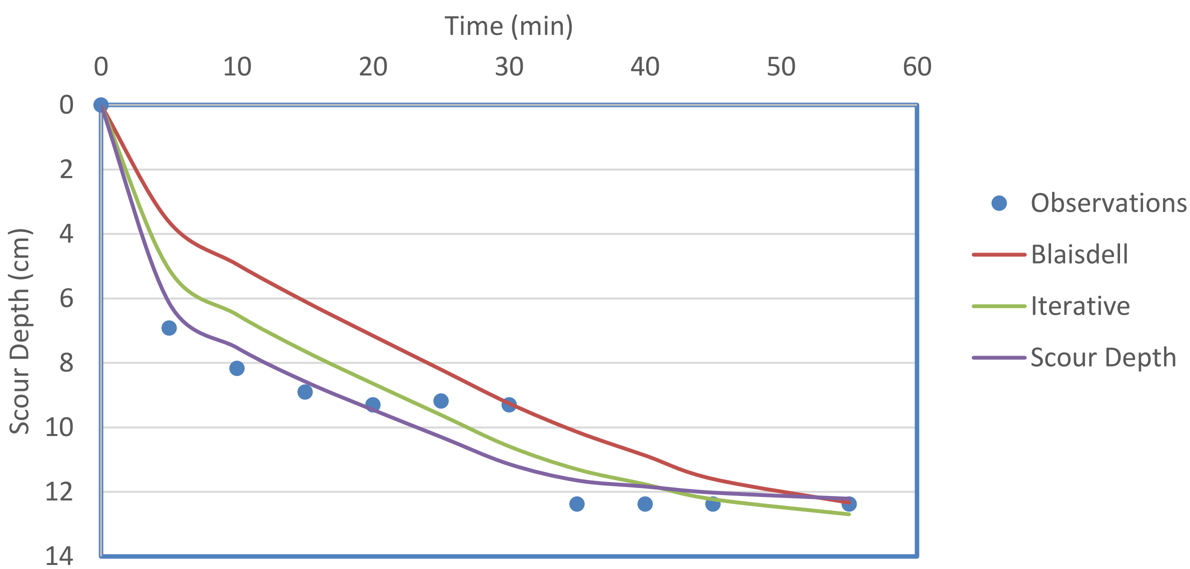


Jet Erosion Test: Heinz Terrace FT-24 (raw)

LOCATION	FT- 24 r
DATE	7/19/2016
HEAD (IN)	97
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.225

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.610	0.000
5	5	2.383	0.227
10	5	2.342	0.268
15	5	2.318	0.292
20	5	2.305	0.305
25	5	2.309	0.301
30	5	2.305	0.305
35	5	2.204	0.406
40	5	2.204	0.406
45	5	2.204	0.406
55	5	2.204	0.406

SOLUTIONS			
	Blaisdell	***Iterative***	***Scour Depth***
τ_c (Pa)	0.24	11.15	16.07
k_d (cm^3/N·s)	1.345	2.155	2.764

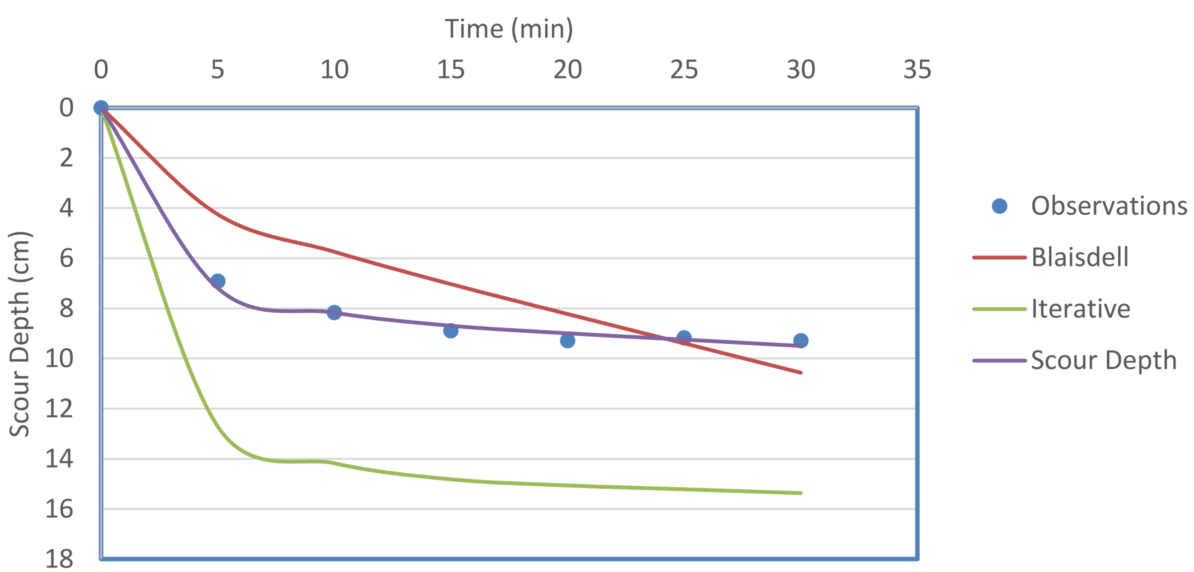


Jet Erosion Test: Heinz Terrace FT-24 (modified)

LOCATION	FT- 24 m
DATE	7/19/2016
HEAD (IN)	97
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.225

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.610	0.000
5	5	2.383	0.227
10	5	2.342	0.268
15	5	2.318	0.292
20	5	2.305	0.305
30	10	2.305	0.305
35	5	2.204	0.406
40	5	2.204	0.406
45	5	2.204	0.406
55	5	2.204	0.406

SOLUTIONS			
	Blaisdell	*Iterative*	*Scour Depth*
τ_c (Pa)	0.21	12.47	16.43
k_d (cm^3/N·s)	1.350	2.390	2.853

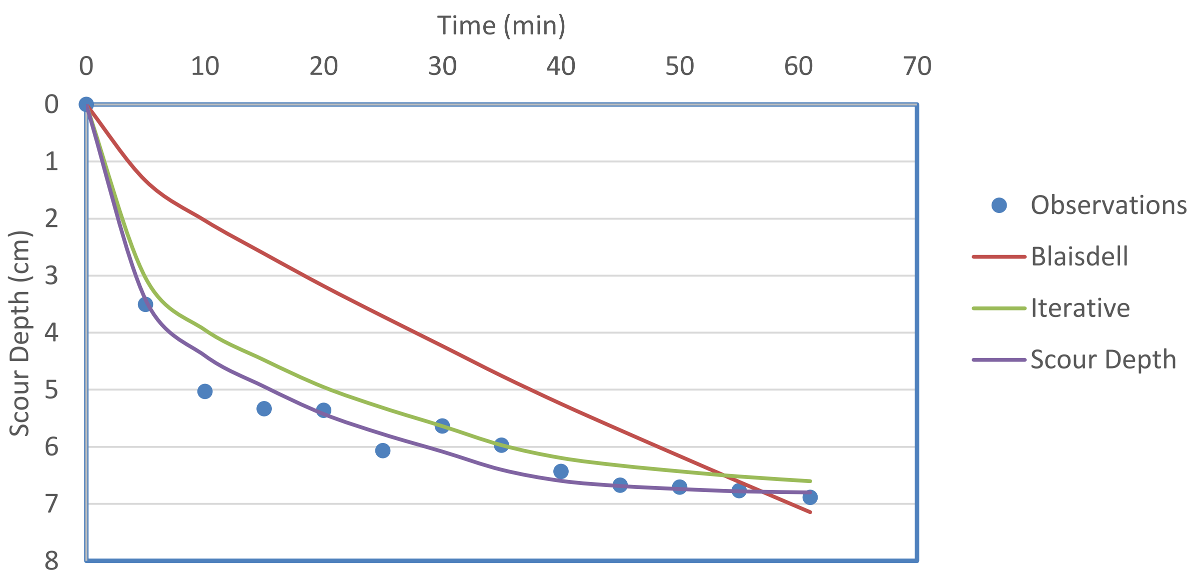


Jet Erosion Test: Heinz Terrace FT-25 (raw)

LOCATION	FT-25 r
DATE	7/19/2016
HEAD (IN)	105.5
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.220

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.615	0.000
5	5	2.500	0.115
10	5	2.450	0.165
15	5	2.440	0.175
20	5	2.439	0.176
25	5	2.416	0.199
30	5	2.430	0.185
35	5	2.419	0.196
40	5	2.404	0.211
45	5	2.396	0.219
50	5	2.395	0.220
55	5	2.393	0.222
61	6	2.389	0.226

SOLUTIONS	Blaisdell	Iterative	Scour Depth
τ_c (Pa)	1.98	38.52	39.95
k_d (cm^3/N·s)	0.386	1.283	1.470

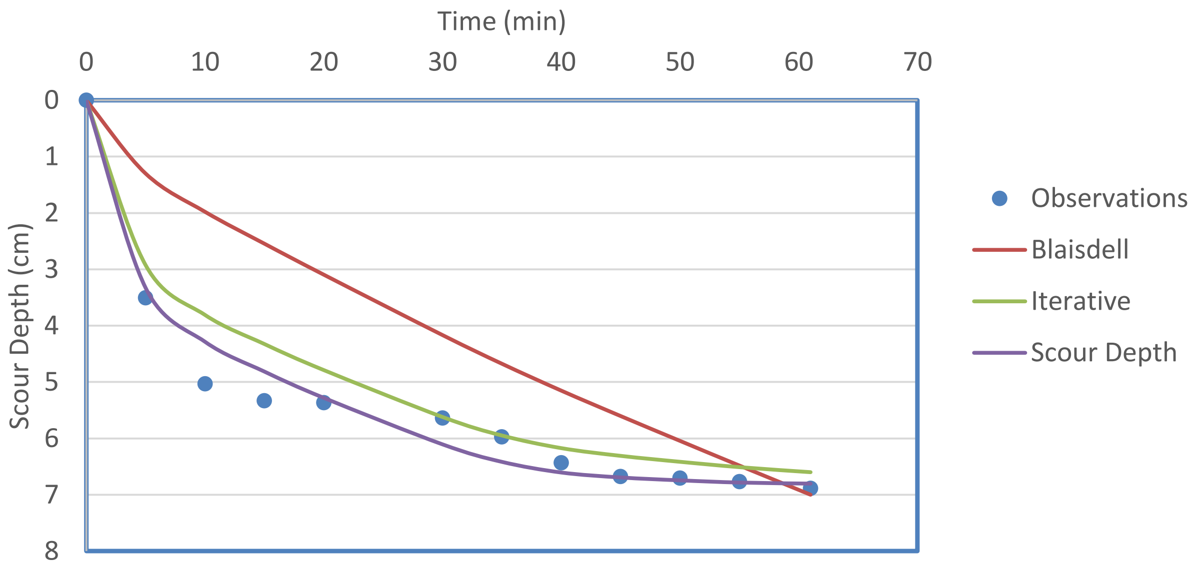


Jet Erosion Test: <u>Heinz Terrace FT-25 (modified)</u>

LOCATION	FT-25 m
DATE	7/19/2016
HEAD (IN)	105.5
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.220

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.615	0.000
5	5	2.5	0.115
10	5	2.45	0.165
15	5	2.44	0.175
20	5	2.439	0.176
30	10	2.43	0.185
35	5	2.419	0.196
40	5	2.404	0.211
45	5	2.396	0.219
50	5	2.395	0.220
55	5	2.393	0.222
61	6	2.389	0.226

SOLUTIONS			
	Blaisdell	***Iterative***	***Scour Depth***
τ_c (Pa)	1.98	38.29	39.95
k_d ($cm^3/N{\cdot}s$)	0.375	1.231	1.431

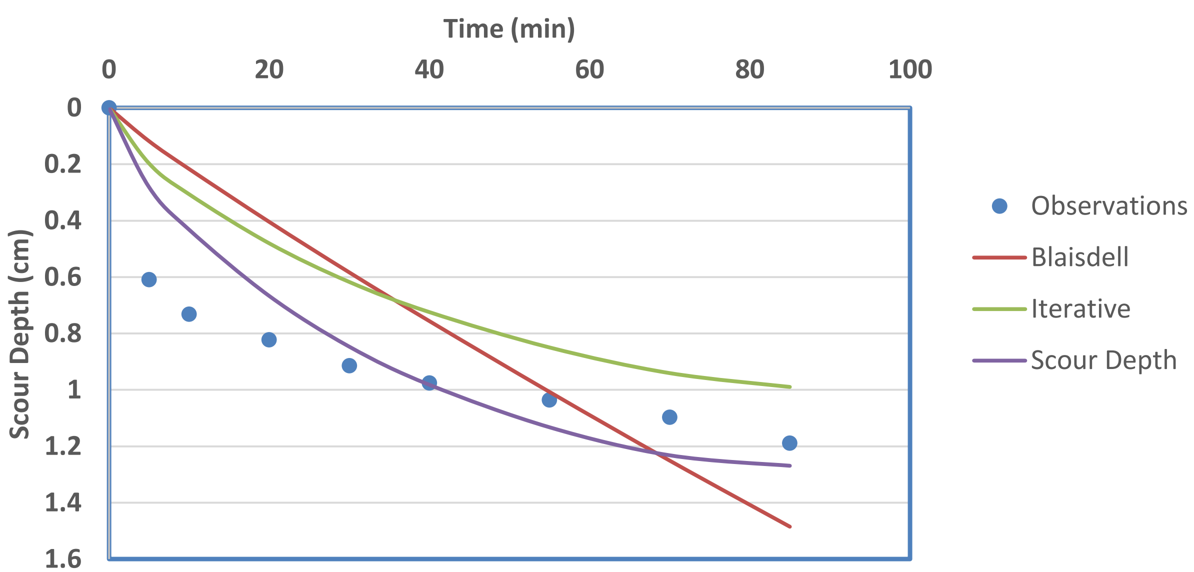


Jet Erosion Test: Heinz Terrace FT-26 (raw)

LOCATION	FT-26 r
DATE	7/26/2016
HEAD (IN)	92.75
PT GAGE H (FT)	2.834
NOZZLE H (FT)	0.257

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.577	0.000
5	5	2.557	0.020
10	5	2.553	0.024
20	10	2.550	0.027
30	10	2.547	0.030
40	10	2.545	0.032
55	15	2.543	0.034
70	15	2.541	0.036
85	15	2.538	0.039

SOLUTIONS			
	Blaisdell	*Iterative*	*Scour Depth*
τ_c (Pa)	45.66	78.94	79.73
k_d (cm^3/N·s)	0.075	0.337	0.502

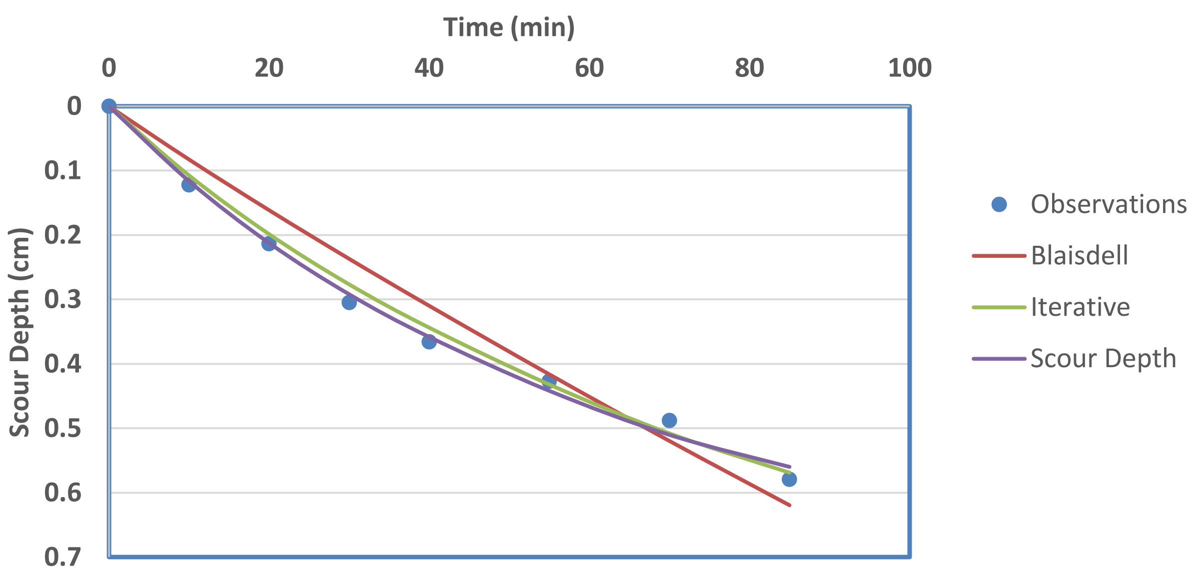


Jet Erosion Test: <u>Heinz Terrace FT-26 (modified)</u>

LOCATION	FT-26 m
DATE	7/26/2016
HEAD (IN)	92.75
PT GAGE H (FT)	2.834
NOZZLE H (FT)	0.277

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.557	0.000
10	10	2.553	0.004
20	10	2.550	0.007
30	10	2.547	0.010
40	10	2.545	0.012
55	15	2.543	0.014
70	15	2.541	0.016
85	15	2.538	0.019

SOLUTIONS	Blaisdell	Iterative	Scour Depth
τ_c (Pa)	42.47	74.95	76.88
k_d (cm^3/N·s)	0.029	0.121	0.150

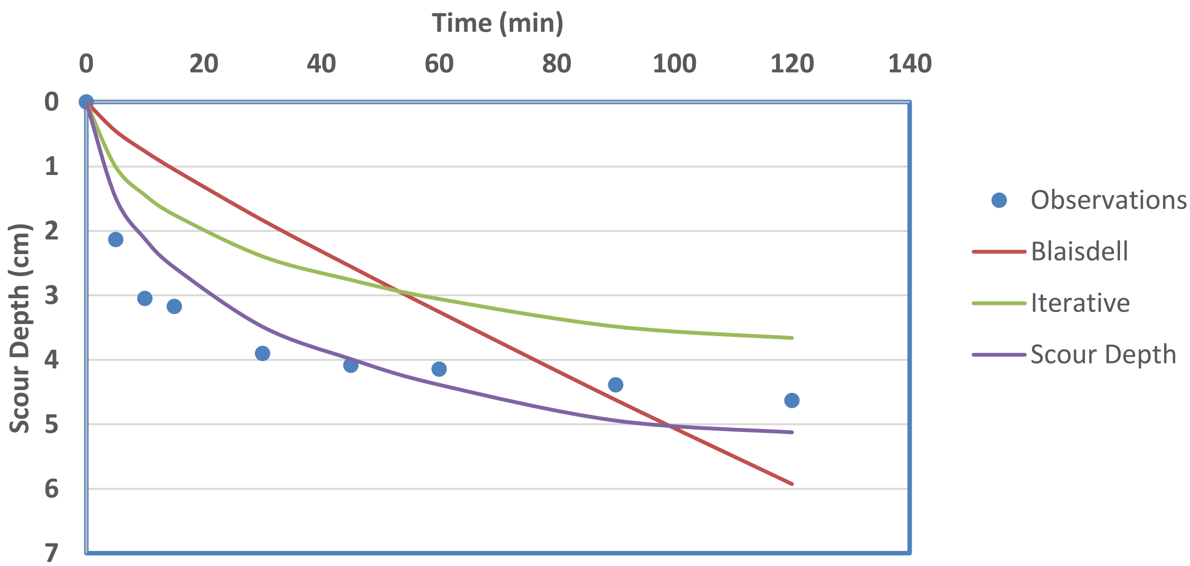


Jet Erosion Test: Heinz Terrace MT-31 (raw)

LOCATION	MT-31 r
DATE	8/9/2016
HEAD (IN)	103.75
PT GAGE H (FT)	2.828
NOZZLE H (FT)	0.294

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.534	0.000
5	5	2.464	0.070
10	5	2.434	0.100
15	5	2.430	0.104
30	15	2.406	0.128
45	15	2.400	0.134
60	15	2.398	0.136
90	30	2.390	0.144
120	30	2.382	0.152

SOLUTIONS	Blaisdell	Iterative	Scour Depth
τ_c (Pa)	7.55	38.96	39.28
k_d (cm^3/N·s)	0.223	0.937	1.395

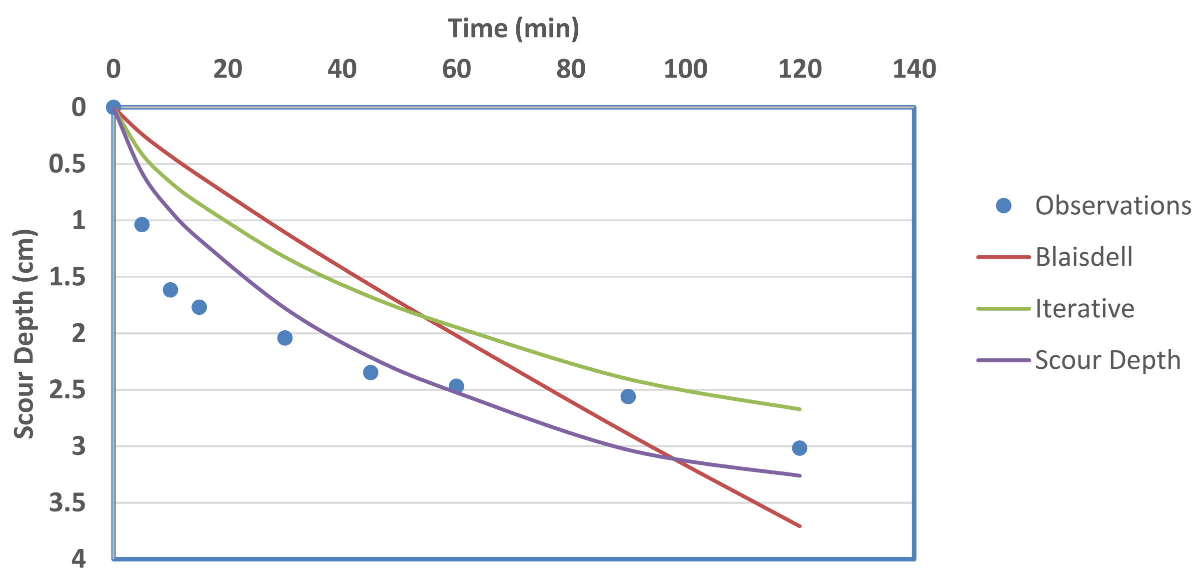


Jet Erosion Test: <u>Heinz Terrace MT-36 (raw)</u>

LOCATION	MT-36 r
DATE	8/8/2016
HEAD (IN)	106
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.292

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.543	0.000
5	5	2.509	0.034
10	5	2.490	0.053
15	5	2.485	0.058
30	15	2.476	0.067
45	15	2.466	0.077
60	15	2.462	0.081
90	30	2.459	0.084
120	30	2.444	0.099

SOLUTIONS	Blaisdell	Iterative	Scour Depth
τ_c (Pa)	13.63	50.70	52.22
k_d (cm^3/N·s)	0.112	0.409	0.599

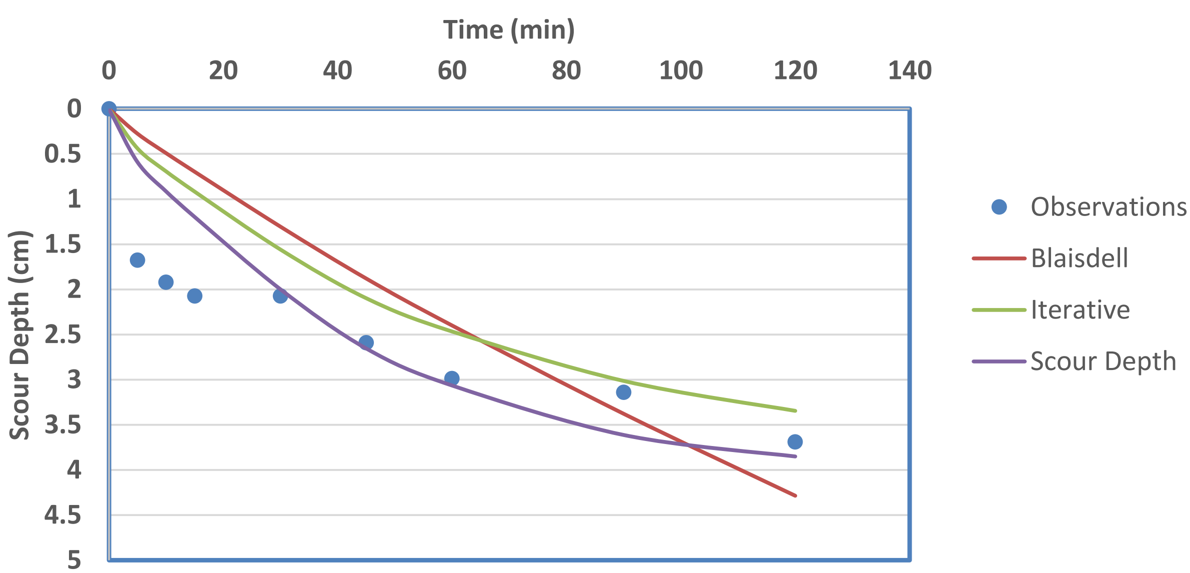


Jet Erosion Test: Heinz Terrace MT-37 (raw)

LOCATION	MT-37 r
DATE	8/8/2016
HEAD (IN)	107.25
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.312

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.523	0.000
5	5	2.468	0.055
10	5	2.460	0.063
15	5	2.455	0.068
30	15	2.455	0.068
45	15	2.438	0.085
60	15	2.425	0.098
90	30	2.420	0.103
120	30	2.402	0.121

SOLUTIONS			
	Blaisdell	*Iterative*	*Scour Depth*
τ_c (Pa)	12.72	41.18	43.08
k_d (cm^3/N·s)	0.156	0.483	0.693

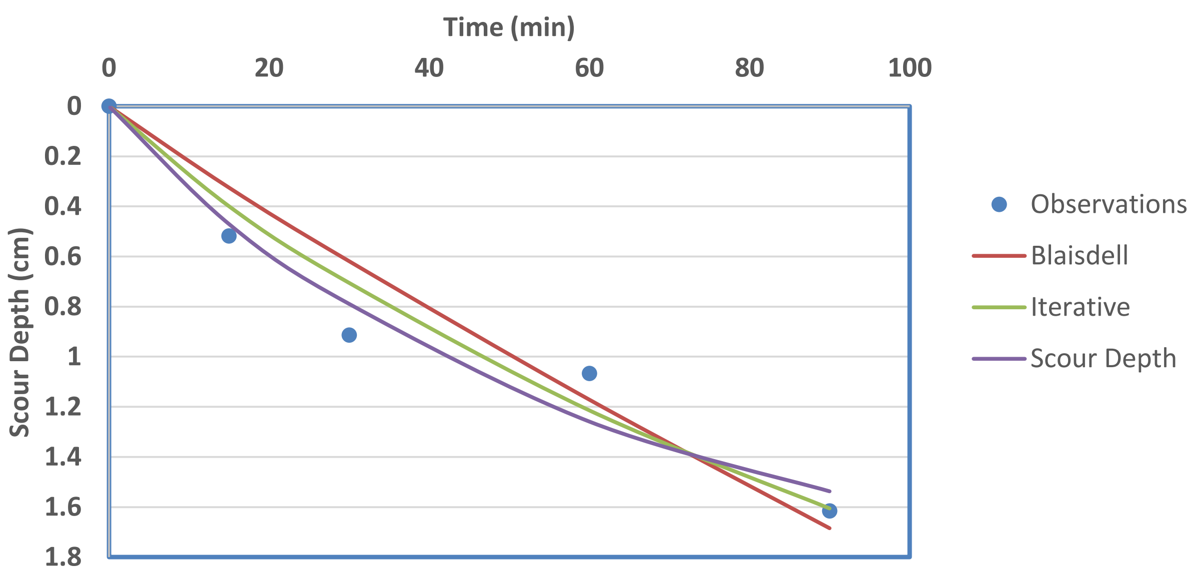


Jet Erosion Test: Heinz Terrace MT-37 (modified)

LOCATION	MT-37 m
DATE	8/8/2016
HEAD (IN)	107.25
PT GAGE H (FT)	2.835
NOZZLE H (FT)	0.312

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.523	0.000
5	5	2.468	0.055
10	5	2.460	0.063
15	5	2.455	0.068
45	30	2.438	0.085
60	15	2.425	0.098
90	30	2.420	0.103
120	30	2.402	0.121

SOLUTIONS			
	Blaisdell	*Iterative*	*Scour Depth*
τ_c (Pa)	12.35	41.20	43.08
k_d (cm^3/N·s)	0.152	0.485	0.722

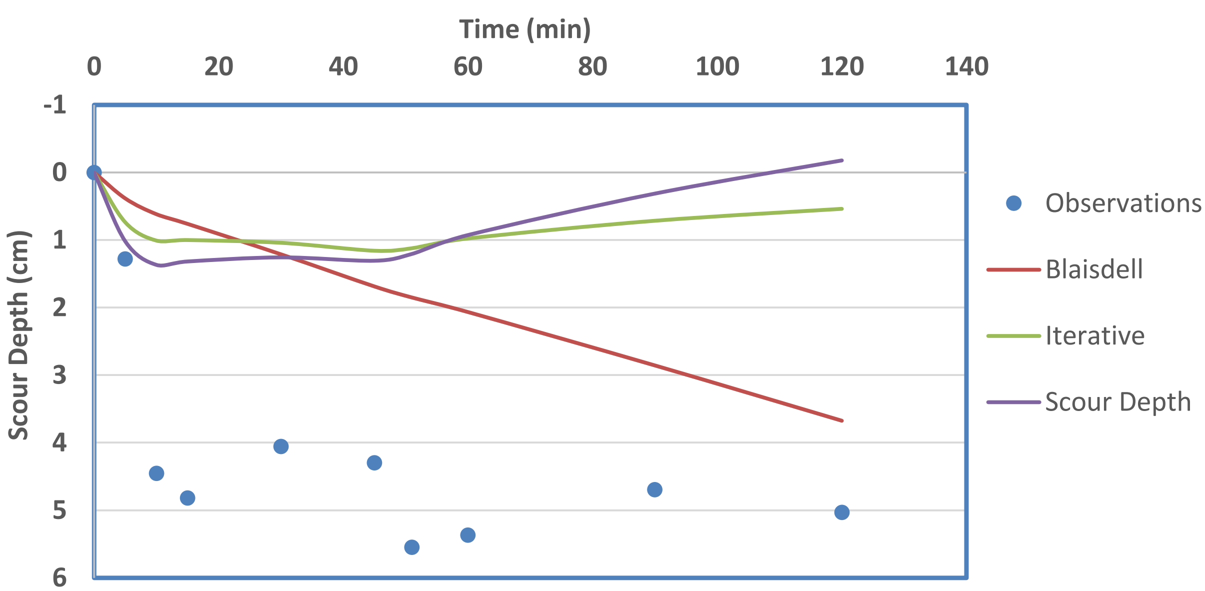


Jet Erosion Test: Heinz Terrace UMT-1 (raw)

LOCATION	**UMT-1 r**
DATE	8/10/2016
HEAD (IN)	85
PT GAGE H (FT)	2.827
NOZZLE H (FT)	0.245

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.582	0.000
5	5	2.540	0.042
10	5	2.436	0.146
15	5	2.424	0.158
30	15	2.449	0.133
45	15	2.441	0.141
51	6	2.400	0.182
60	9	2.406	0.176
90	30	2.428	0.154
120	30	2.417	0.165

SOLUTIONS			
	Blaisdell	***Iterative***	***Scour Depth***
τ_c (Pa)	4.17	19.29	35.11
k_d (cm^3/N·s)	0.272	0.396	1.164

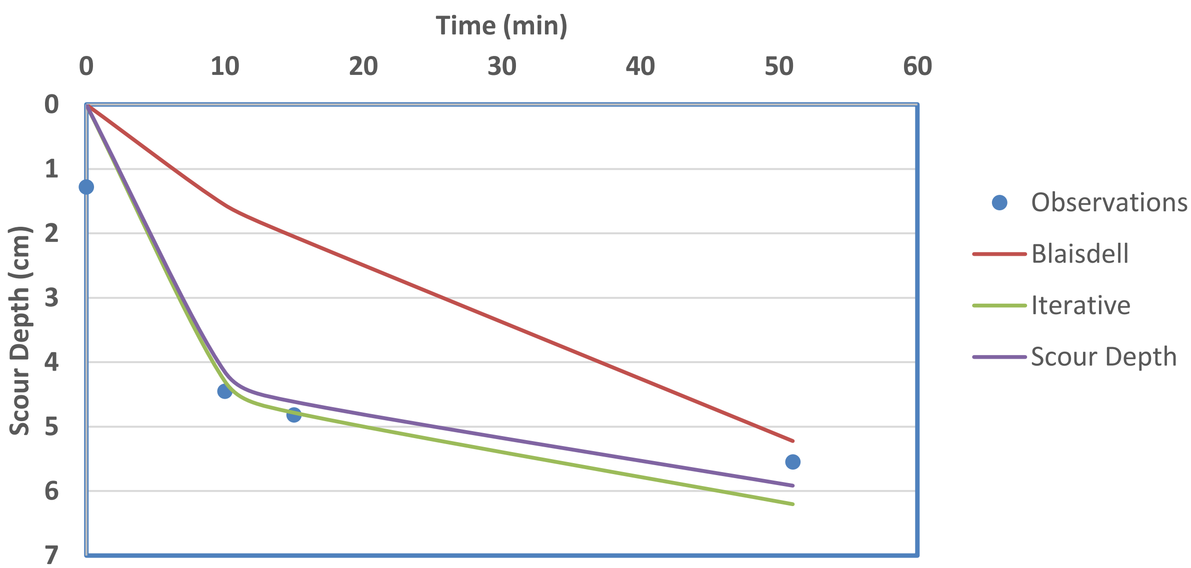


Jet Erosion Test: Heinz Terrace UMT-1 (modified)

LOCATION	UMT-1 m
DATE	8/10/2016
HEAD (IN)	85
PT GAGE H (FT)	2.827
NOZZLE H (FT)	0.287

SCOUR DEPTH READINGS			
TIME (MIN)	DIFF TIME (MIN)	PT GAGE READING (FT)	MAXIMUM DEPTH OF SCOUR (FT)
0	0	2.540	0.042
10	10	2.436	0.146
15	5	2.424	0.158
51	36	2.400	0.182

SOLUTIONS	Blaisdell	Iterative	Scour Depth
τ_c (Pa)	7.93	34.99	35.11
k_d (cm^3/N·s)	0.501	2.884	2.801

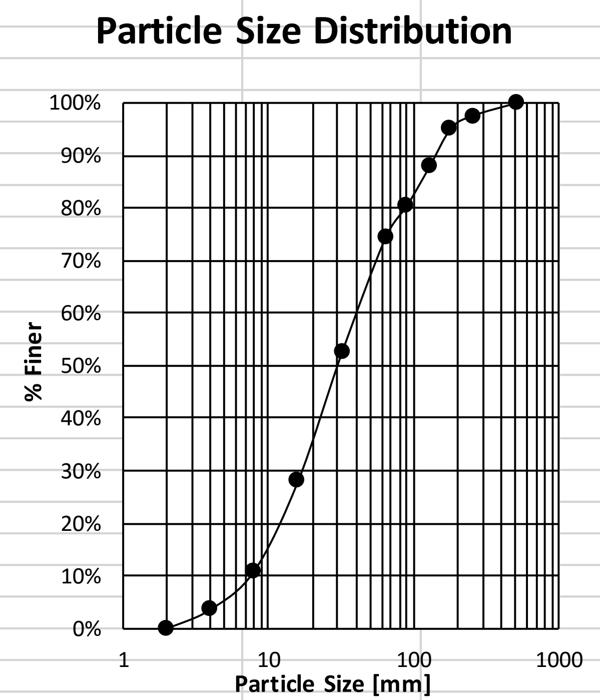


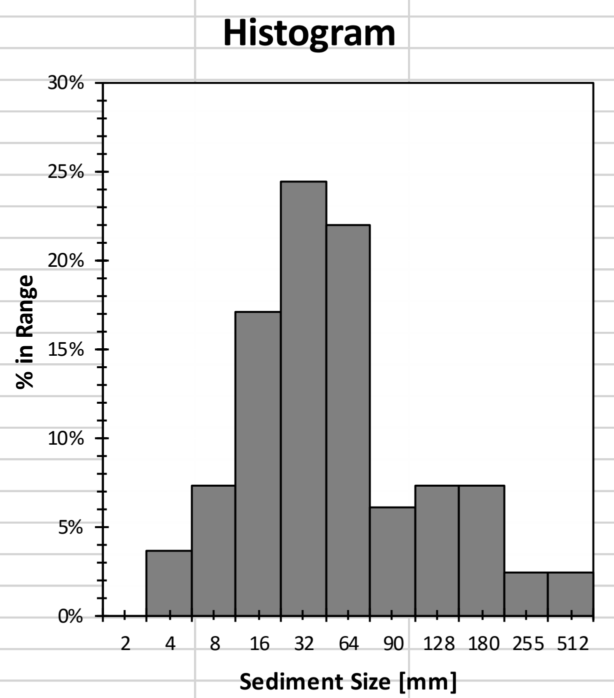
Appendix 4. Summary of grain size statistics obtained in stream channels near the WVDP. These are listed in the order in which they were collected (GS-1, GS-2, etc.), their GPS locations are provided, and the percentiles of the distribution are tabulated (D_{10}, D_{16}, D_{50}, D_{84}, D_{90}, and D_{95}; D_{50} refers to the grain size D in which 50% of the sediment population is finer than this size.)

Pebble Count: GS-1

Site Name:	Rock Springs Rd., ~1 mi S of WVDP, east side of creek			
Location:	42°26'18.0"N 78°39'04.9"W			
Date:	6/16/2016			

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	0	0%	0%
	2 - 4	3	4%	4%
	5 - 8	6	7%	11%
Gravels	9 - 16	14	17%	28%
	17 - 32	20	24%	52%
	33 - 64	18	22%	74%
	65 - 90	5	6%	80%
Cobbles	91 - 128	6	7%	88%
	129 - 180	6	7%	95%
	181 - 255	2	2%	98%
Boulders	256 - 512	2	2%	100%
	TOTALS:	**82**		



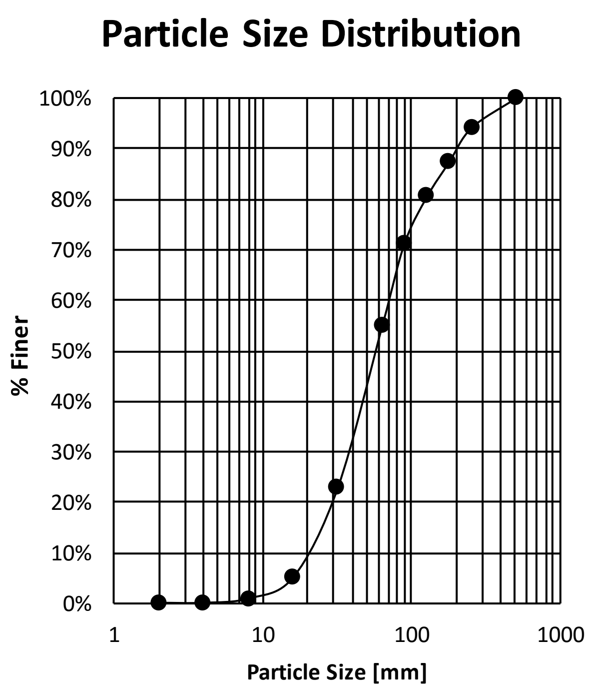


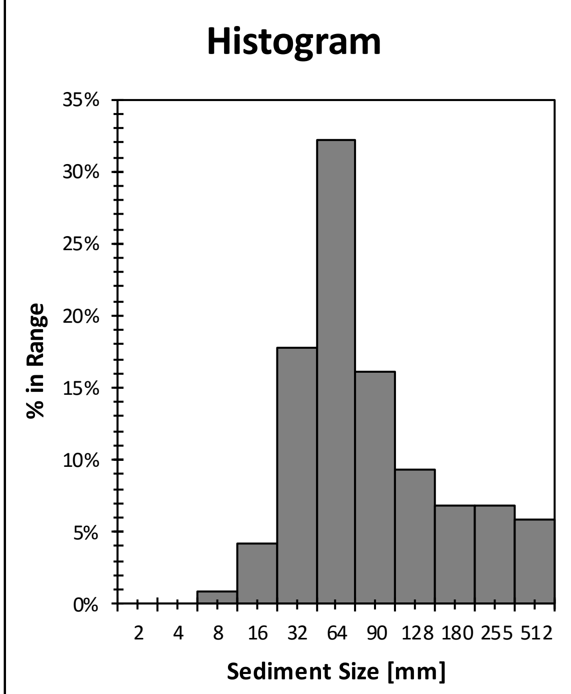
D_{10}	7.5	mm
D_{16}	10.4	mm
D_{50}	30.4	mm
D_{84}	108.2	mm
D_{90}	143.6	mm
D_{95}	179.1	mm

Pebble Count: GS-2

Site Name:	Rock Springs Rd., ~1 mi S of WVDP, west side of creek
Location:	42°26'17.5"N 78°39'08.3"W
Date:	6/16/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	0	0%	0%
	5 - 8	1	1%	1%
	9 - 16	5	4%	5%
	17 - 32	21	18%	23%
	33 - 64	38	32%	55%
Cobbles	65 - 90	19	16%	71%
	91 - 128	11	9%	81%
	129 - 180	8	7%	87%
	181 - 255	8	7%	94%
Boulders	256 - 512	7	6%	100%
	TOTALS:	**118**		



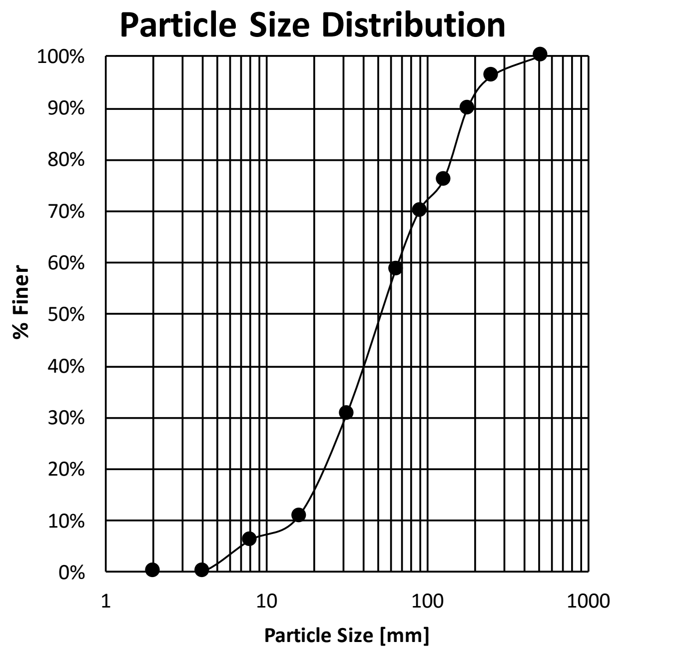


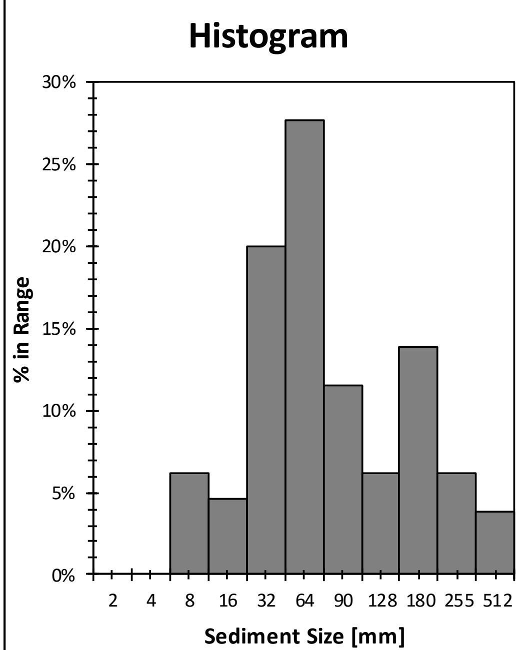
D_{10}	20.4	mm
D_{16}	25.8	mm
D_{50}	58.9	mm
D_{84}	154.8	mm
D_{90}	210.0	mm
D_{95}	295.4	mm

Pebble Count: GS-3

Site Name:	On 240, just south of Thomas Corners Rd., west side, ~100 m from road
Location:	42°28'32.4"N 78°38'14.3"W
Date:	6/16/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	0	0%	0%
	5 - 8	8	6%	6%
	9 - 16	6	5%	11%
	17 - 32	26	20%	31%
	33 - 64	36	28%	58%
Cobbles	65 - 90	15	12%	70%
	91 - 128	8	6%	76%
	129 - 180	18	14%	90%
	181 - 255	8	6%	96%
Boulders	256 - 512	5	4%	100%
	TOTALS:	130		

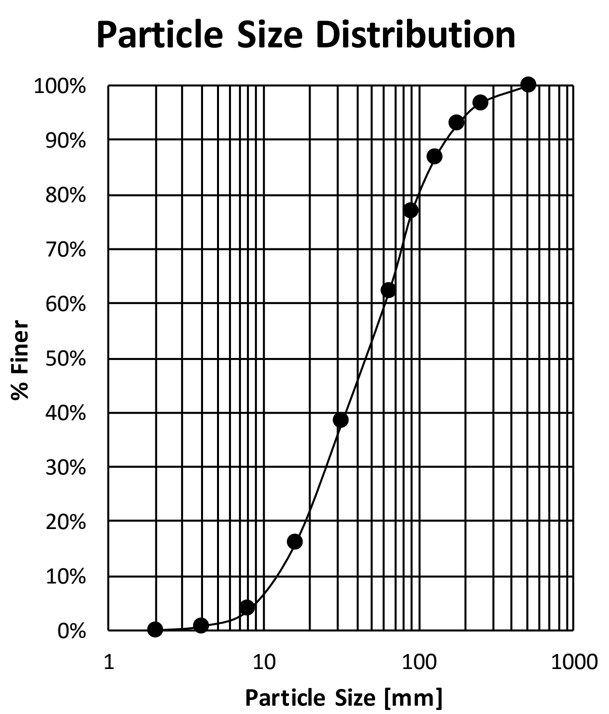


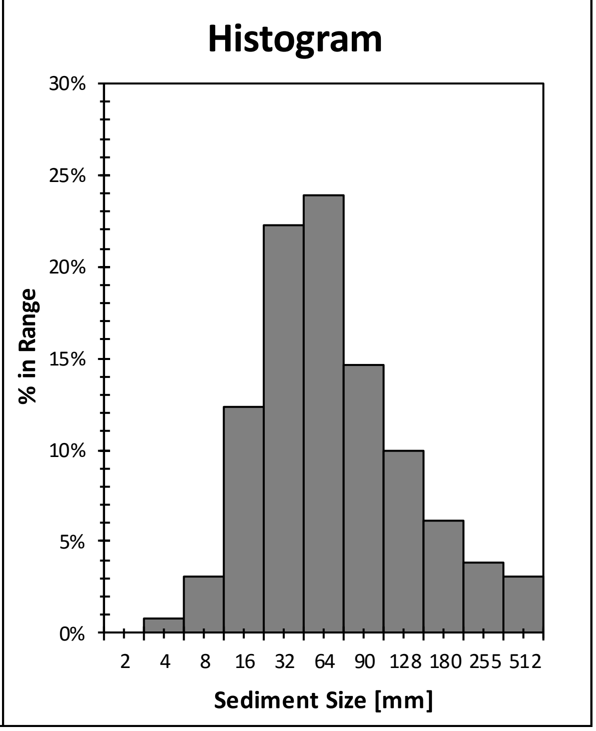


D_{10}	14.7	mm
D_{16}	20.2	mm
D_{50}	54.2	mm
D_{84}	157.5	mm
D_{90}	180.0	mm
D_{95}	240.9	mm

Pebble Count: GS-4

Site Name:	On 240, just north of bend, west side			
Location:	42°27'54.5"N 78°38'10.9"W			
Date:	6/16/2016			
	Particle Size (mm)	**Total #**	**% in Range**	**% Finer**
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	1	1%	1%
	5 - 8	4	3%	4%
	9 - 16	16	12%	16%
	17 - 32	29	22%	38%
	33 - 64	31	24%	62%
Cobbles	65 - 90	19	15%	77%
	91 - 128	13	10%	87%
	129 - 180	8	6%	93%
	181 - 255	5	4%	97%
Boulders	256 - 512	4	3%	100%
	TOTALS:	**130**		

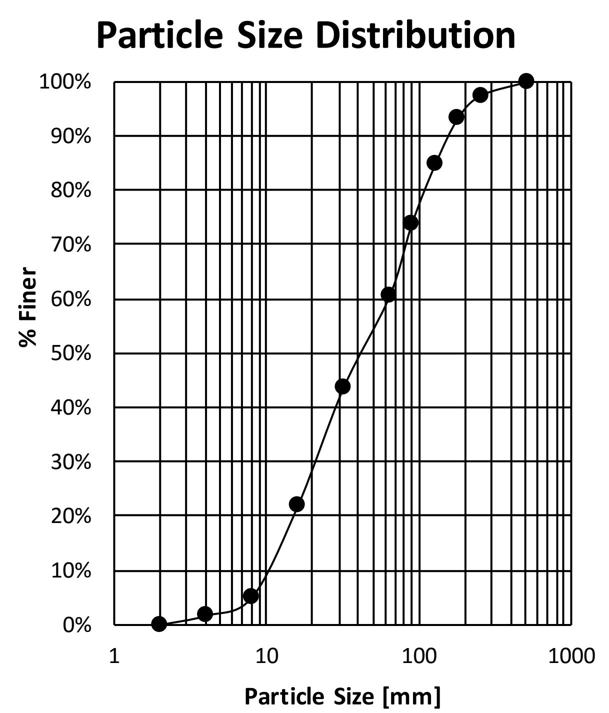


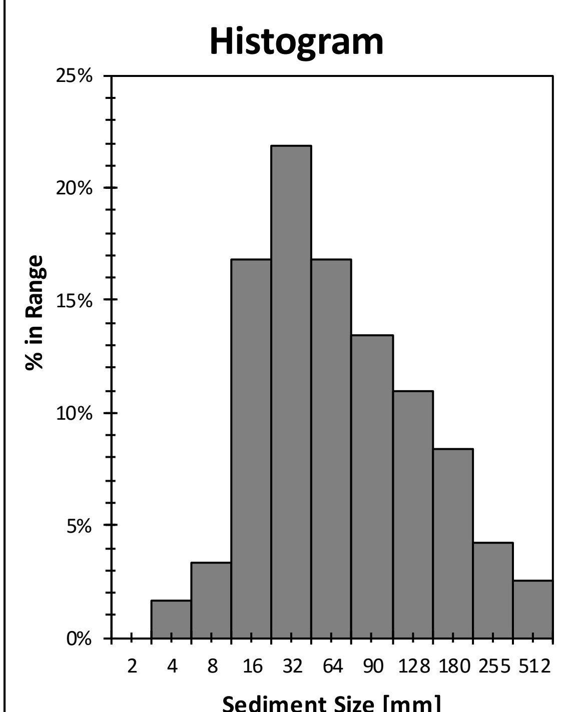


D_{10}	12.0	mm
D_{16}	15.9	mm
D_{50}	47.5	mm
D_{84}	116.9	mm
D_{90}	154.0	mm
D_{95}	217.5	mm

Pebble Count: GS-5

Site Name:	On 240, upstream of road culvert			
Location:	42°27'27.2"N 78°37'27.3"W			
Date:	6/16/2016			
	Particle Size (mm)	**Total #**	**% in Range**	**% Finer**
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	2	2%	2%
	5 - 8	4	3%	5%
	9 - 16	20	17%	22%
	17 - 32	26	22%	44%
	33 - 64	20	17%	61%
Cobbles	65 - 90	16	13%	74%
	91 - 128	13	11%	85%
	129 - 180	10	8%	93%
	181 - 255	5	4%	97%
Boulders	256 - 512	3	3%	100%
	TOTALS:	**119**		

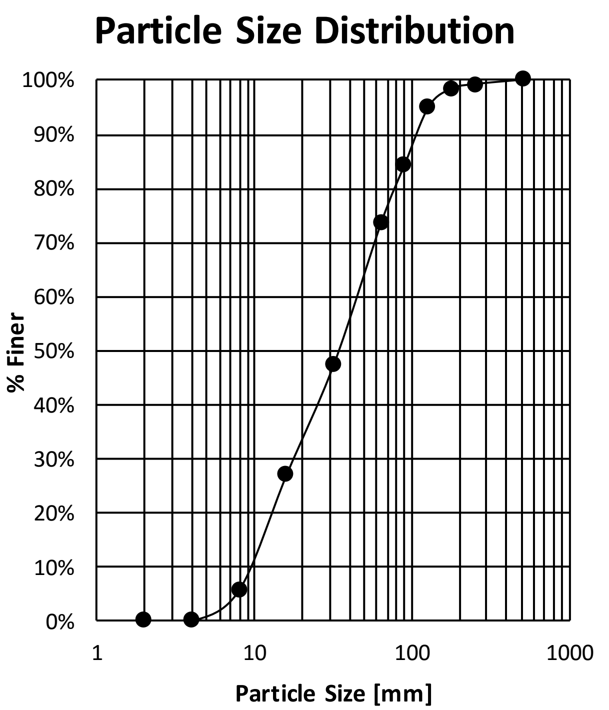


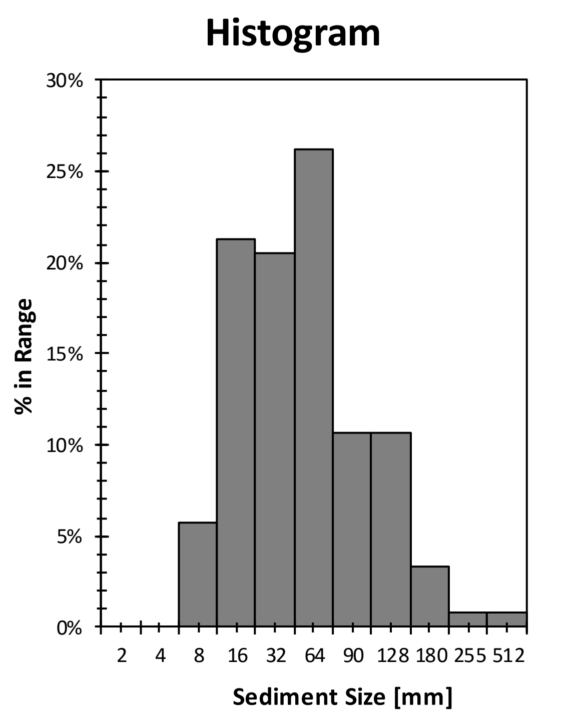


D_{10}	10.4	mm
D_{16}	13.2	mm
D_{50}	44.0	mm
D_{84}	125.0	mm
D_{90}	159.7	mm
D_{95}	210.8	mm

Pebble Count: GS-6

Site Name:	On 240 further downstream, ~1 mi			
Location:	42°27'25.7"N 78°37'28.1"W			
Date:	6/16/2016			
	Particle Size (mm)	**Total #**	**% in Range**	**% Finer**
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	0	0%	0%
	5 - 8	7	6%	6%
	9 - 16	26	21%	27%
	17 - 32	25	20%	48%
	33 - 64	32	26%	74%
Cobbles	65 - 90	13	11%	84%
	91 - 128	13	11%	95%
	129 - 180	4	3%	98%
	181 - 255	1	1%	99%
Boulders	256 - 512	1	1%	100%
	TOTALS:	**122**		



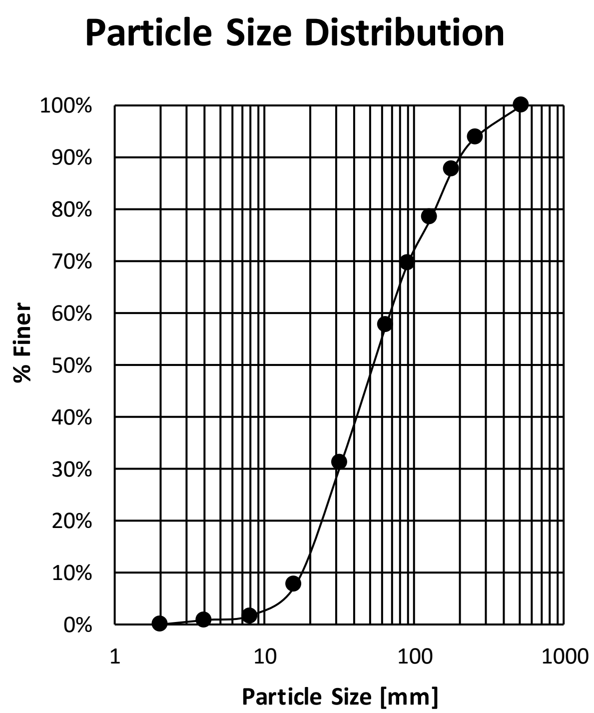


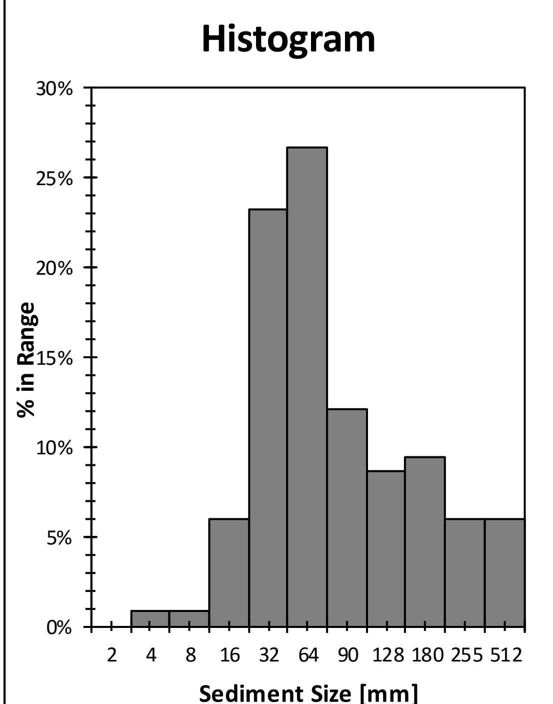
D_{10}	9.6	mm
D_{16}	11.9	mm
D_{50}	35.0	mm
D_{84}	89.0	mm
D_{90}	109.9	mm
D_{95}	127.7	mm

Pebble Count: GS-7

Site Name:	GS-7, Intersection of Goose Creek and 240
Location:	42°26'30.2"N 78°36'53.3"W
Date:	6/16/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	1	1%	1%
	5 - 8	1	1%	2%
	9 - 16	7	6%	8%
	17 - 32	27	23%	31%
	33 - 64	31	27%	58%
Cobbles	65 - 90	14	12%	70%
	91 - 128	10	9%	78%
	129 - 180	11	9%	88%
	181 - 255	7	6%	94%
Boulders	256 - 512	7	6%	100%
	TOTALS:	**116**		



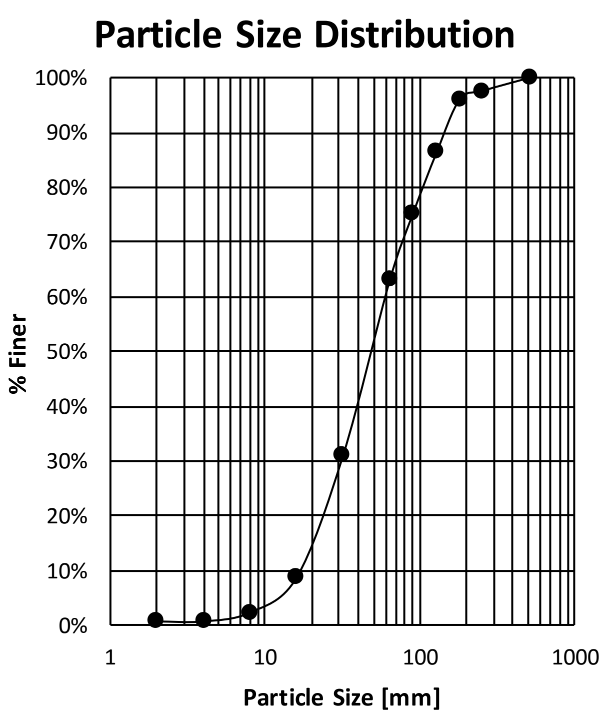


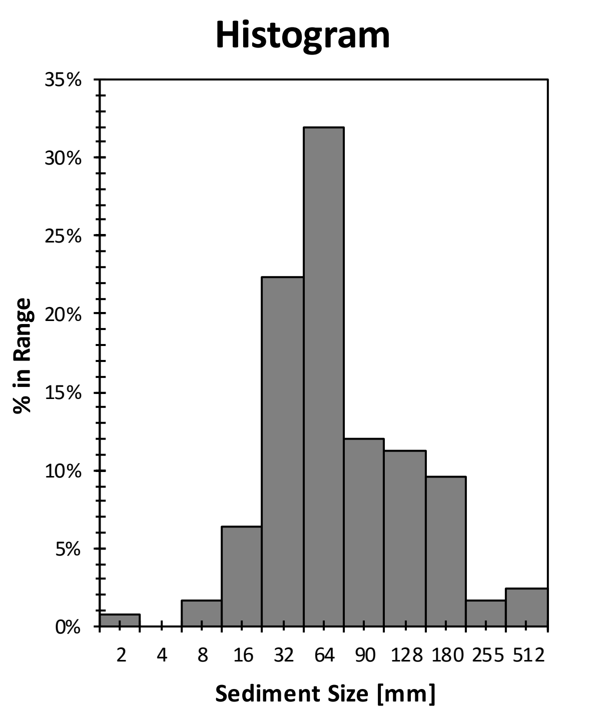
D_{10}	17.5	mm
D_{16}	21.7	mm
D_{50}	54.7	mm
D_{84}	158.4	mm
D_{90}	205.7	mm
D_{95}	299.1	mm

Pebble Count: GS-8

Site Name:	Thornwood Rd., near West Vally, southside of creek
Location:	42°25'47.2"N 78°38'04.3"W
Date:	6/16/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	1	1%	1%
Gravels	2 - 4	0	0%	1%
	5 - 8	2	2%	2%
	9 - 16	8	6%	9%
	17 - 32	28	22%	31%
	33 - 64	40	32%	63%
Cobbles	65 - 90	15	12%	75%
	91 - 128	14	11%	86%
	129 - 180	12	10%	96%
	181 - 255	2	2%	98%
Boulders	256 - 512	3	2%	100%
	TOTALS:	**125**		

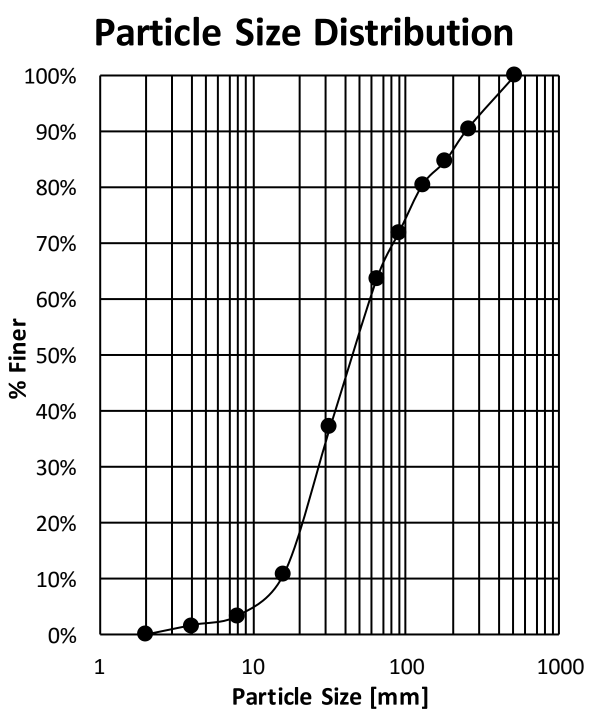


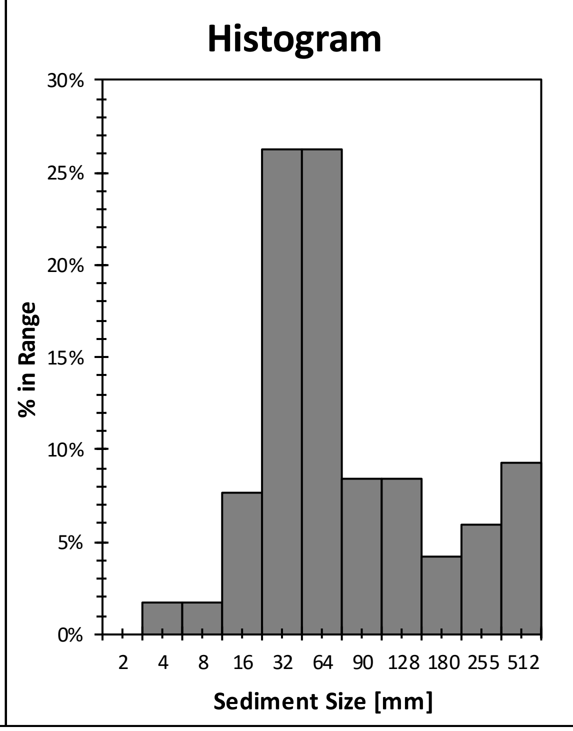


D_{10}	16.9	mm
D_{16}	21.1	mm
D_{50}	50.8	mm
D_{84}	119.9	mm
D_{90}	147.5	mm
D_{95}	174.6	mm

Pebble Count: GS-9

Site Name:	240 at Firehouse, West Vally (upper Buttermilk Creek)			
Location:	42°23'48.0"N 78°36'39.6"W			
Date:	6/16/2016			
	Particle Size (mm)	**Total #**	**% in Range**	**% Finer**
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	2	2%	2%
	5 - 8	2	2%	3%
	9 - 16	9	8%	11%
	17 - 32	31	26%	37%
	33 - 64	31	26%	64%
Cobbles	65 - 90	10	8%	72%
	91 - 128	10	8%	81%
	129 - 180	5	4%	85%
	181 - 255	7	6%	91%
Boulders	256 - 512	11	9%	100%
	TOTALS:	**118**		



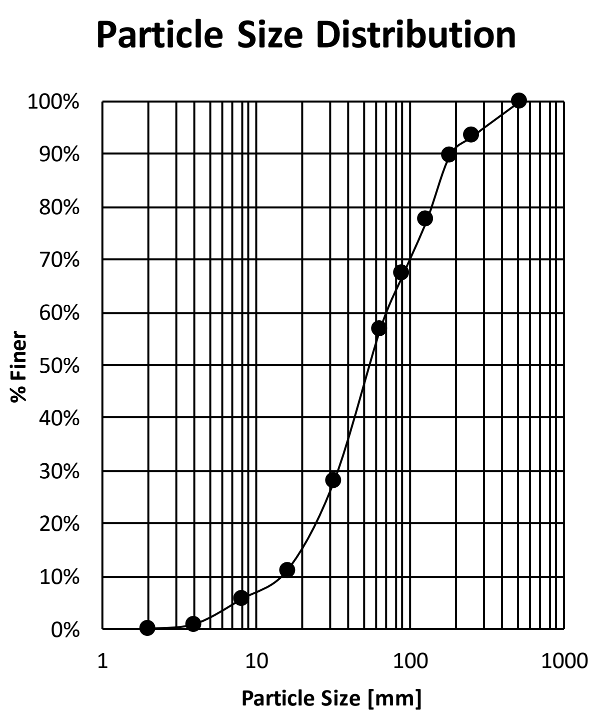


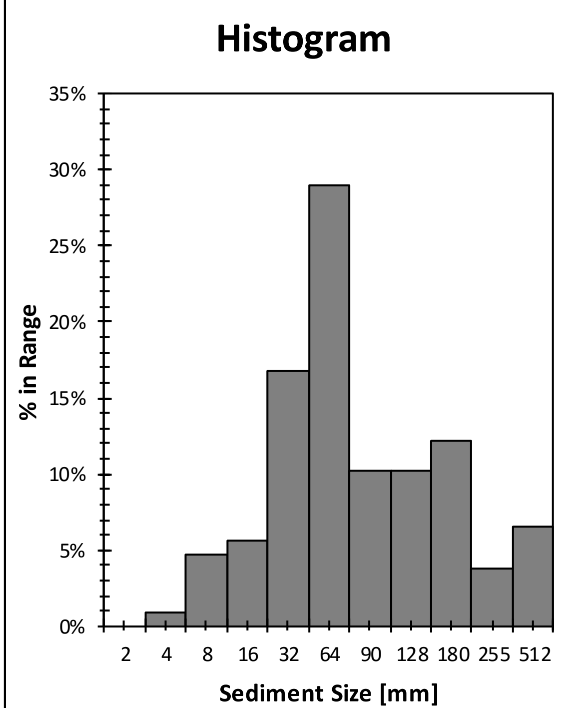
D_{10}	14.9	mm
D_{16}	19.0	mm
D_{50}	47.5	mm
D_{84}	170.8	mm
D_{90}	246.4	mm
D_{95}	374.2	mm

Pebble Count: GS-10

Site Name:	Upper Heinz Creek			
Location:	42°27'15.1"N 78°37'43.2"W			
Date:	6/22/2016			

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	1	1%	1%
	5 - 8	5	5%	6%
	9 - 16	6	6%	11%
	17 - 32	18	17%	28%
	33 - 64	31	29%	57%
Cobbles	65 - 90	11	10%	67%
	91 - 128	11	10%	78%
	129 - 180	13	12%	90%
	181 - 255	4	4%	93%
Boulders	256 - 512	7	7%	100%
	TOTALS:	**107**		



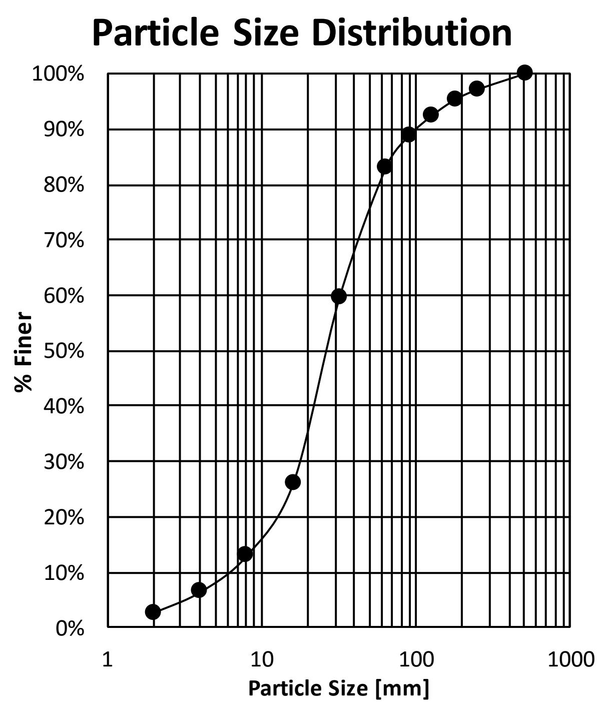


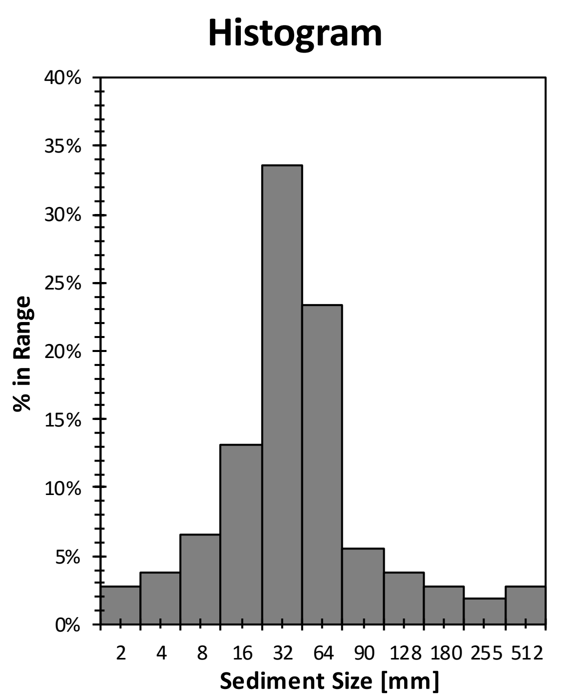
D_{10}	14.3	mm
D_{16}	20.6	mm
D_{50}	56.3	mm
D_{84}	155.5	mm
D_{90}	185.6	mm
D_{95}	315.6	mm

Pebble Count: GS-11

Site Name: Near gas pipeline
Location: 42°27'15.1"N 78°37'43.1"W
Date: 6/22/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	3	3%	3%
Gravels	2 - 4	4	4%	7%
	5 - 8	7	7%	13%
	9 - 16	14	13%	26%
	17 - 32	36	34%	60%
	33 - 64	25	23%	83%
Cobbles	65 - 90	6	6%	89%
	91 - 128	4	4%	93%
	129 - 180	3	3%	95%
	181 - 255	2	2%	97%
Boulders	256 - 512	3	3%	100%
	TOTALS:	107		



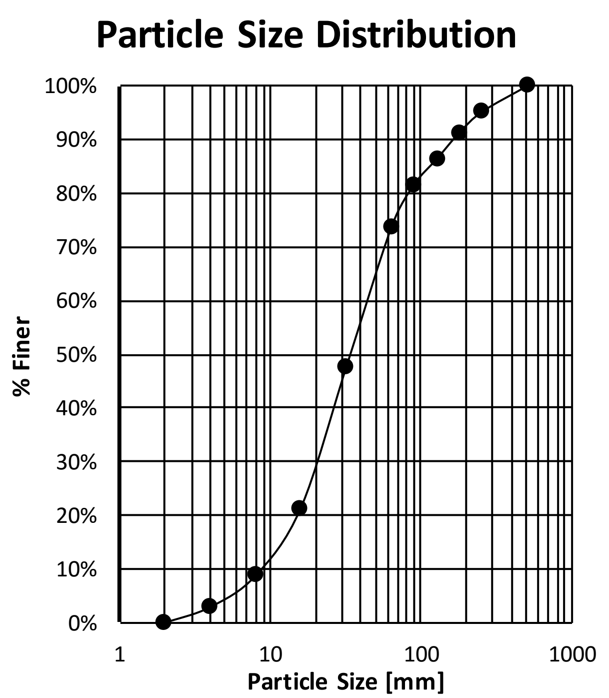


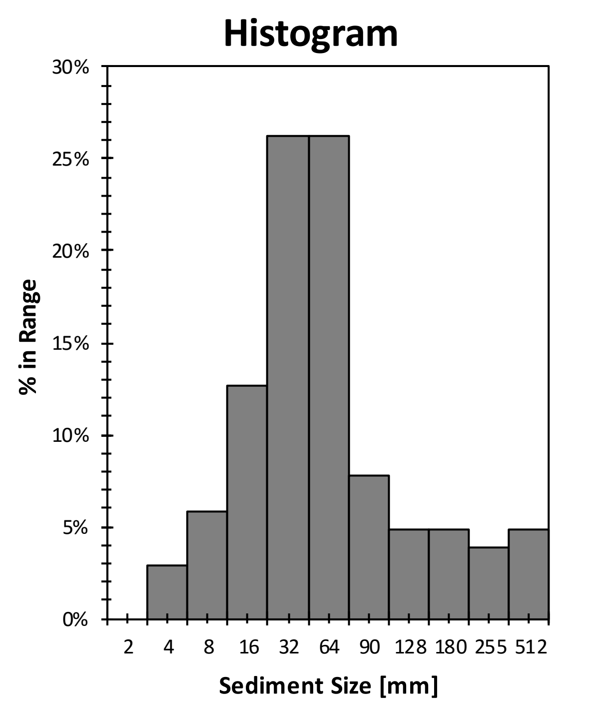
D_{10}	6.1	mm
D_{16}	9.8	mm
D_{50}	27.3	mm
D_{84}	67.8	mm
D_{90}	102.4	mm
D_{95}	173.9	mm

Pebble Count: GS-12

Site Name:	Near gas pipeline
Location:	42°27'16.4"N 78°37'42.1"W
Date:	6/22/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	3	3%	3%
	5 - 8	6	6%	9%
	9 - 16	13	13%	21%
	17 - 32	27	26%	48%
	33 - 64	27	26%	74%
Cobbles	65 - 90	8	8%	82%
	91 - 128	5	5%	86%
	129 - 180	5	5%	91%
	181 - 255	4	4%	95%
Boulders	256 - 512	5	5%	100%
	TOTALS:	**103**		



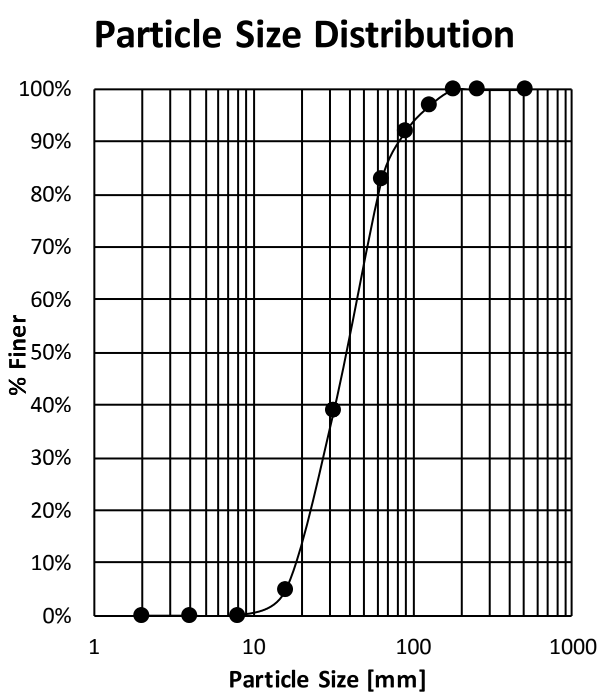


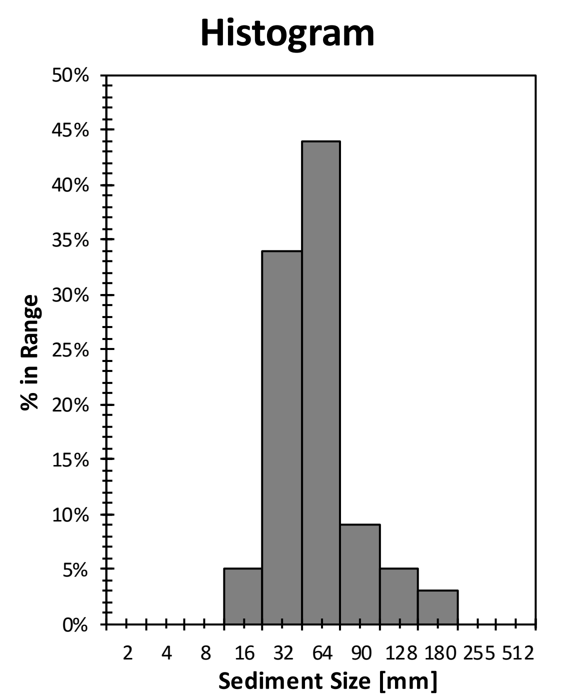
D_{10}	8.8	mm
D_{16}	12.6	mm
D_{50}	35.0	mm
D_{84}	109.2	mm
D_{90}	166.5	mm
D_{95}	252.2	mm

Pebble Count: GS-13

Site Name:	Near gas pipeline
Location:	42°27'15.7"N 78°37'41.6"W
Date:	6/16/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	0	0%	0%
	2 - 4	0	0%	0%
	5 - 8	0	0%	0%
Gravels	9 - 16	5	5%	5%
	17 - 32	34	34%	39%
	33 - 64	44	44%	83%
	65 - 90	9	9%	92%
Cobbles	91 - 128	5	5%	97%
	129 - 180	3	3%	100%
	181 - 255	0	0%	100%
Boulders	256 - 512	0	0%	100%
	TOTALS:	**100**		



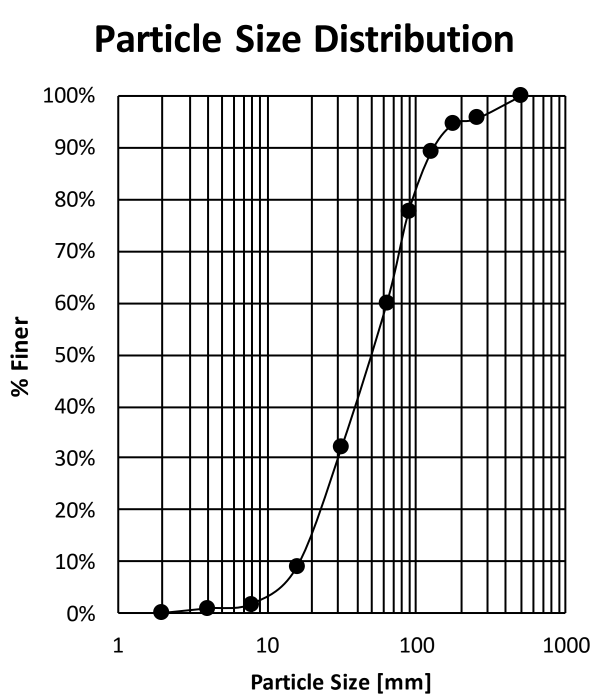


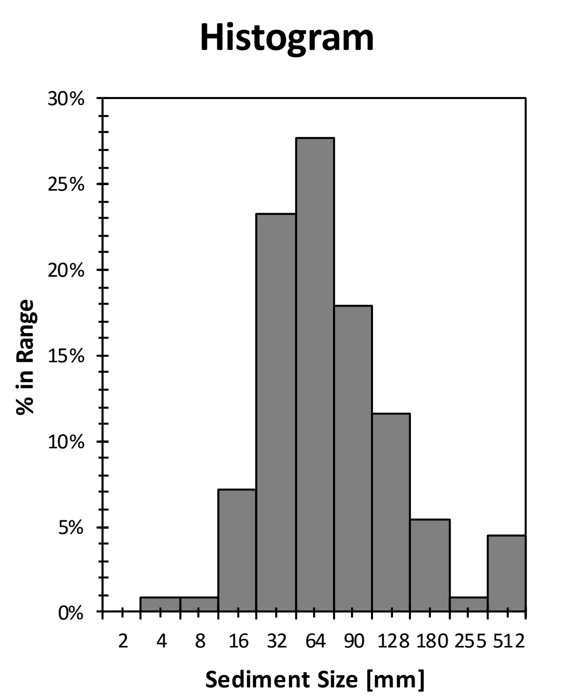
D_{10}	18.4	mm
D_{16}	21.2	mm
D_{50}	40.0	mm
D_{84}	66.9	mm
D_{90}	84.2	mm
D_{95}	112.8	mm

Pebble Count: GS-14

Site Name:	South East of Rock Springs Road and County Road 86-1 Intersection
Location:	42°26'21.7"N 78°38'56.0"W
Date:	6/22/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	1	1%	1%
	5 - 8	1	1%	2%
	9 - 16	8	7%	9%
	17 - 32	26	23%	32%
	33 - 64	31	28%	60%
Cobbles	65 - 90	20	18%	78%
	91 - 128	13	12%	89%
	129 - 180	6	5%	95%
	181 - 255	1	1%	96%
Boulders	256 - 512	5	4%	100%
	TOTALS:	**112**		



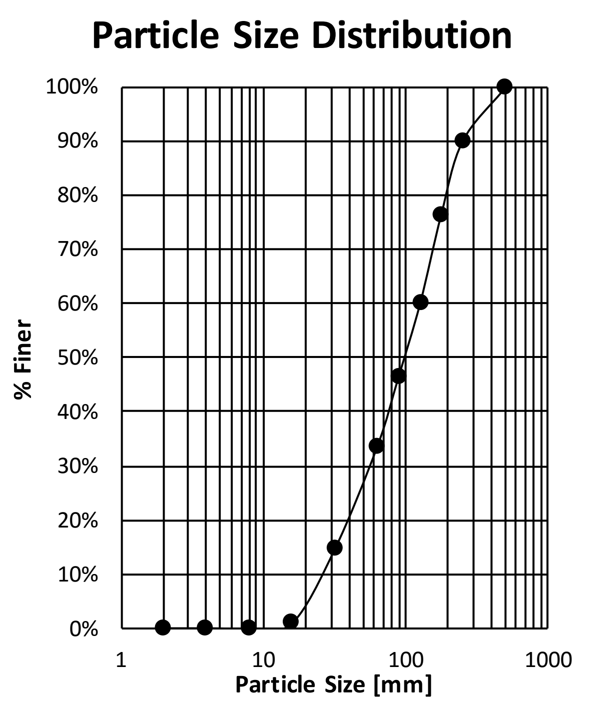


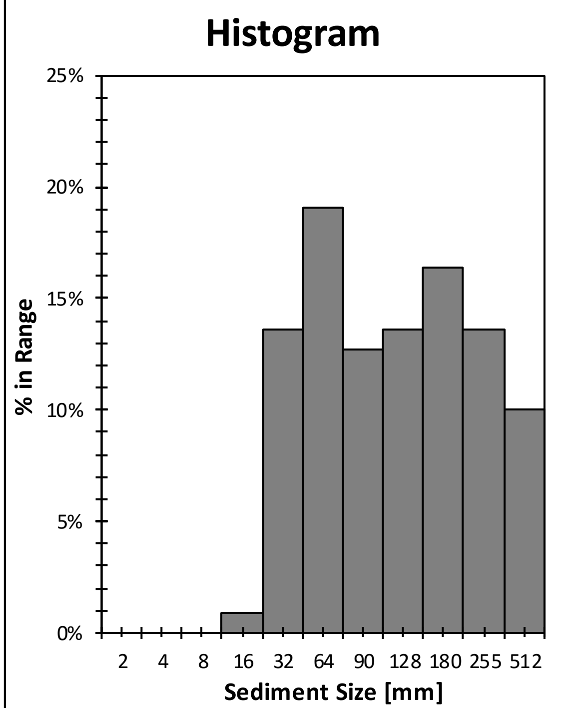
D_{10}	16.7	mm
D_{16}	20.9	mm
D_{50}	52.6	mm
D_{84}	110.7	mm
D_{90}	134.9	mm
D_{95}	210.0	mm

Pebble Count: GS-15

Site Name:	South East of Rock Springs Road and County Road 86-1 Intersection
Location:	42°26'21.5"N 78°38'53.9"W
Date:	6/22/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	0	0%	0%
	5 - 8	0	0%	0%
	9 - 16	1	1%	1%
	17 - 32	15	14%	15%
	33 - 64	21	19%	34%
Cobbles	65 - 90	14	13%	46%
	91 - 128	15	14%	60%
	129 - 180	18	16%	76%
	181 - 255	15	14%	90%
Boulders	256 - 512	11	10%	100%
	TOTALS:	**110**		



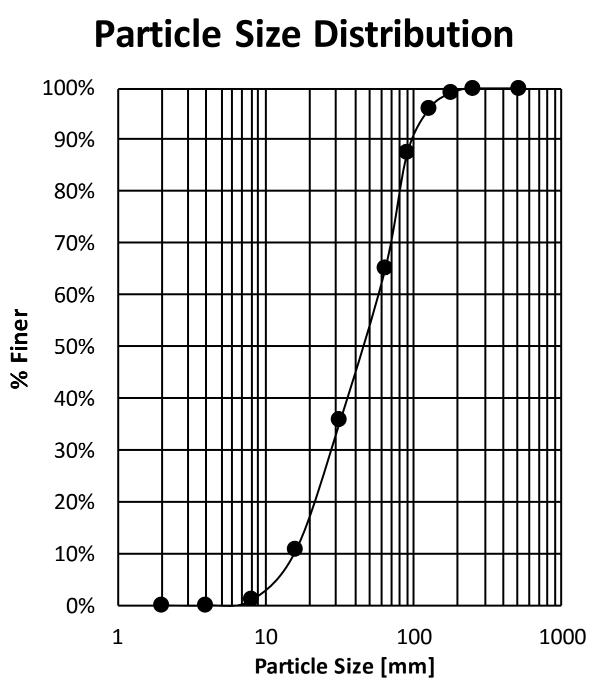


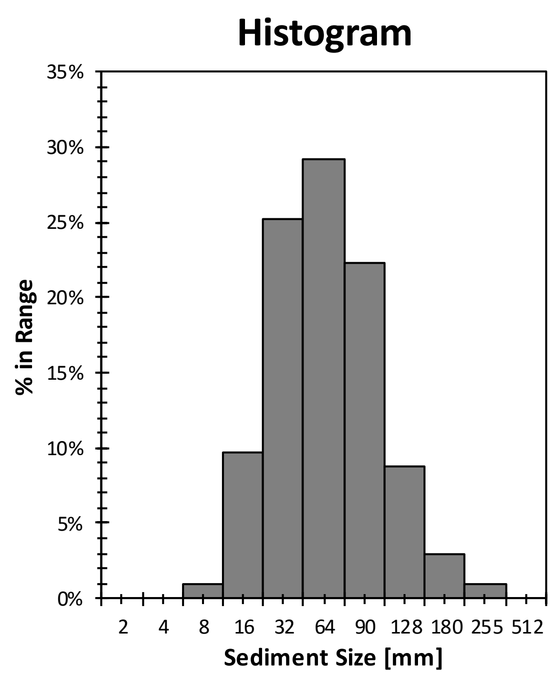
D_{10}	26.7	mm
D_{16}	34.4	mm
D_{50}	100.1	mm
D_{84}	222.0	mm
D_{90}	255.0	mm
D_{95}	383.5	mm

Pebble Count: GS-16

Site Name:	South East of Rock Springs Road and County Road 86-1 Intersection
Location:	42°26'24.2"N 78°38'51.6"W
Date:	6/22/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	0	0%	0%
	5 - 8	1	1%	1%
	9 - 16	10	10%	11%
	17 - 32	26	25%	36%
	33 - 64	30	29%	65%
Cobbles	65 - 90	23	22%	87%
	91 - 128	9	9%	96%
	129 - 180	3	3%	99%
	181 - 255	1	1%	100%
Boulders	256 - 512	0	0%	100%
	TOTALS:	**103**		

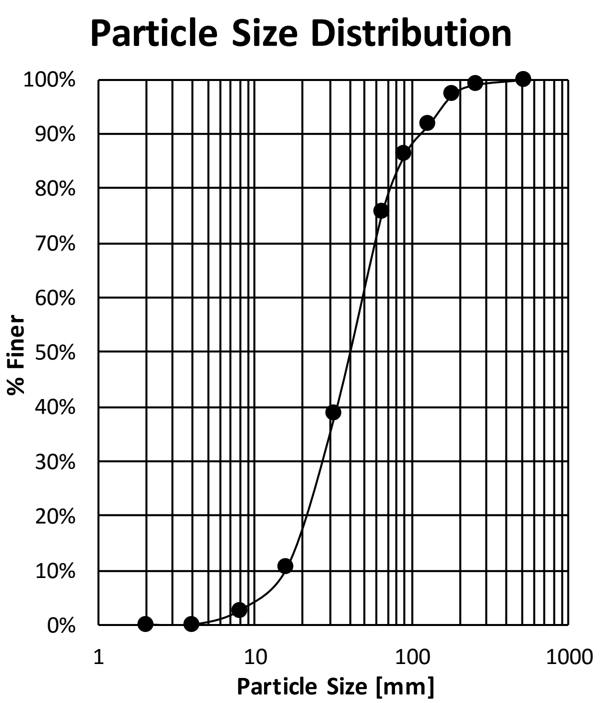


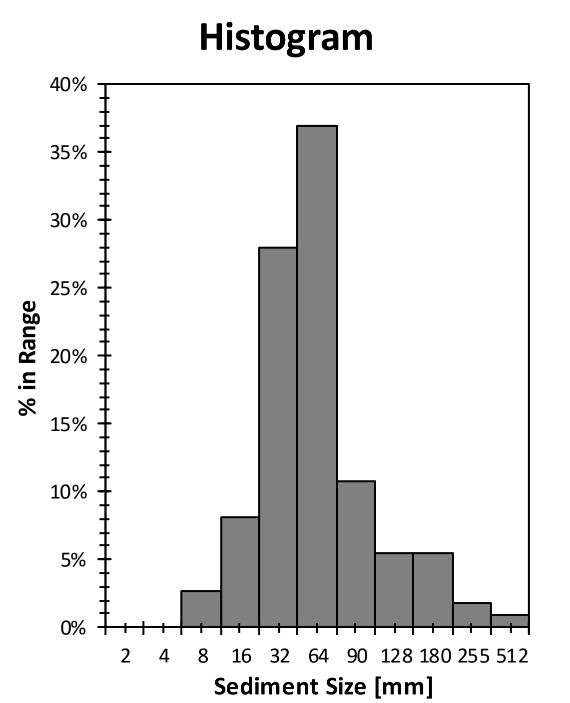


D_{10}	15.4	mm
D_{16}	19.4	mm
D_{50}	47.5	mm
D_{84}	86.1	mm
D_{90}	101.4	mm
D_{95}	123.1	mm

Pebble Count: GS-17

Site Name:	South East of Rock Springs Road and County Road 86-1 Intersection			
Location:	42°26'25.4"N 78°38'47.3"W			
Date:	6/22/2016			
	Particle Size (mm)	**Total #**	**% in Range**	**% Finer**
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	0	0%	0%
	5 - 8	3	3%	3%
	9 - 16	9	8%	11%
	17 - 32	31	28%	39%
	33 - 64	41	37%	76%
Cobbles	65 - 90	12	11%	86%
	91 - 128	6	5%	92%
	129 - 180	6	5%	97%
	181 - 255	2	2%	99%
Boulders	256 - 512	1	1%	100%
	TOTALS:	**111**		



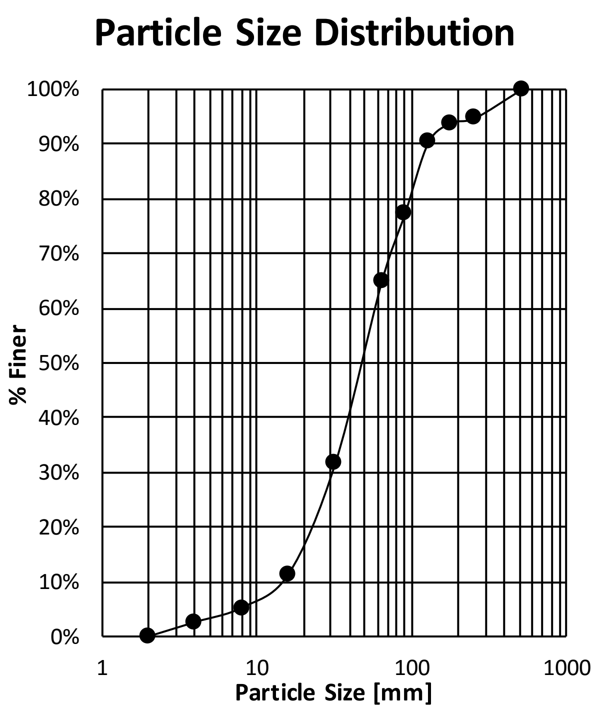


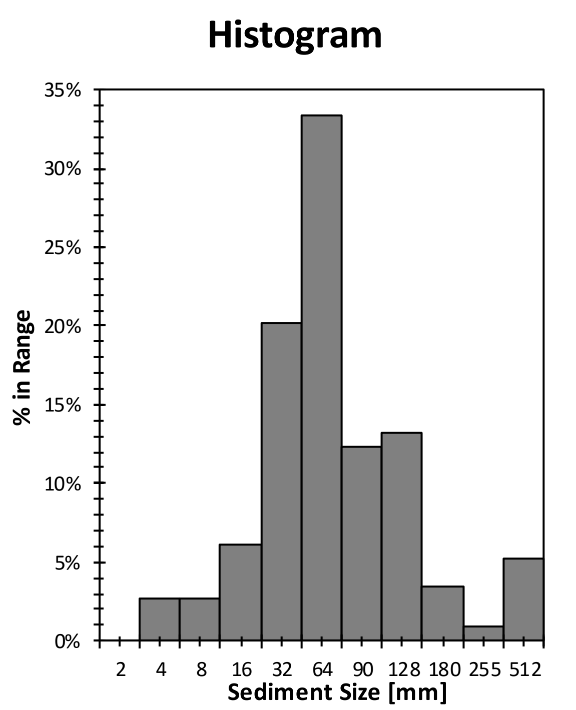
D_{10}	15.2	mm
D_{16}	19.0	mm
D_{50}	41.8	mm
D_{84}	84.0	mm
D_{90}	114.7	mm
D_{95}	157.9	mm

Pebble Count: GS-18

Site Name:	Near Fox Valley Rd and Railroad intersection
Location:	42°26'00.8"N 78°37'51.8"W
Date:	6/22/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	3	3%	3%
	5 - 8	3	3%	5%
	9 - 16	7	6%	11%
	17 - 32	23	20%	32%
	33 - 64	38	33%	65%
Cobbles	65 - 90	14	12%	77%
	91 - 128	15	13%	90%
	129 - 180	4	4%	94%
	181 - 255	1	1%	95%
Boulders	256 - 512	6	5%	100%
	TOTALS:	**114**		



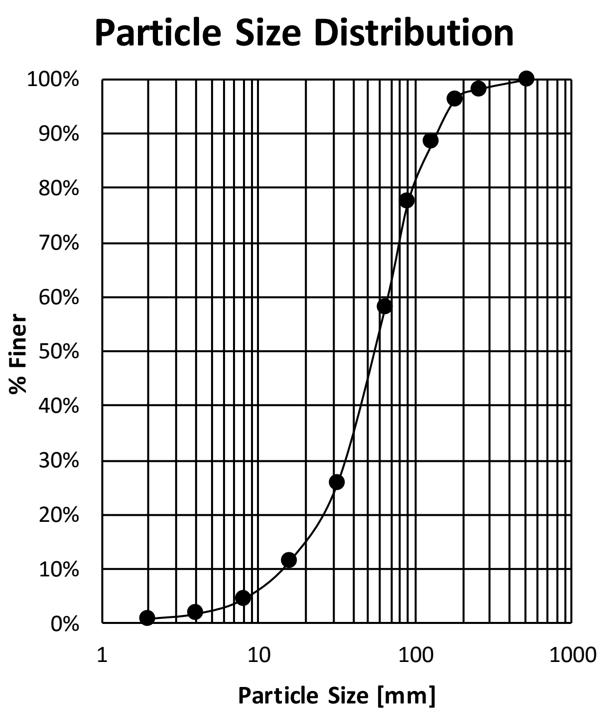


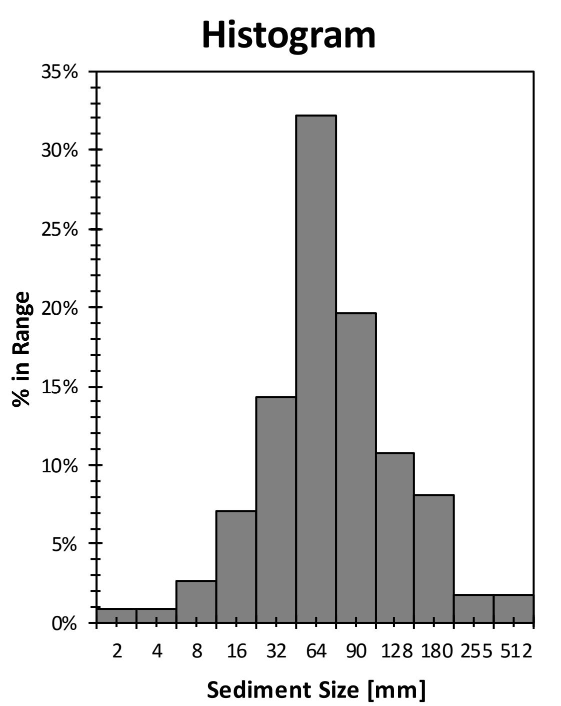
D_{10}	14.2	mm
D_{16}	19.6	mm
D_{50}	49.7	mm
D_{84}	109.7	mm
D_{90}	127.0	mm
D_{95}	267.9	mm

Pebble Count: GS-19

Site Name:	Near Fox Valley Rd and Railroad intersection
Location:	42°26'02.1"N 78°37'53.7"W
Date:	6/22/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	1	1%	1%
Gravels	2 - 4	1	1%	2%
	5 - 8	3	3%	4%
	9 - 16	8	7%	12%
	17 - 32	16	14%	26%
	33 - 64	36	32%	58%
Cobbles	65 - 90	22	20%	78%
	91 - 128	12	11%	88%
	129 - 180	9	8%	96%
	181 - 255	2	2%	98%
Boulders	256 - 512	2	2%	100%
	TOTALS:	**112**		



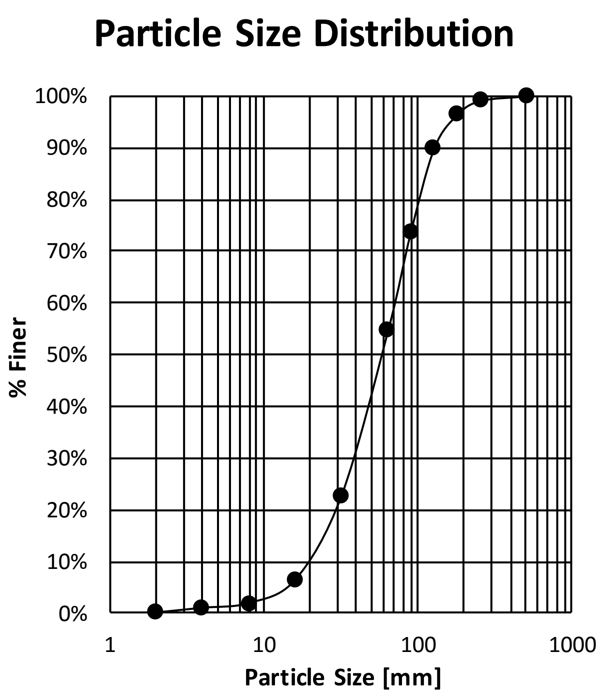


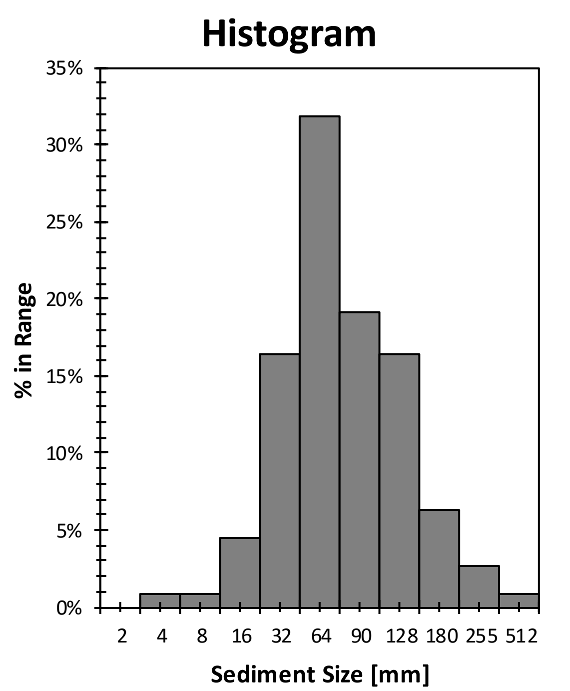
D_{10}	14.2	mm
D_{16}	20.9	mm
D_{50}	56.0	mm
D_{84}	112.4	mm
D_{90}	138.4	mm
D_{95}	170.8	mm

Pebble Count: GS-20

Site Name:	Near Fox Valley Rd and Railroad intersection
Location:	42°25'59.7"N 78°37'47.7"W
Date:	6/22/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	1	1%	1%
	5 - 8	1	1%	2%
	9 - 16	5	5%	6%
	17 - 32	18	16%	23%
	33 - 64	35	32%	55%
Cobbles	65 - 90	21	19%	74%
	91 - 128	18	16%	90%
	129 - 180	7	6%	96%
	181 - 255	3	3%	99%
Boulders	256 - 512	1	1%	100%
	TOTALS:	**110**		



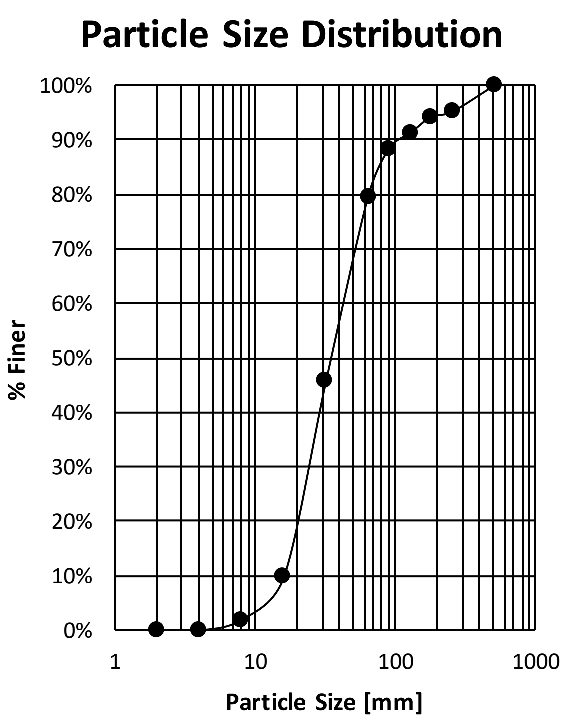


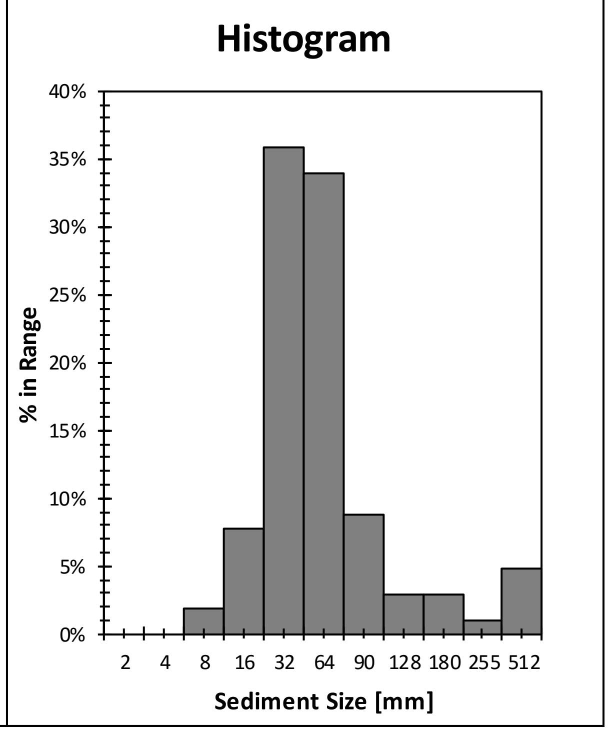
D_{10}	19.6	mm
D_{16}	25.4	mm
D_{50}	59.4	mm
D_{84}	114.1	mm
D_{90}	128.0	mm
D_{95}	168.9	mm

Pebble Count: GS-21

Site Name: Heinz Creek
Location: 42°27'07.7"N 78°38'25.8"W
Date: 6/23/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	0	0%	0%
	5 - 8	2	2%	2%
	9 - 16	8	8%	10%
	17 - 32	37	36%	46%
	33 - 64	35	34%	80%
Cobbles	65 - 90	9	9%	88%
	91 - 128	3	3%	91%
	129 - 180	3	3%	94%
	181 - 255	1	1%	95%
Boulders	256 - 512	5	5%	100%
	TOTALS:	103		



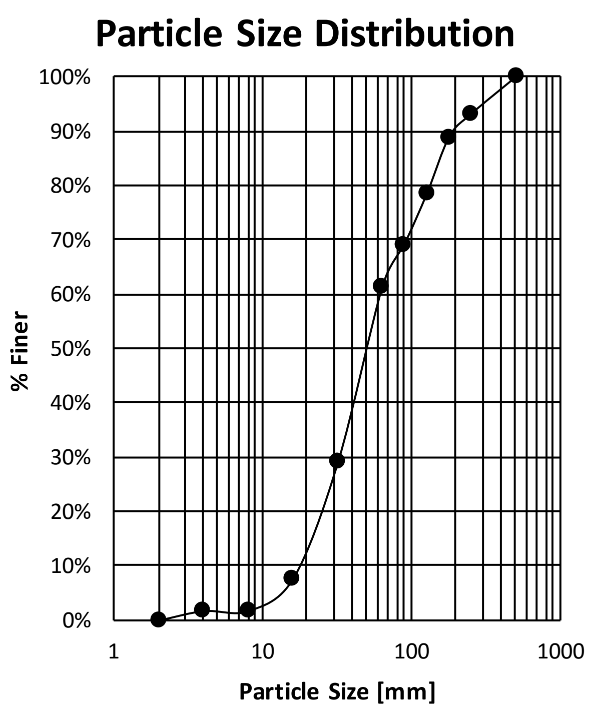


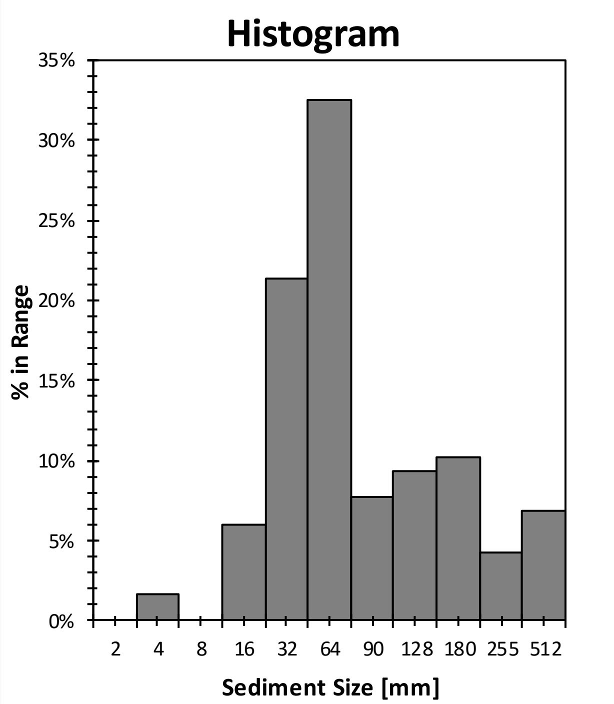
D_{10}	16.1	mm
D_{16}	18.8	mm
D_{50}	36.1	mm
D_{84}	77.1	mm
D_{90}	111.5	mm
D_{95}	243.7	mm

Pebble Count: GS-22

Site Name:	Heinz Creek
Location:	42°27'07.9"N 78°38'29.4"W
Date:	6/23/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	2	2%	2%
	5 - 8	0	0%	2%
	9 - 16	7	6%	8%
	17 - 32	25	21%	29%
	33 - 64	38	32%	62%
Cobbles	65 - 90	9	8%	69%
	91 - 128	11	9%	79%
	129 - 180	12	10%	89%
	181 - 255	5	4%	93%
Boulders	256 - 512	8	7%	100%
	TOTALS:	**117**		

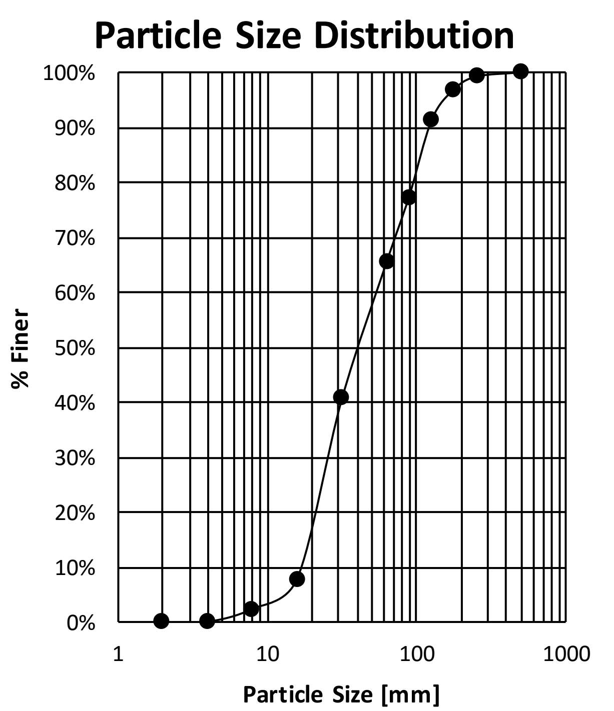


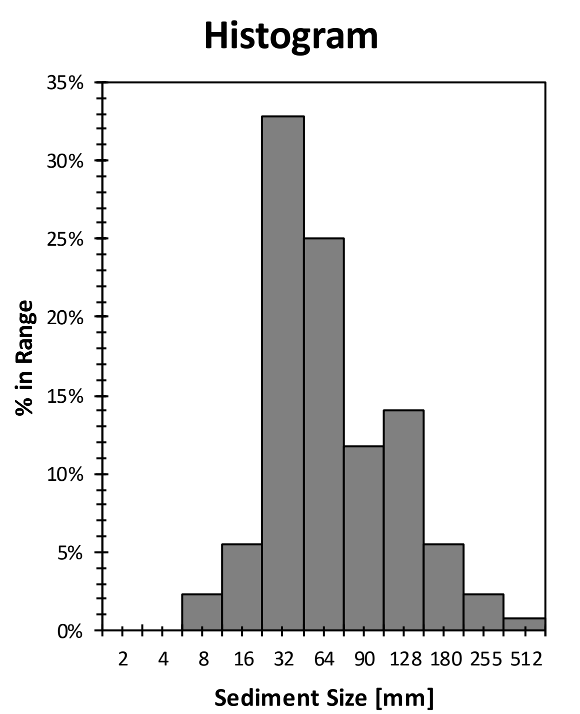


D_{10}	17.7	mm
D_{16}	22.2	mm
D_{50}	52.6	mm
D_{84}	155.2	mm
D_{90}	199.5	mm
D_{95}	324.1	mm

Pebble Count: GS-23

Site Name:	Heinz Creek			
Location:	42°27'06.2"N 78°38'30.9"W			
Date:	6/23/2016			
	Particle Size (mm)	**Total #**	**% in Range**	**% Finer**
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	0	0%	0%
	5 - 8	3	2%	2%
	9 - 16	7	5%	8%
	17 - 32	42	33%	41%
	33 - 64	32	25%	66%
Cobbles	65 - 90	15	12%	77%
	91 - 128	18	14%	91%
	129 - 180	7	5%	97%
	181 - 255	3	2%	99%
Boulders	256 - 512	1	1%	100%
	TOTALS:	**128**		



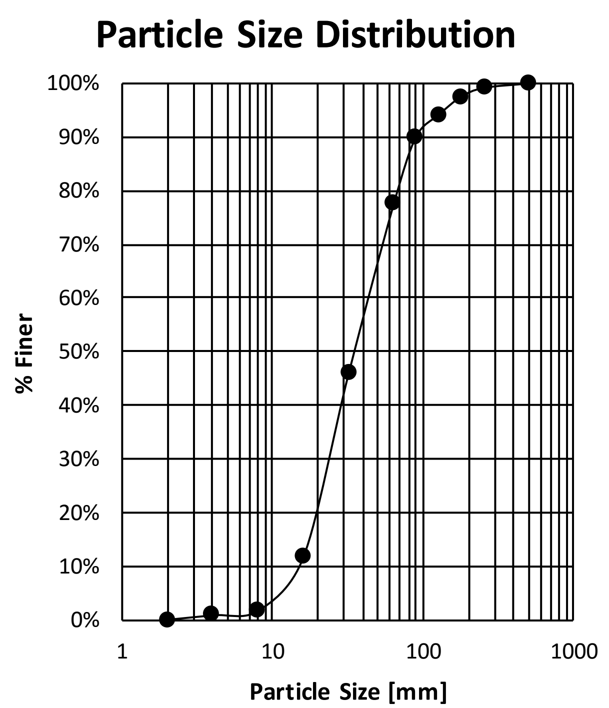


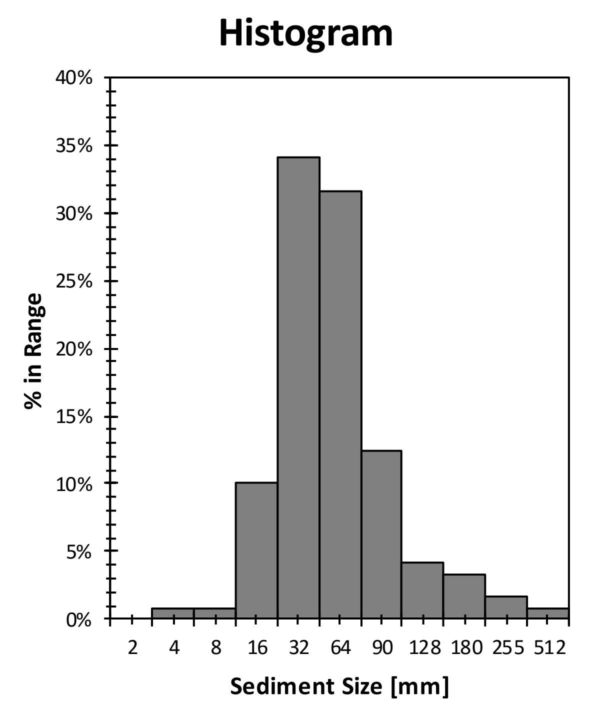
D_{10}	17.1	mm
D_{16}	20.0	mm
D_{50}	44.0	mm
D_{84}	108.0	mm
D_{90}	124.2	mm
D_{95}	162.2	mm

Pebble Count: GS-24

Site Name:	Buttermilk Creek
Location:	42°27'10.9"N 78°38'40.0"W
Date:	7/12/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	1	1%	1%
	5 - 8	1	1%	2%
	9 - 16	12	10%	12%
	17 - 32	41	34%	46%
	33 - 64	38	32%	78%
Cobbles	65 - 90	15	13%	90%
	91 - 128	5	4%	94%
	129 - 180	4	3%	98%
	181 - 255	2	2%	99%
Boulders	256 - 512	1	1%	100%
	TOTALS:	**120**		

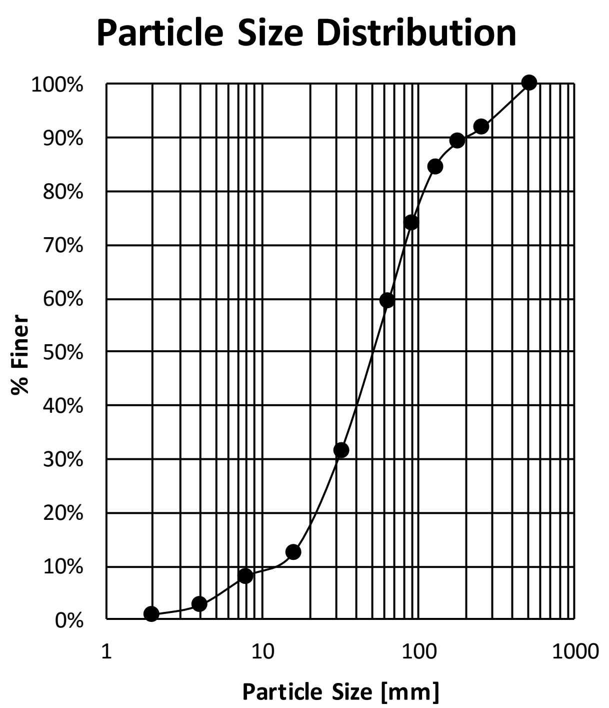


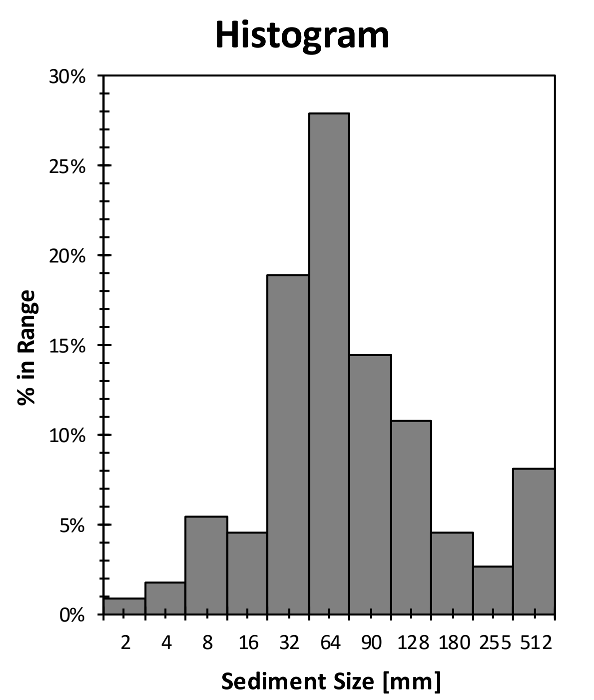


D_{10}	14.7	mm
D_{16}	18.0	mm
D_{50}	36.2	mm
D_{84}	77.5	mm
D_{90}	90.0	mm
D_{95}	141.0	mm

Pebble Count: GS-25

Site Name:	N. of fire hall, Buttermilk			
Location:	42°23'57.1"N 78°36'28.0"W			
Date:	7/12/2016			
	Particle Size (mm)	**Total #**	**% in Range**	**% Finer**
Sand and Silt	< 2	1	1%	1%
Gravels	2 - 4	2	2%	3%
	5 - 8	6	5%	8%
	9 - 16	5	5%	13%
	17 - 32	21	19%	32%
	33 - 64	31	28%	59%
Cobbles	65 - 90	16	14%	74%
	91 - 128	12	11%	85%
	129 - 180	5	5%	89%
	181 - 255	3	3%	92%
Boulders	256 - 512	9	8%	100%
	TOTALS:	**111**		



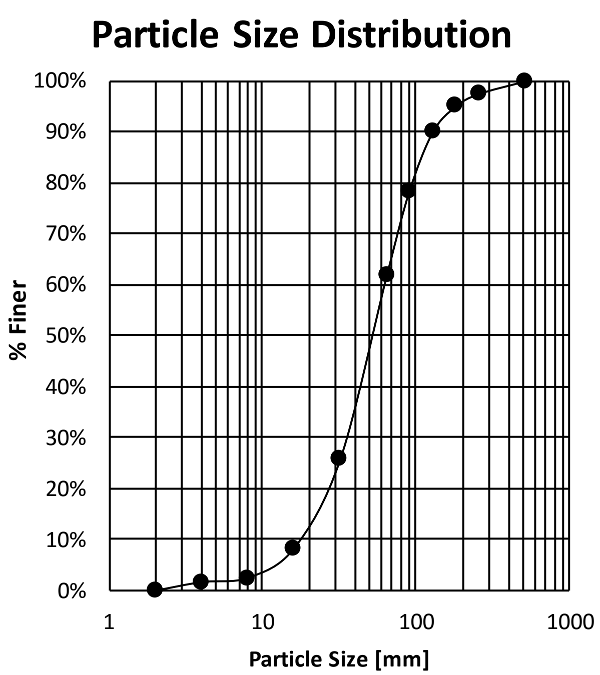


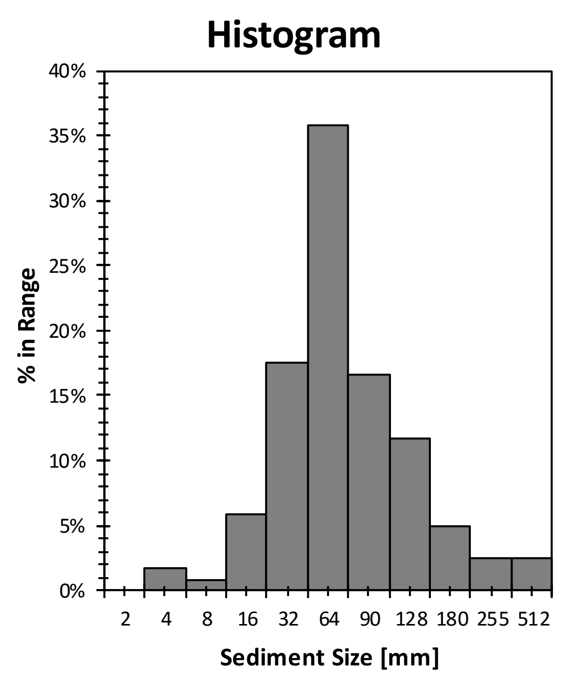
D_{10}	11.4	mm
D_{16}	18.9	mm
D_{50}	53.2	mm
D_{84}	125.6	mm
D_{90}	202.5	mm
D_{95}	353.5	mm

Pebble Count: GS-26

Site Name:	N. of fire hall, Buttermilk
Location:	42°24'03.2"N 78°36'30.6"W
Date:	7/12/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	2	2%	2%
	5 - 8	1	1%	3%
	9 - 16	7	6%	8%
	17 - 32	21	18%	26%
	33 - 64	43	36%	62%
Cobbles	65 - 90	20	17%	78%
	91 - 128	14	12%	90%
	129 - 180	6	5%	95%
	181 - 255	3	3%	98%
Boulders	256 - 512	3	3%	100%
	TOTALS:	**120**		



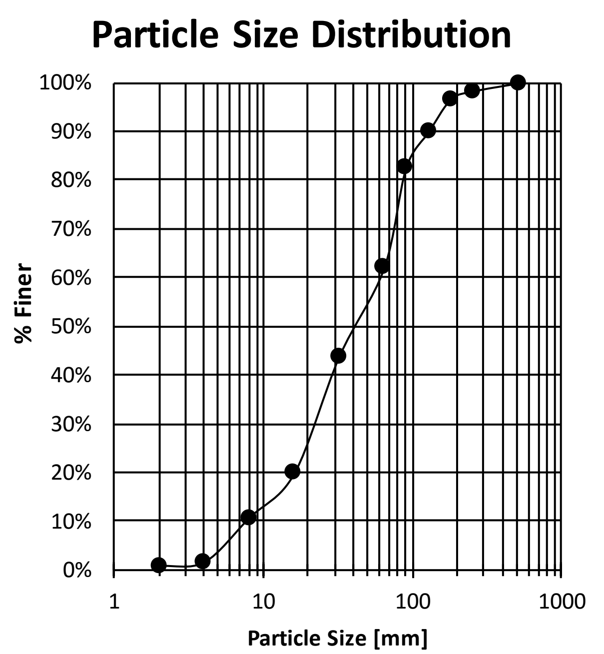


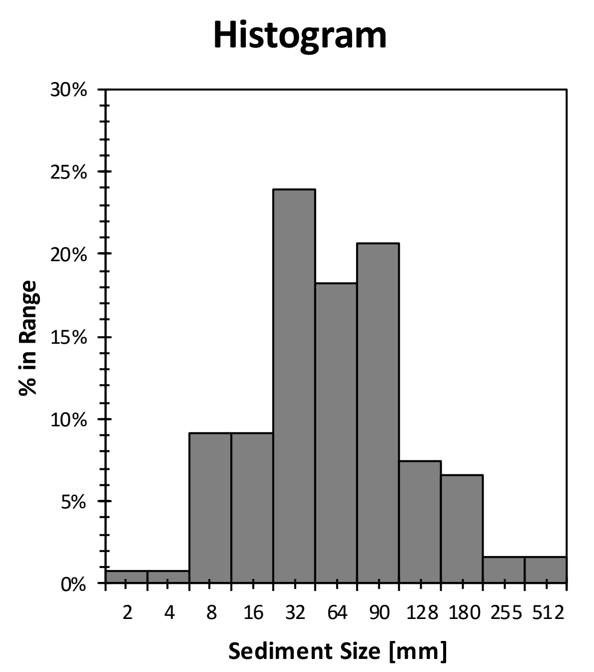
D_{10}	17.5	mm
D_{16}	23.0	mm
D_{50}	53.6	mm
D_{84}	108.5	mm
D_{90}	128.0	mm
D_{95}	180.0	mm

Pebble Count: GS-27

Site Name:	Buttermilk
Location:	42°25'39.9"N 78°37'30.6"W
Date:	7/12/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	1	1%	1%
Gravels	2 - 4	1	1%	2%
	5 - 8	11	9%	11%
	9 - 16	11	9%	20%
	17 - 32	29	24%	44%
	33 - 64	22	18%	62%
Cobbles	65 - 90	25	21%	83%
	91 - 128	9	7%	90%
	129 - 180	8	7%	97%
	181 - 255	2	2%	98%
Boulders	256 - 512	2	2%	100%
	TOTALS:	121		

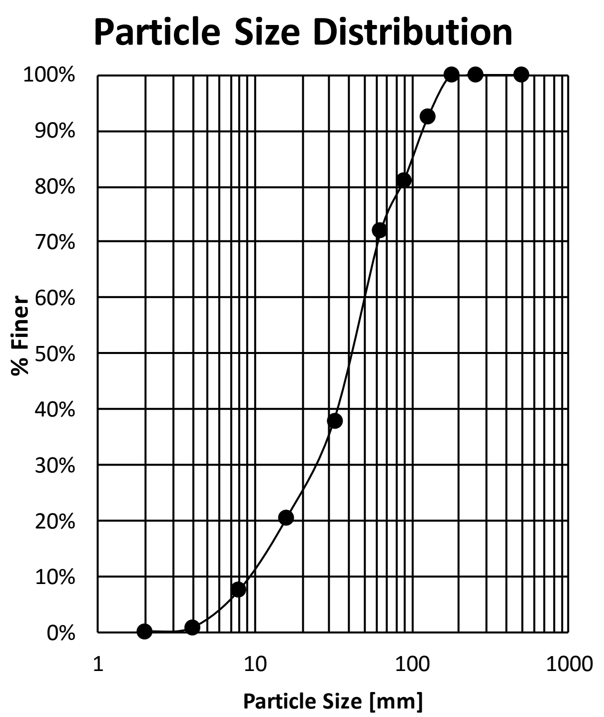


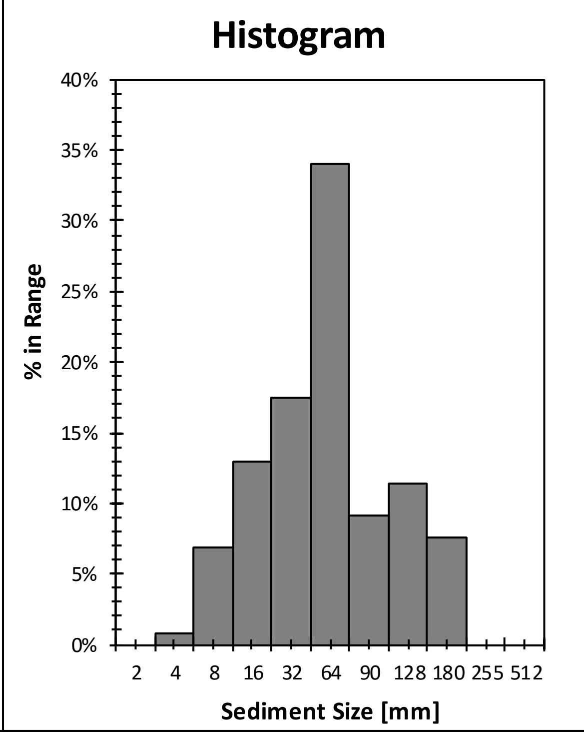


D_{10}	7.7	mm
D_{16}	12.6	mm
D_{50}	42.9	mm
D_{84}	96.9	mm
D_{90}	127.6	mm
D_{95}	166.7	mm

Pebble Count: <u>GS-28</u>

Site Name:	Cattaraugus Creek			
Location:	42°28'51.8"N 78°40'54.5"W			
Date:	7/12/2016			
	Particle Size (mm)	**Total #**	**% in Range**	**% Finer**
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	1	1%	1%
	5 - 8	9	7%	8%
	9 - 16	17	13%	20%
	17 - 32	23	17%	38%
	33 - 64	45	34%	72%
Cobbles	65 - 90	12	9%	81%
	91 - 128	15	11%	92%
	129 - 180	10	8%	100%
	181 - 255	0	0%	100%
Boulders	256 - 512	0	0%	100%
	TOTALS:	**132**		



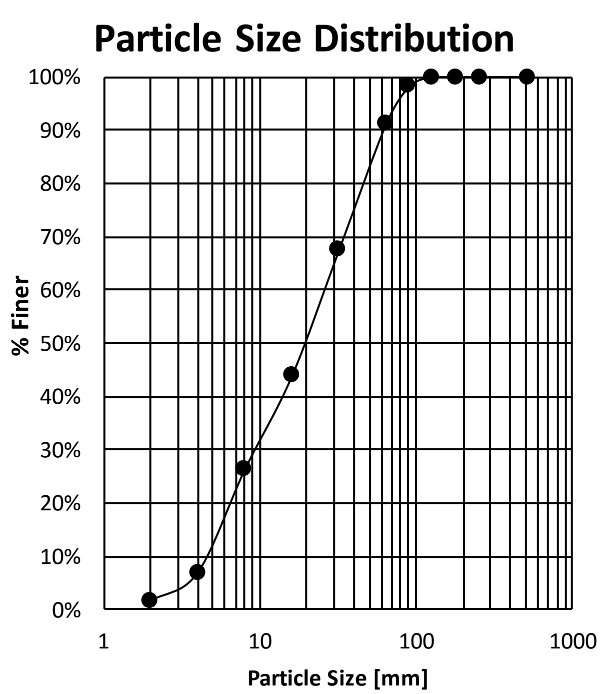


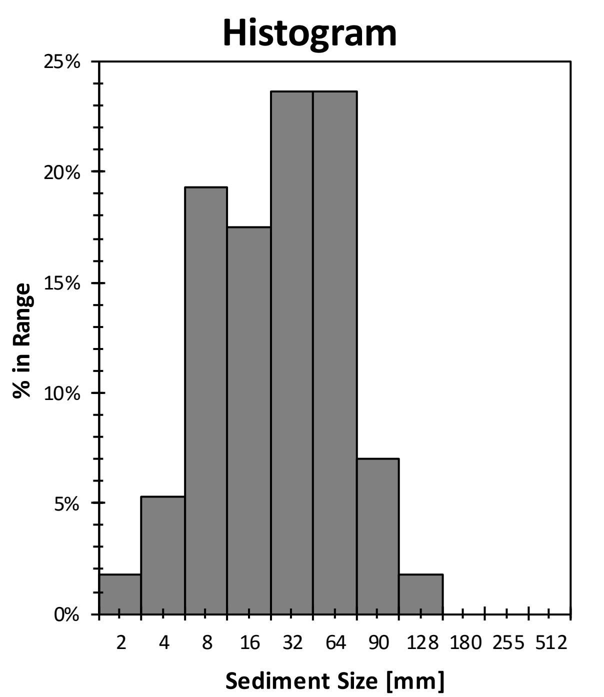
D_{10}	9.5	mm
D_{16}	13.2	mm
D_{50}	43.4	mm
D_{84}	99.8	mm
D_{90}	119.9	mm
D_{95}	145.7	mm

Pebble Count: GS-29

Site Name:	Cattaraugus Creek
Location:	42°29'43.9"N 78°38'26.7"W
Date:	7/12/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	2	2%	2%
Gravels	2 - 4	6	5%	7%
	5 - 8	22	19%	26%
	9 - 16	20	18%	44%
	17 - 32	27	24%	68%
	33 - 64	27	24%	91%
Cobbles	65 - 90	8	7%	98%
	91 - 128	2	2%	100%
	129 - 180	0	0%	100%
	181 - 255	0	0%	100%
Boulders	256 - 512	0	0%	100%
	TOTALS:	**114**		



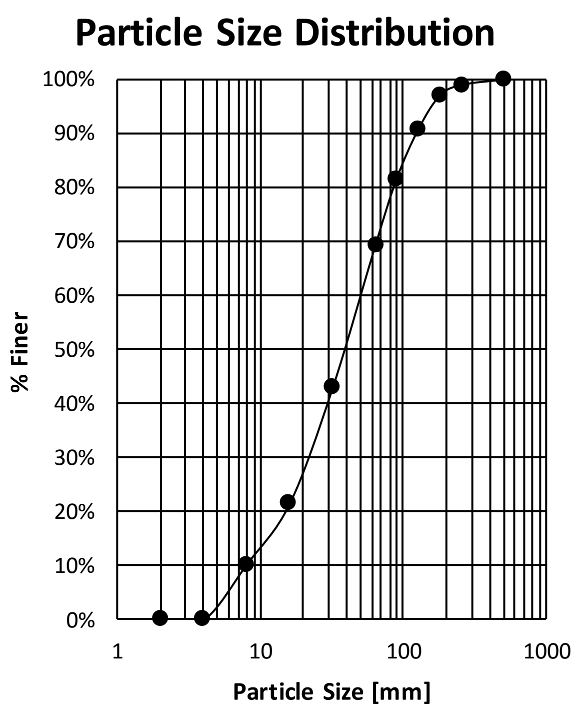


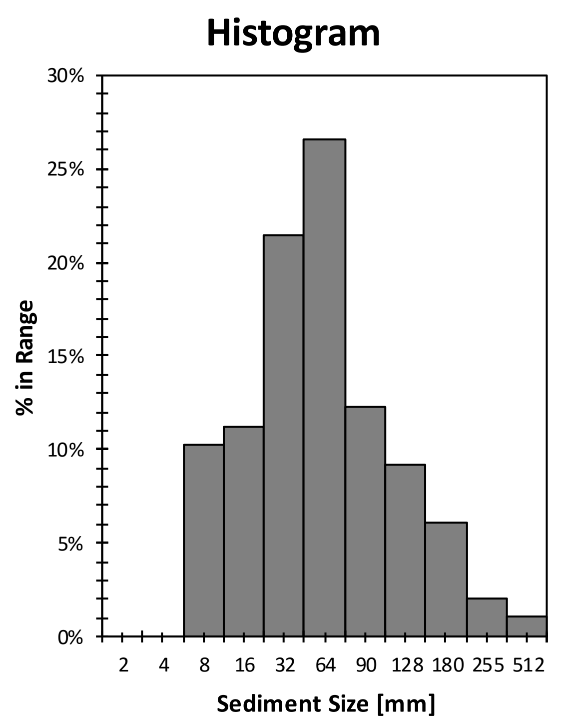
D_{10}	4.6	mm
D_{16}	5.9	mm
D_{50}	20.1	mm
D_{84}	54.2	mm
D_{90}	62.3	mm
D_{95}	78.0	mm

Pebble Count: GS-30

Site Name:	Gooseneck creek
Location:	42°26'17.1"N 78°37'54.2"W
Date:	8/1/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	0	0%	0%
	5 - 8	10	10%	10%
	9 - 16	11	11%	21%
	17 - 32	21	21%	43%
	33 - 64	26	27%	69%
Cobbles	65 - 90	12	12%	82%
	91 - 128	9	9%	91%
	129 - 180	6	6%	97%
	181 - 255	2	2%	99%
Boulders	256 - 512	1	1%	100%
	TOTALS:	**98**		



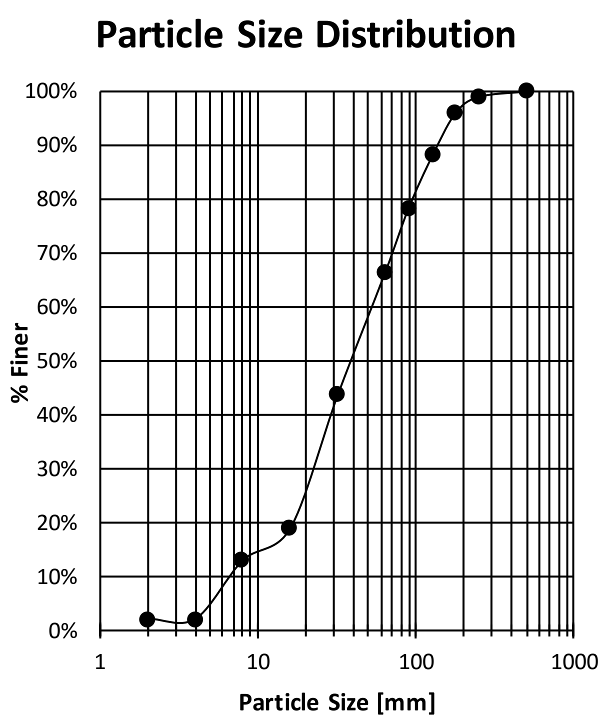


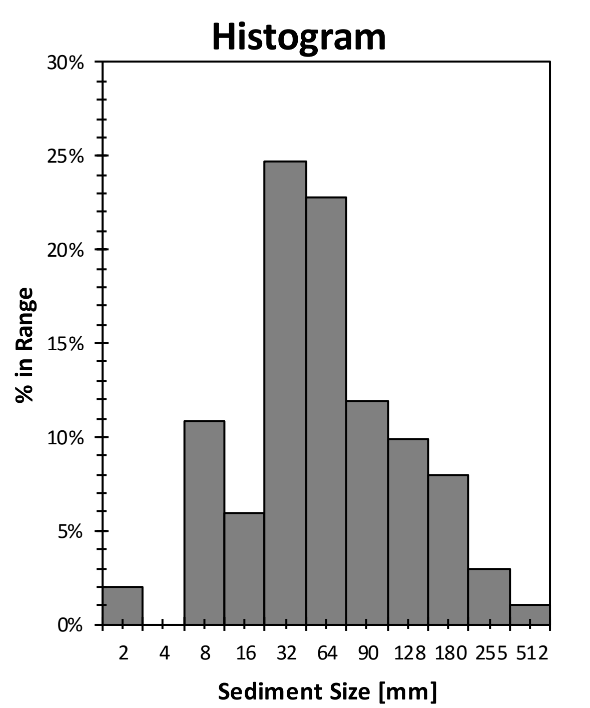
D_{10}	7.9	mm
D_{16}	12.1	mm
D_{50}	40.6	mm
D_{84}	99.8	mm
D_{90}	124.6	mm
D_{95}	163.5	mm

Pebble Count: <u>GS-31</u>

Site Name:	Gooseneck creek			
Location:	42°26'19.6"N 78°37'42.7"W			
Date:	8/1/2016			

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	2	2%	2%
Gravels	2 - 4	0	0%	2%
	5 - 8	11	11%	13%
	9 - 16	6	6%	19%
	17 - 32	25	25%	44%
	33 - 64	23	23%	66%
Cobbles	65 - 90	12	12%	78%
	91 - 128	10	10%	88%
	129 - 180	8	8%	96%
	181 - 255	3	3%	99%
Boulders	256 - 512	1	1%	100%
	TOTALS:	**101**		



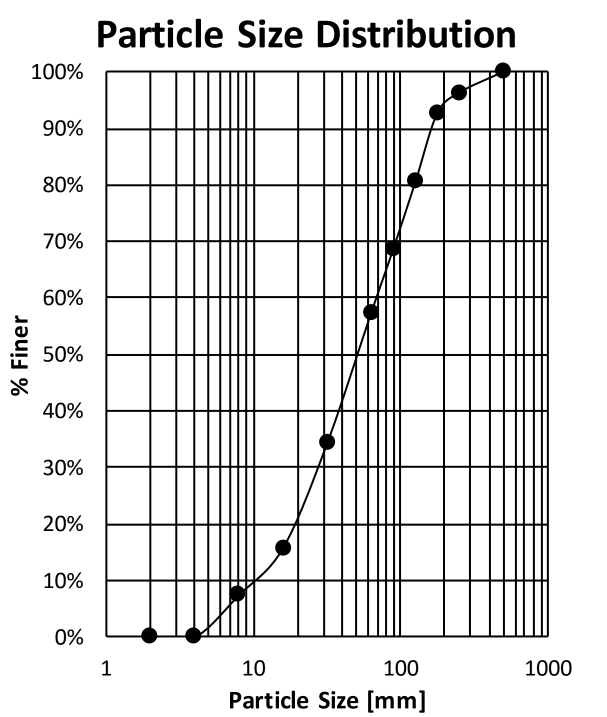


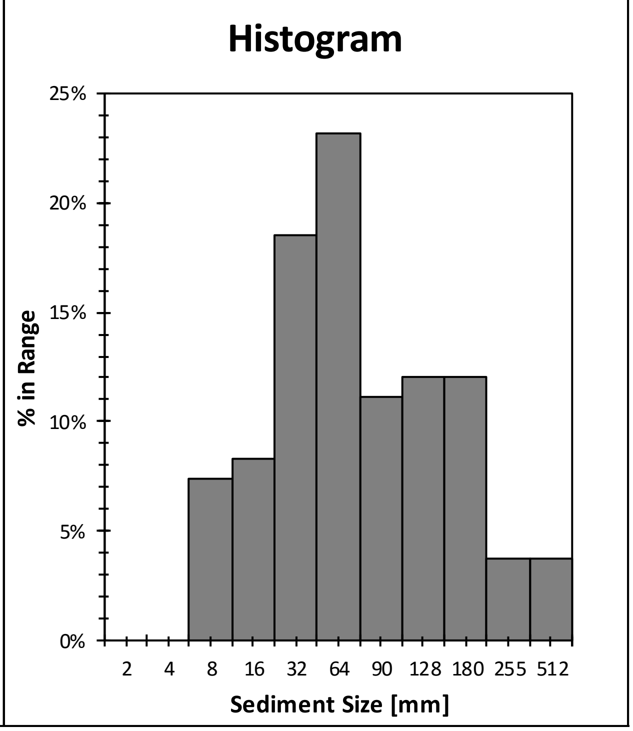
D_{10}	6.9	mm
D_{16}	12.2	mm
D_{50}	41.0	mm
D_{84}	112.2	mm
D_{90}	140.4	mm
D_{95}	173.2	mm

Pebble Count: GS-32

Site Name:	Gooseneck creek
Location:	42°26'19.1"N 78°37'28.6"W
Date:	8/1/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	0	0%	0%
	5 - 8	8	7%	7%
	9 - 16	9	8%	16%
	17 - 32	20	19%	34%
	33 - 64	25	23%	57%
Cobbles	65 - 90	12	11%	69%
	91 - 128	13	12%	81%
	129 - 180	13	12%	93%
	181 - 255	4	4%	96%
Boulders	256 - 512	4	4%	100%
	TOTALS:	**108**		



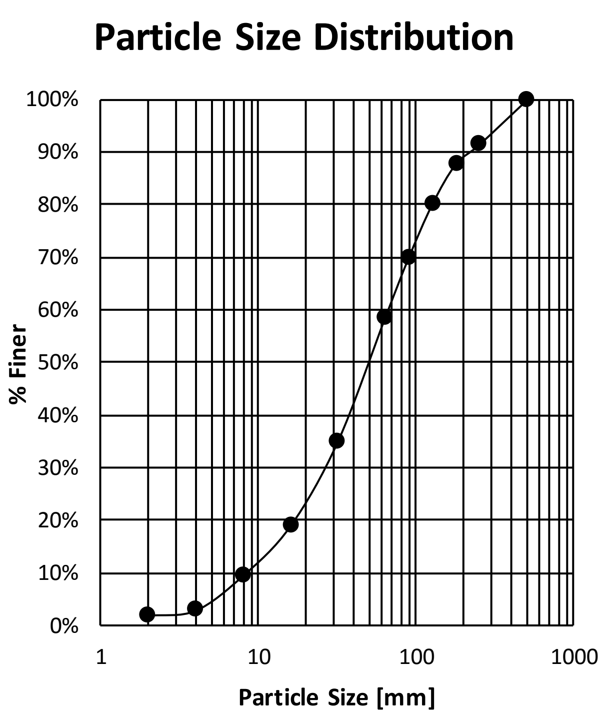


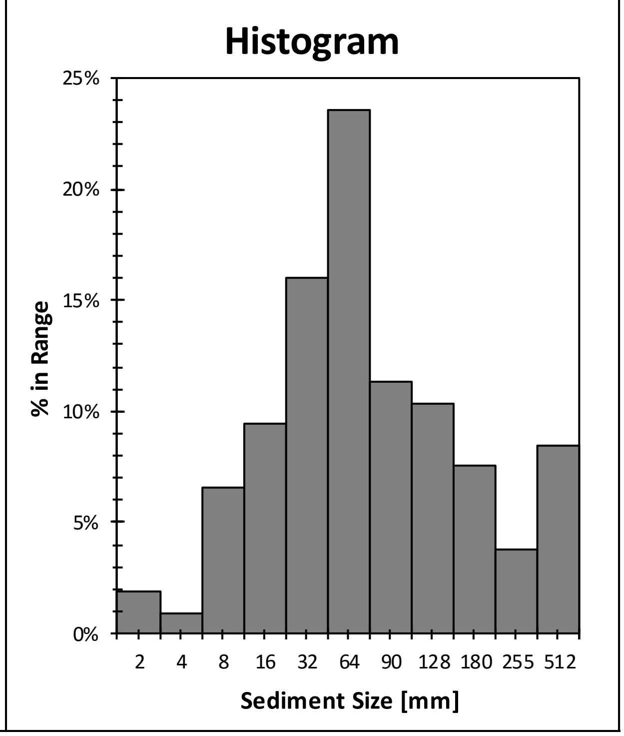
D_{10}	10.5	mm
D_{16}	16.2	mm
D_{50}	53.8	mm
D_{84}	142.9	mm
D_{90}	168.8	mm
D_{95}	228.8	mm

Pebble Count: GS-33

Site Name:	Gooseneck creek
Location:	42°26'20.2"N 78°37'08.7"W
Date:	8/1/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	2	2%	2%
Gravels	2 - 4	1	1%	3%
	5 - 8	7	7%	9%
	9 - 16	10	9%	19%
	17 - 32	17	16%	35%
	33 - 64	25	24%	58%
Cobbles	65 - 90	12	11%	70%
	91 - 128	11	10%	80%
	129 - 180	8	8%	88%
	181 - 255	4	4%	92%
Boulders	256 - 512	9	8%	100%
	TOTALS:	**106**		



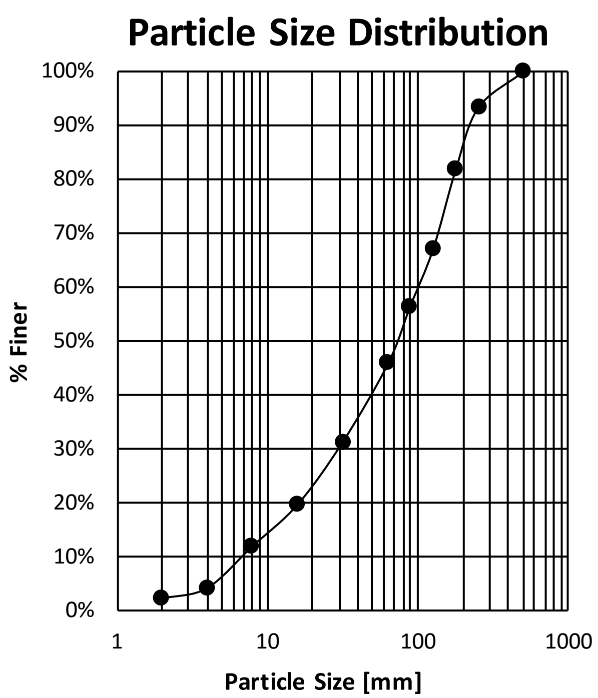


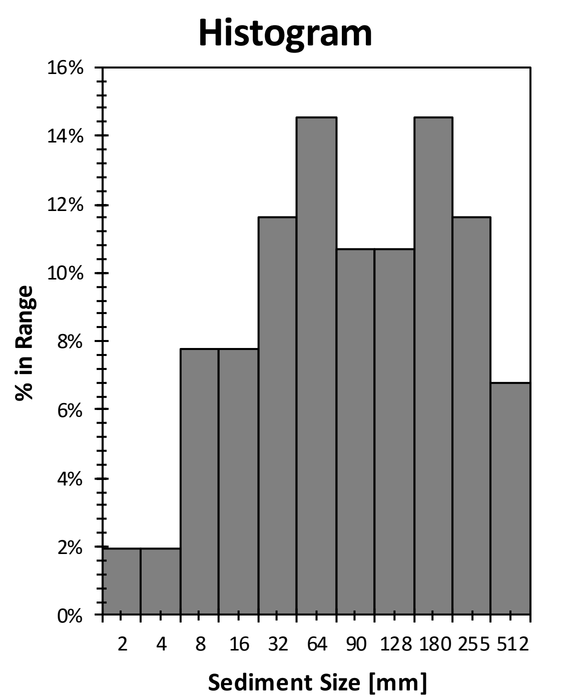
D_{10}	8.5	mm
D_{16}	13.6	mm
D_{50}	52.5	mm
D_{84}	154.3	mm
D_{90}	225.0	mm
D_{95}	360.7	mm

Pebble Count: GS-34

Site Name:	Gooseneck creek
Location:	42°26'34.3"N 78°36'51.5"W
Date:	8/1/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	2	2%	2%
Gravels	2 - 4	2	2%	4%
	5 - 8	8	8%	12%
	9 - 16	8	8%	19%
	17 - 32	12	12%	31%
	33 - 64	15	15%	46%
Cobbles	65 - 90	11	11%	56%
	91 - 128	11	11%	67%
	129 - 180	15	15%	82%
	181 - 255	12	12%	93%
Boulders	256 - 512	7	7%	100%
	TOTALS:	**103**		

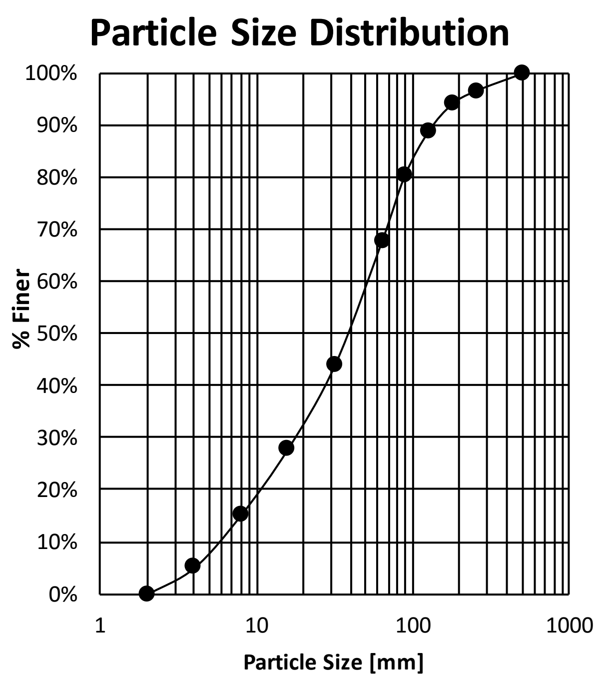


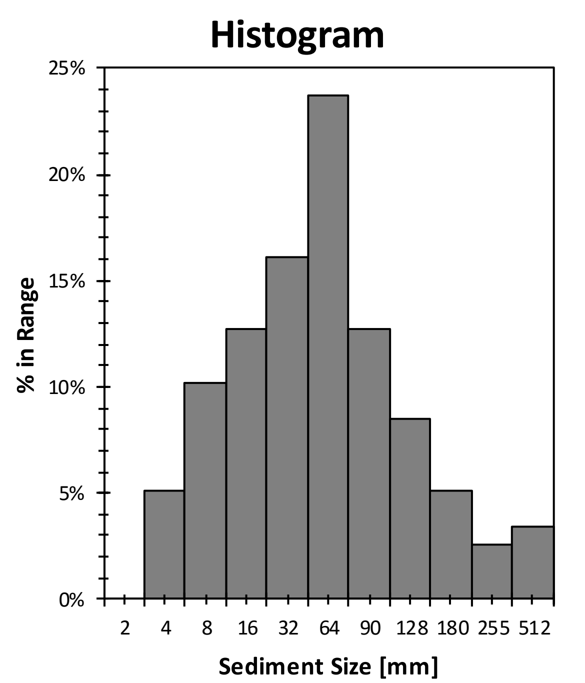


D_{10}	7.2	mm
D_{16}	12.5	mm
D_{50}	74.6	mm
D_{84}	195.8	mm
D_{90}	234.4	mm
D_{95}	322.9	mm

Pebble Count: GS-35

Site Name:	Gooseneck creek			
Location:	42°26'37.0"N 78°36'38.5"W			
Date:	8/1/2016			
	Particle Size (mm)	**Total #**	**% in Range**	**% Finer**
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	6	5%	5%
	5 - 8	12	10%	15%
	9 - 16	15	13%	28%
	17 - 32	19	16%	44%
	33 - 64	28	24%	68%
Cobbles	65 - 90	15	13%	81%
	91 - 128	10	8%	89%
	129 - 180	6	5%	94%
	181 - 255	3	3%	97%
Boulders	256 - 512	4	3%	100%
	TOTALS:	**118**		

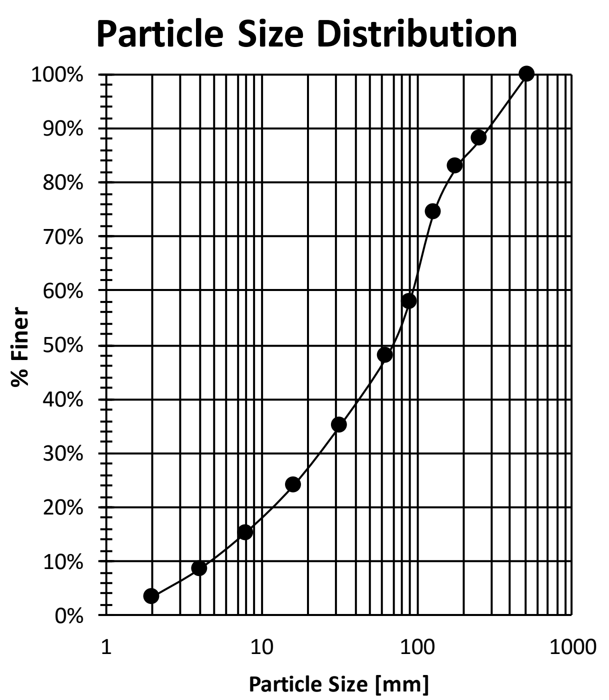


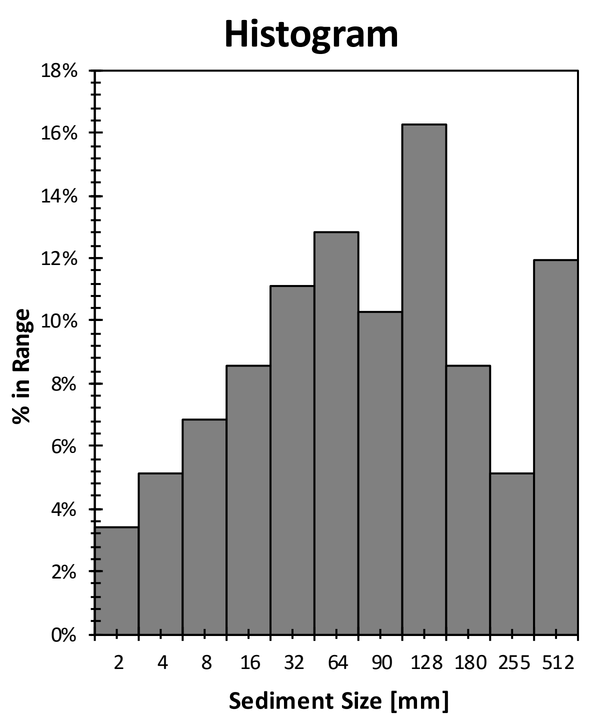


D_{10}	5.9	mm
D_{16}	8.5	mm
D_{50}	40.0	mm
D_{84}	105.7	mm
D_{90}	138.4	mm
D_{95}	207.5	mm

Pebble Count: GS-36

Site Name:	Gooseneck creek			
Location:	42°26'38.9"N 78°36'20.5"W			
Date:	8/1/2016			
	Particle Size (mm)	**Total #**	**% in Range**	**% Finer**
Sand and Silt	< 2	4	3%	3%
Gravels	2 - 4	6	5%	9%
	5 - 8	8	7%	15%
	9 - 16	10	9%	24%
	17 - 32	13	11%	35%
	33 - 64	15	13%	48%
Cobbles	65 - 90	12	10%	58%
	91 - 128	19	16%	74%
	129 - 180	10	9%	83%
	181 - 255	6	5%	88%
Boulders	256 - 512	14	12%	100%
	TOTALS:	**117**		



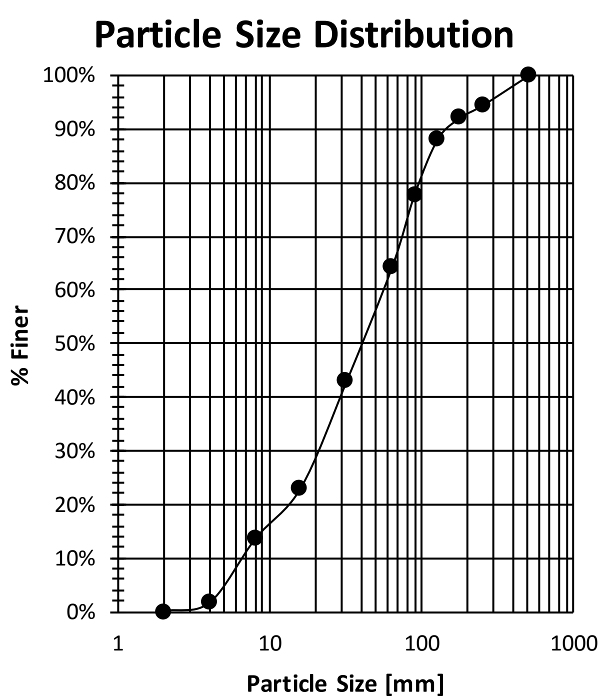


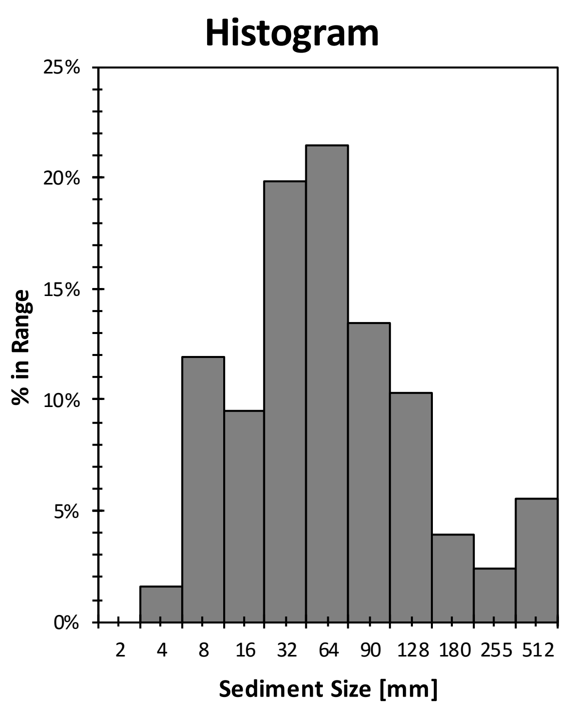
D_{10}	4.9	mm
D_{16}	8.6	mm
D_{50}	69.4	mm
D_{84}	196.0	mm
D_{90}	297.2	mm
D_{95}	404.6	mm

Pebble Count: GS-37

Site Name:	Gooseneck creek			
Location:	42°26'42.7"N 78°36'08.1"W			
Date:	8/1/2016			

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	2	2%	2%
	5 - 8	15	12%	13%
	9 - 16	12	10%	23%
	17 - 32	25	20%	43%
	33 - 64	27	21%	64%
Cobbles	65 - 90	17	13%	78%
	91 - 128	13	10%	88%
	129 - 180	5	4%	92%
	181 - 255	3	2%	94%
Boulders	256 - 512	7	6%	100%
	TOTALS:	**126**		

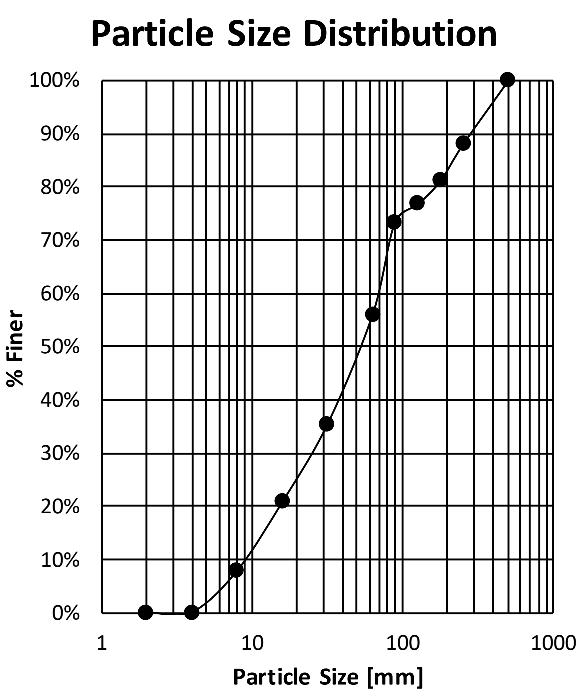


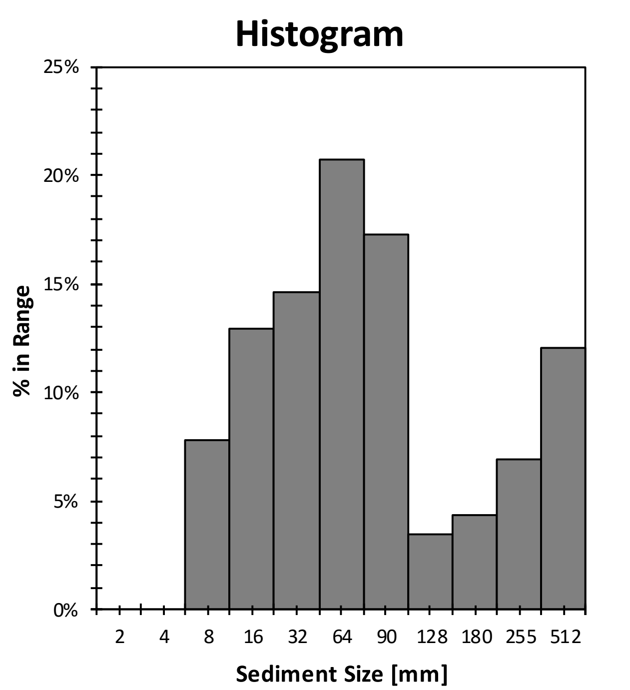


D_{10}	6.8	mm
D_{16}	10.1	mm
D_{50}	42.7	mm
D_{84}	112.9	mm
D_{90}	153.0	mm
D_{95}	280.7	mm

Pebble Count: GS-38

Site Name:	Gooseneck creek			
Location:	42°26'51.6"N 78°35'57.3"W			
Date:	8/1/2016			
	Particle Size (mm)	**Total #**	**% in Range**	**% Finer**
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	0	0%	0%
	5 - 8	9	8%	8%
	9 - 16	15	13%	21%
	17 - 32	17	15%	35%
	33 - 64	24	21%	56%
Cobbles	65 - 90	20	17%	73%
	91 - 128	4	3%	77%
	129 - 180	5	4%	81%
	181 - 255	8	7%	88%
Boulders	256 - 512	14	12%	100%
	TOTALS:	**116**		



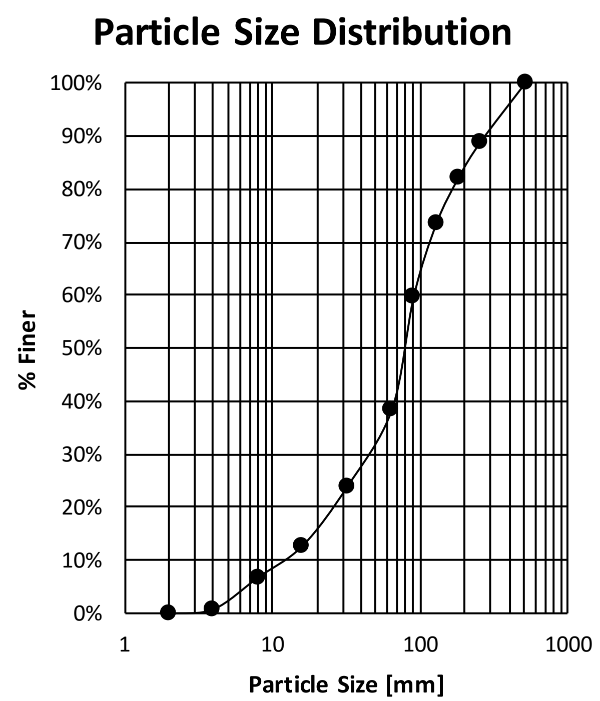


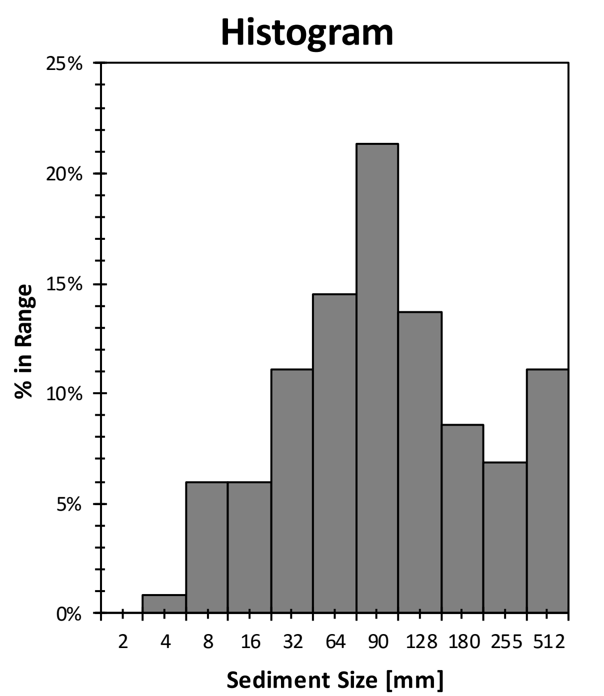
D_{10}	9.4	mm
D_{16}	13.1	mm
D_{50}	54.7	mm
D_{84}	212.3	mm
D_{90}	299.1	mm
D_{95}	405.5	mm

Pebble Count: GS-39

Site Name:	Gooseneck creek
Location:	42°26'59.0"N 78°35'46.3"W
Date:	8/1/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	1	1%	1%
	5 - 8	7	6%	7%
	9 - 16	7	6%	13%
	17 - 32	13	11%	24%
	33 - 64	17	15%	38%
Cobbles	65 - 90	25	21%	60%
	91 - 128	16	14%	74%
	129 - 180	10	9%	82%
	181 - 255	8	7%	89%
Boulders	256 - 512	13	11%	100%
	TOTALS:	**117**		



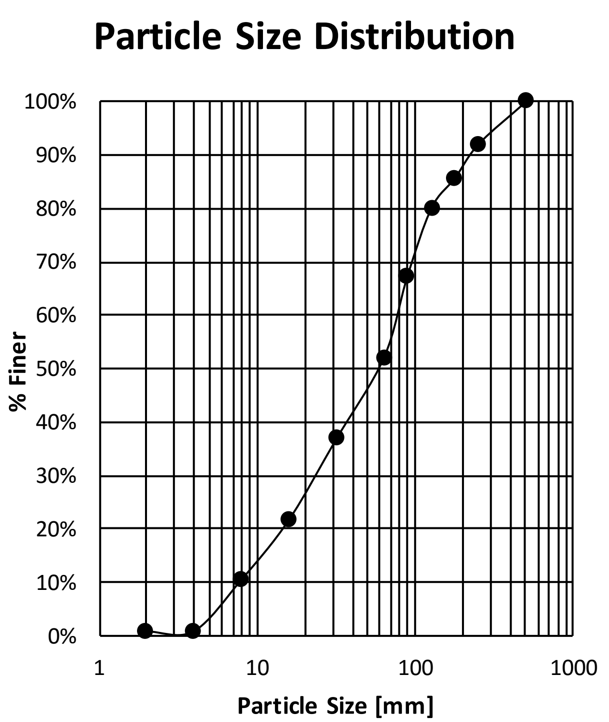


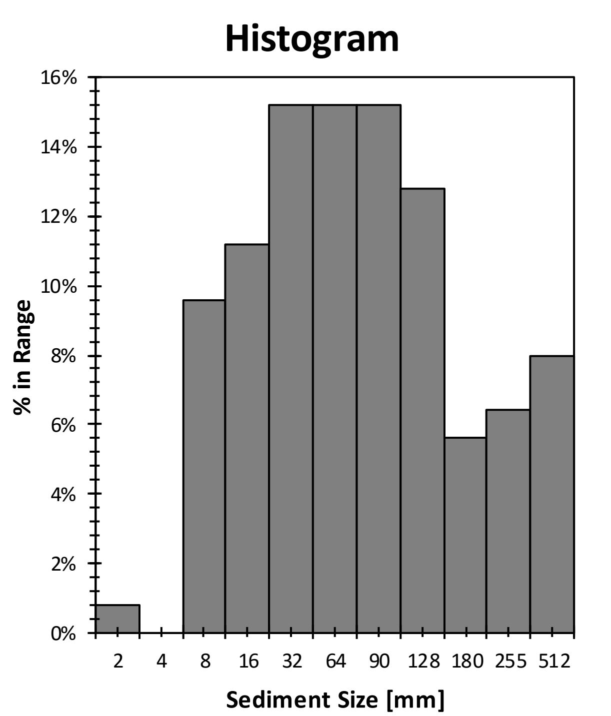
D_{10}	12.2	mm
D_{16}	20.6	mm
D_{50}	78.0	mm
D_{84}	201.4	mm
D_{90}	280.7	mm
D_{95}	396.4	mm

Pebble Count: GS-40

Site Name:	Gooseneck creek			
Location:	42°27'04.4"N 78°35'32.2"W			
Date:	8/1/2016			

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	1	1%	1%
Gravels	2 - 4	0	0%	1%
	5 - 8	12	10%	10%
	9 - 16	14	11%	22%
	17 - 32	19	15%	37%
	33 - 64	19	15%	52%
Cobbles	65 - 90	19	15%	67%
	91 - 128	16	13%	80%
	129 - 180	7	6%	86%
	181 - 255	8	6%	92%
Boulders	256 - 512	10	8%	100%
	TOTALS:	**125**		



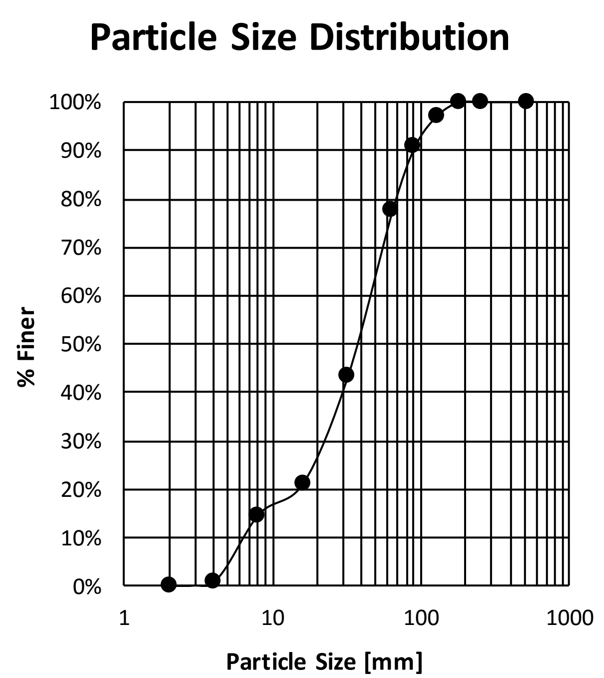


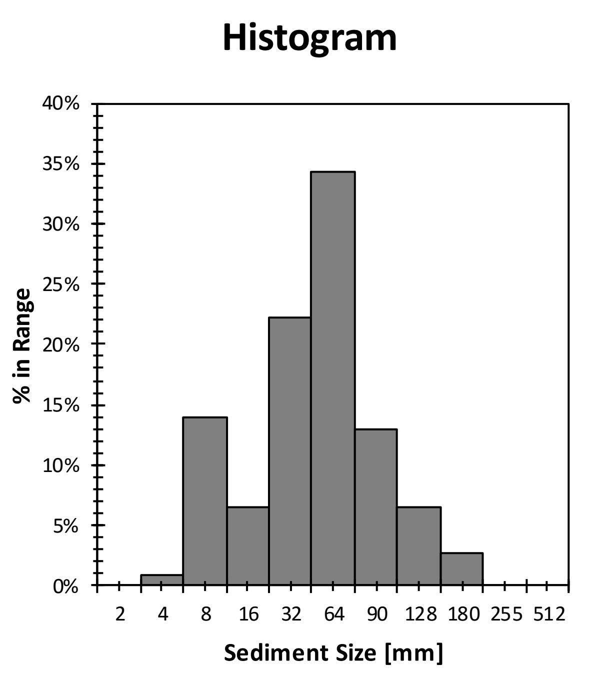
D_{10}	7.8	mm
D_{16}	12.0	mm
D_{50}	59.8	mm
D_{84}	165.1	mm
D_{90}	231.6	mm
D_{95}	351.4	mm

Pebble Count: GS-41

Site Name:	Gooseneck Creek			
Location:	42°27'08.9"N 78°35'18.4"W			
Date:	8/1/2016			

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	1	1%	1%
	5 - 8	15	14%	15%
	9 - 16	7	6%	21%
	17 - 32	24	22%	44%
	33 - 64	37	34%	78%
Cobbles	65 - 90	14	13%	91%
	91 - 128	7	6%	97%
	129 - 180	3	3%	100%
	181 - 255	0	0%	100%
Boulders	256 - 512	0	0%	100%
	TOTALS:	108		





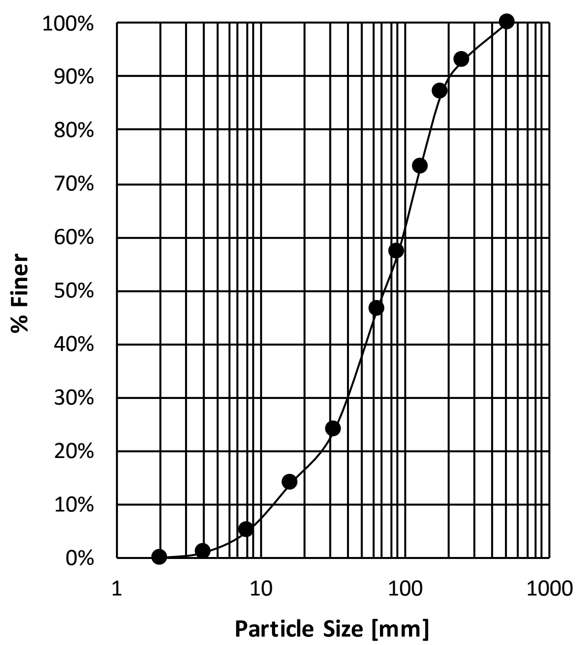
D_{10}	6.6	mm
D_{16}	9.5	mm
D_{50}	38.1	mm
D_{84}	76.5	mm
D_{90}	88.5	mm
D_{95}	115.0	mm

Pebble Count: GS-42

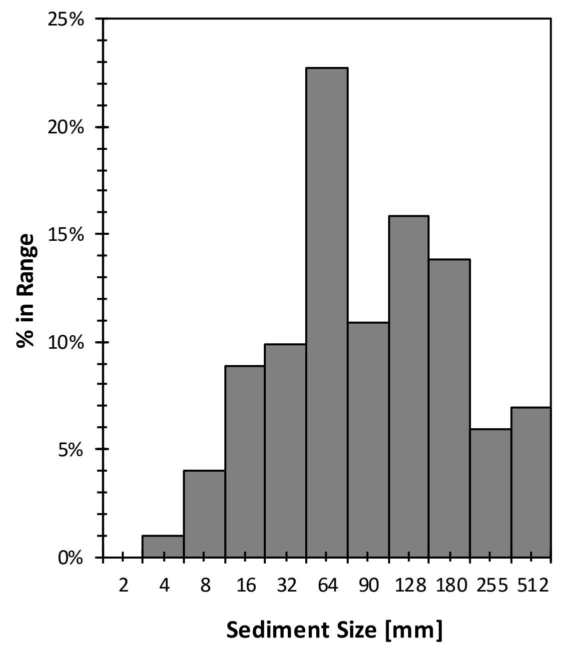
Site Name:	Gooseneck Creek
Location:	42°27'13.7"N 78°35'04.1"W
Date:	8/1/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	1	1%	1%
	5 - 8	4	4%	5%
	9 - 16	9	9%	14%
	17 - 32	10	10%	24%
	33 - 64	23	23%	47%
Cobbles	65 - 90	11	11%	57%
	91 - 128	16	16%	73%
	129 - 180	14	14%	87%
	181 - 255	6	6%	93%
Boulders	256 - 512	7	7%	100%
	TOTALS:	**101**		

Particle Size Distribution



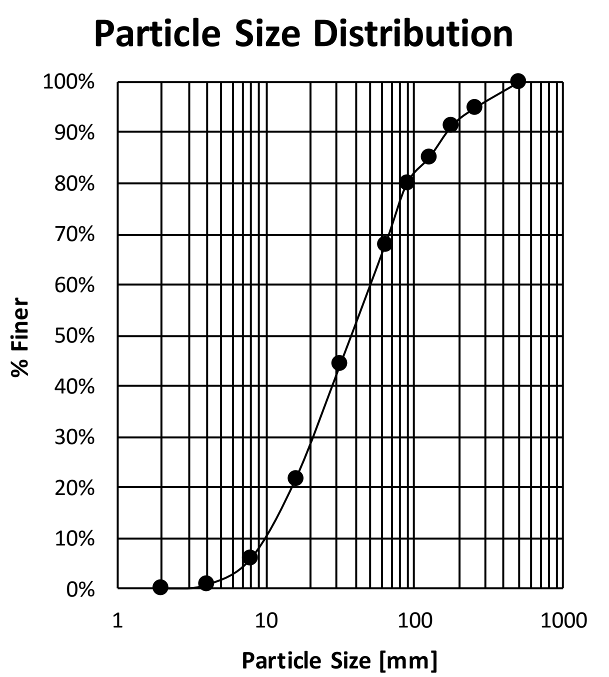
Histogram

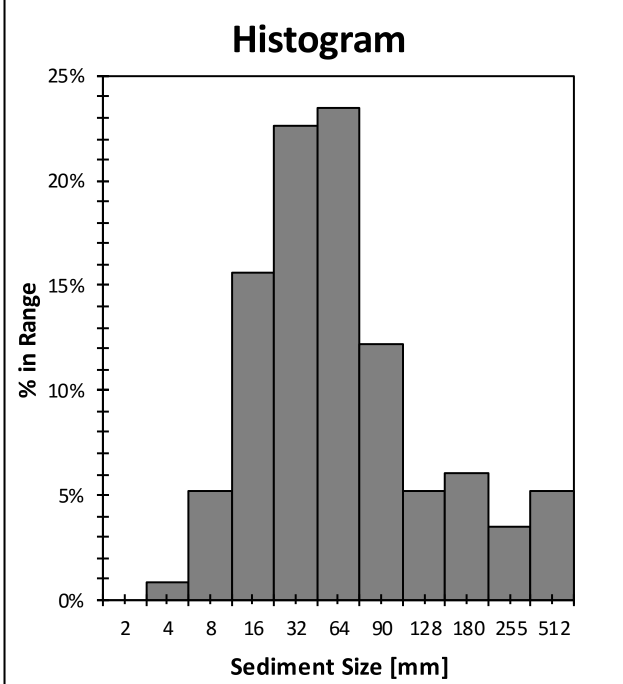


D_{10}	12.5	mm
D_{16}	19.5	mm
D_{50}	72.3	mm
D_{84}	168.3	mm
D_{90}	216.3	mm
D_{95}	326.6	mm

Pebble Count: GS-43

Site Name:	Creek leading into buttermilk			
Location:	42°27'16.4"N 78°37'40.4"W			
Date:	8/3/2016			
	Particle Size (mm)	**Total #**	**% in Range**	**% Finer**
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	1	1%	1%
	5 - 8	6	5%	6%
	9 - 16	18	16%	22%
	17 - 32	26	23%	44%
	33 - 64	27	23%	68%
Cobbles	65 - 90	14	12%	80%
	91 - 128	6	5%	85%
	129 - 180	7	6%	91%
	181 - 255	4	3%	95%
Boulders	256 - 512	6	5%	100%
	TOTALS:	**115**		



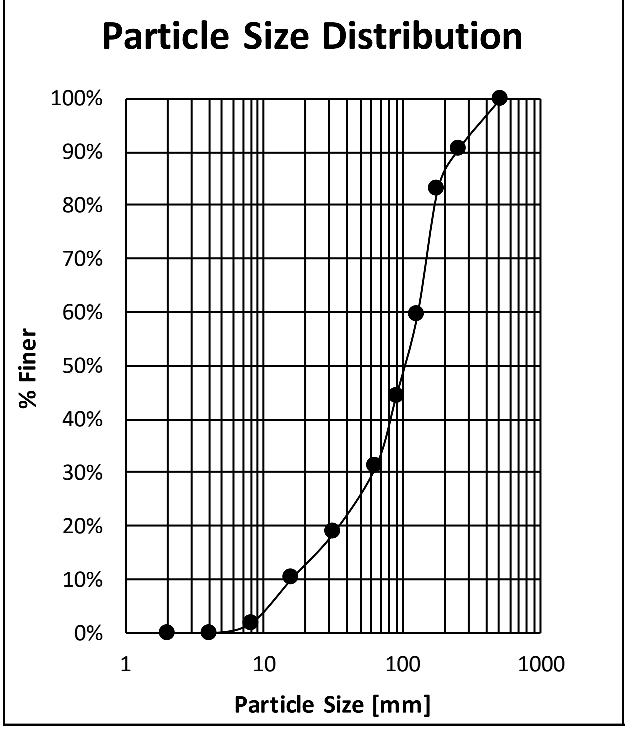


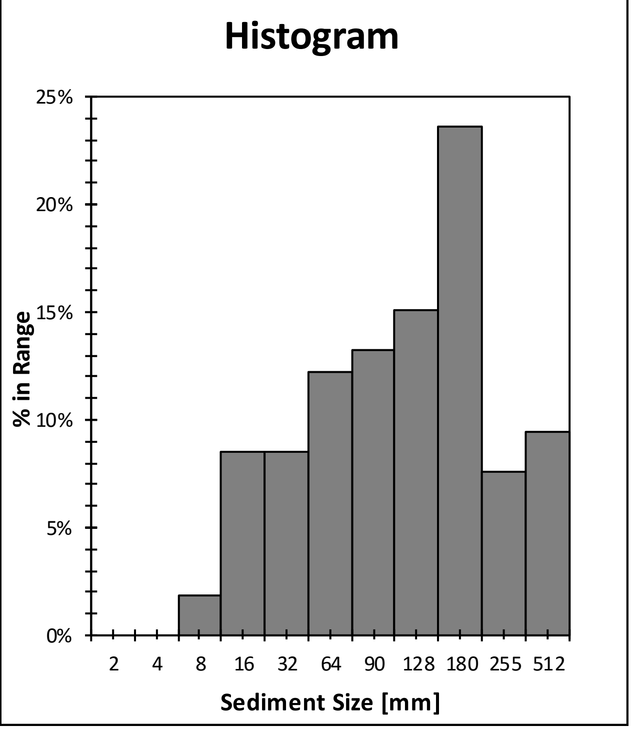
D_{10}	10.0	mm
D_{16}	13.1	mm
D_{50}	39.7	mm
D_{84}	119.1	mm
D_{90}	168.9	mm
D_{95}	265.7	mm

Pebble Count: GS-44

Site Name:	Creek leading into buttermilk
Location:	42°27'15.7"N 78°38'12.2"W
Date:	8/3/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	0	0%	0%
	5 - 8	2	2%	2%
	9 - 16	9	8%	10%
	17 - 32	9	8%	19%
	33 - 64	13	12%	31%
Cobbles	65 - 90	14	13%	44%
	91 - 128	16	15%	59%
	129 - 180	25	24%	83%
	181 - 255	8	8%	91%
Boulders	256 - 512	10	9%	100%
	TOTALS:	**106**		

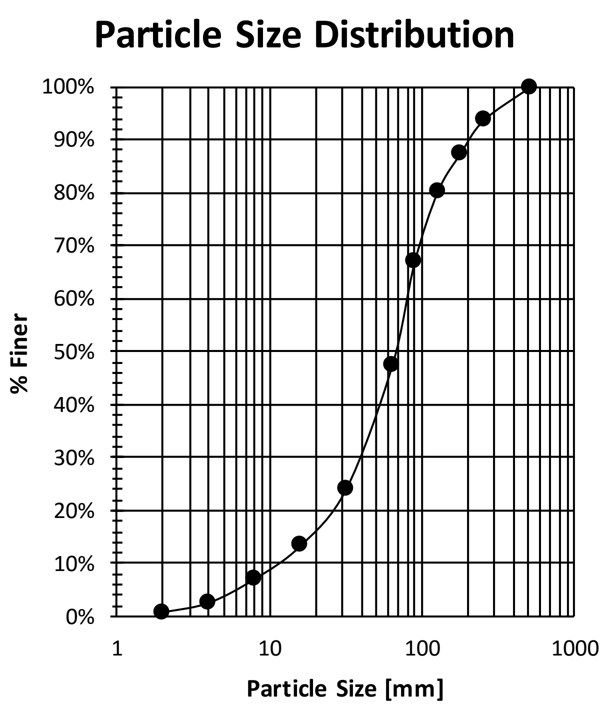


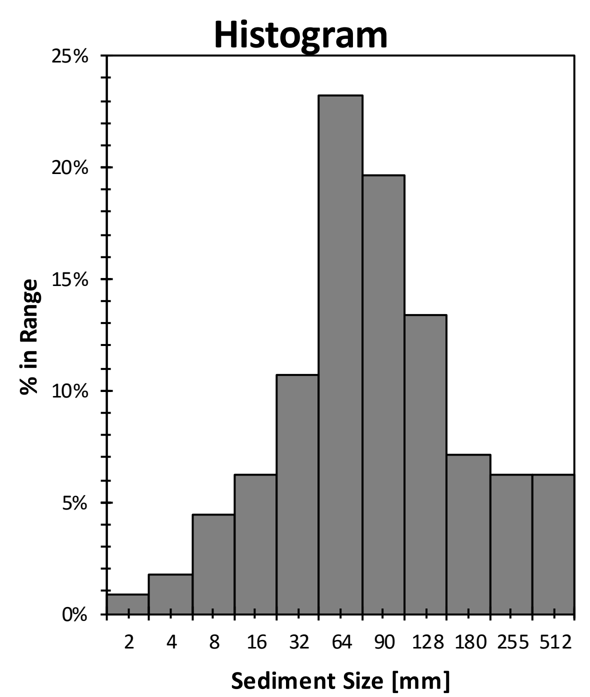


D_{10}	15.6	mm
D_{16}	26.6	mm
D_{50}	104.3	mm
D_{84}	189.8	mm
D_{90}	249.4	mm
D_{95}	375.8	mm

Pebble Count: GS-45

Site Name:	Creek leading into buttermilk			
Location:	42°27'17.2"N 78°37'41.0"W			
Date:	8/3/2016			
	Particle Size (mm)	**Total #**	**% in Range**	**% Finer**
Sand and Silt	< 2	1	1%	1%
Gravels	2 - 4	2	2%	3%
	5 - 8	5	4%	7%
	9 - 16	7	6%	13%
	17 - 32	12	11%	24%
	33 - 64	26	23%	47%
Cobbles	65 - 90	22	20%	67%
	91 - 128	15	13%	80%
	129 - 180	8	7%	88%
	181 - 255	7	6%	94%
Boulders	256 - 512	7	6%	100%
	TOTALS:	**112**		

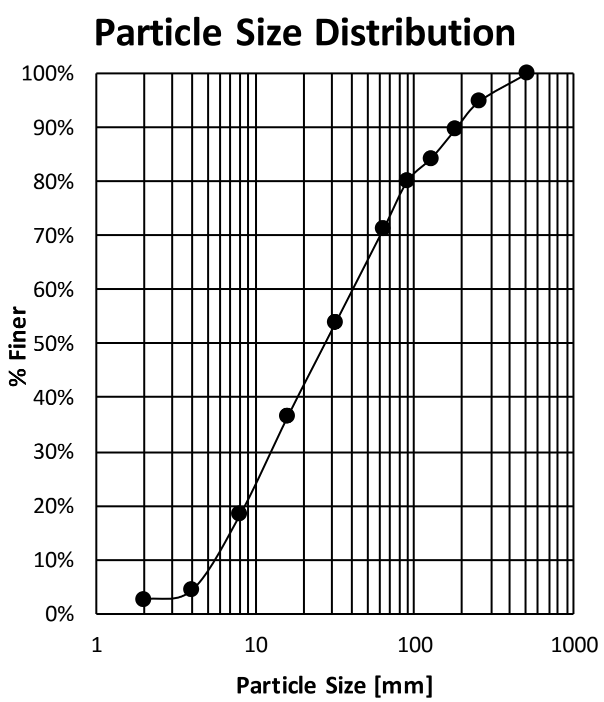


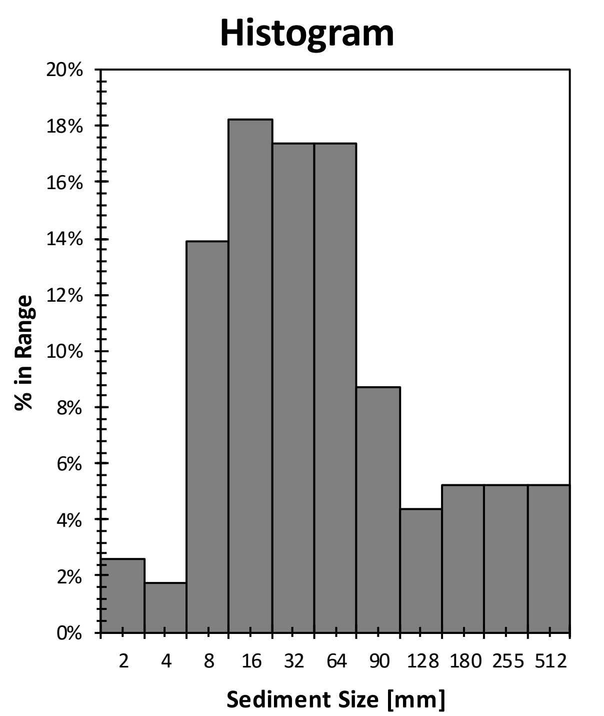


D_{10}	11.7	mm
D_{16}	19.9	mm
D_{50}	67.5	mm
D_{84}	154.5	mm
D_{90}	210.0	mm
D_{95}	306.4	mm

Pebble Count: <u>GS-46</u>

Site Name:	Creek leading into buttermilk			
Location:	42°27'10.6"N 78°38'25.4"W			
Date:	8/3/2016			
	Particle Size (mm)	**Total #**	**% in Range**	**% Finer**
Sand and Silt	< 2	3	3%	3%
Gravels	2 - 4	2	2%	4%
	5 - 8	16	14%	18%
	9 - 16	21	18%	37%
	17 - 32	20	17%	54%
	33 - 64	20	17%	71%
Cobbles	65 - 90	10	9%	80%
	91 - 128	5	4%	84%
	129 - 180	6	5%	90%
	181 - 255	6	5%	95%
Boulders	256 - 512	6	5%	100%
	TOTALS:	**115**		



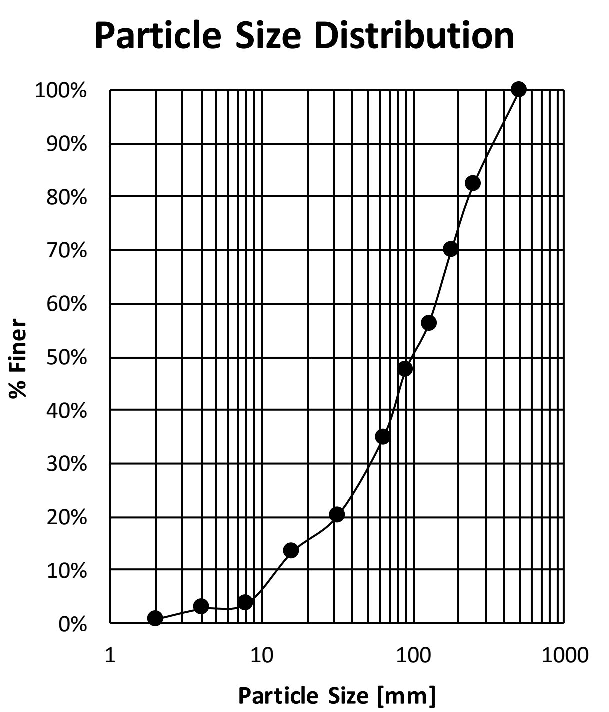


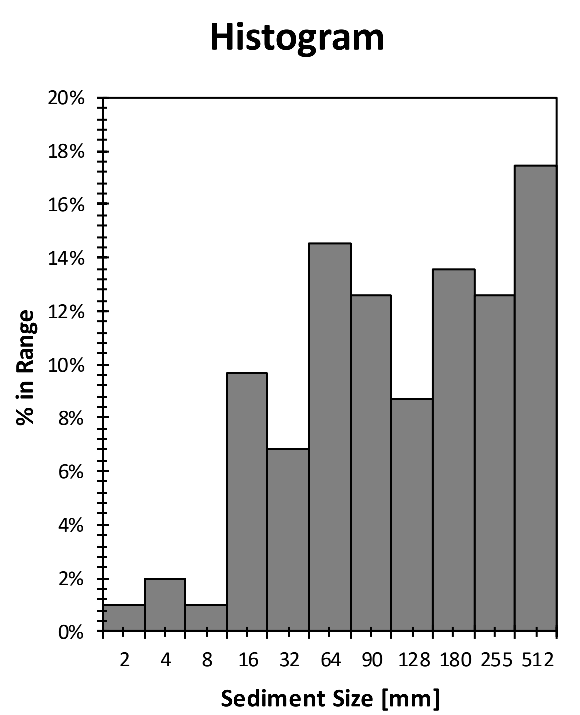
D_{10}	5.6	mm
D_{16}	7.4	mm
D_{50}	28.4	mm
D_{84}	125.0	mm
D_{90}	186.3	mm
D_{95}	265.7	mm

Pebble Count: GS-47

Site Name:	Creek leading into buttermilk
Location:	42°27'05.2"N 78°38'33.3"W
Date:	8/3/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	1	1%	1%
Gravels	2 - 4	2	2%	3%
	5 - 8	1	1%	4%
	9 - 16	10	10%	14%
	17 - 32	7	7%	20%
	33 - 64	15	15%	35%
Cobbles	65 - 90	13	13%	48%
	91 - 128	9	9%	56%
	129 - 180	14	14%	70%
	181 - 255	13	13%	83%
Boulders	256 - 512	18	17%	100%
	TOTALS:	**103**		

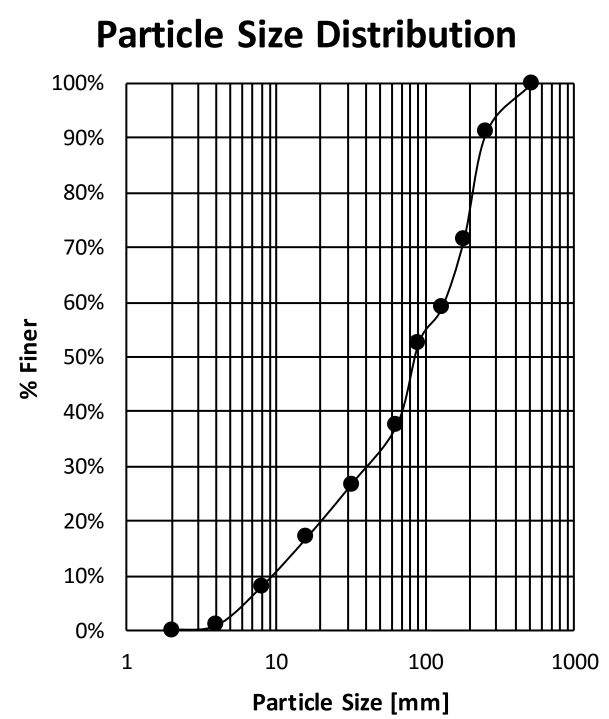


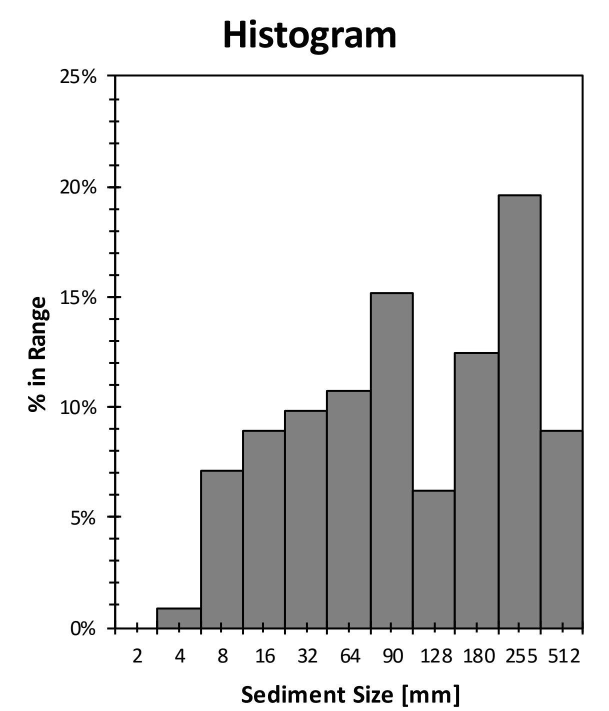


D_{10}	13.0	mm
D_{16}	21.7	mm
D_{50}	100.6	mm
D_{84}	276.7	mm
D_{90}	364.9	mm
D_{95}	438.5	mm

Pebble Count: GS-48

Site Name:	Buttermilk			
Location:	42°27'31.1"N 78°38'44.1"W			
Date:	8/10/2016			
	Particle Size (mm)	**Total #**	**% in Range**	**% Finer**
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	1	1%	1%
	5 - 8	8	7%	8%
	9 - 16	10	9%	17%
	17 - 32	11	10%	27%
	33 - 64	12	11%	38%
Cobbles	65 - 90	17	15%	53%
	91 - 128	7	6%	59%
	129 - 180	14	13%	71%
	181 - 255	22	20%	91%
Boulders	256 - 512	10	9%	100%
	TOTALS:	**112**		



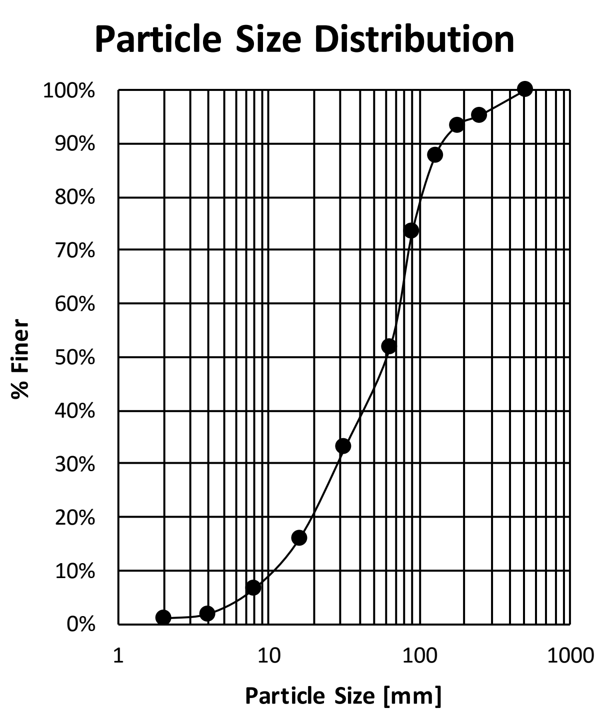


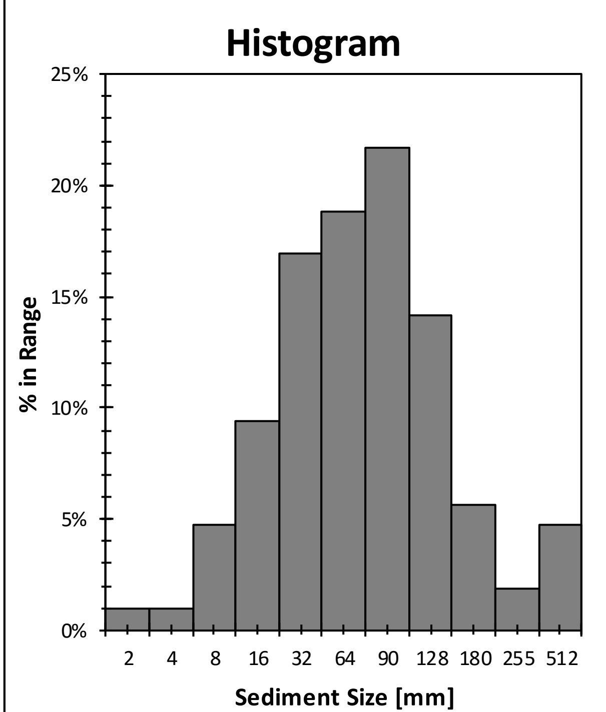
D_{10}	9.8	mm
D_{16}	15.1	mm
D_{50}	85.4	mm
D_{84}	228.0	mm
D_{90}	250.9	mm
D_{95}	368.1	mm

Pebble Count: GS-49

Site Name:	Buttermilk
Location:	42°26'53.9"N 78°38'30.4"W
Date:	8/10/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	1	1%	1%
Gravels	2 - 4	1	1%	2%
	5 - 8	5	5%	7%
	9 - 16	10	9%	16%
	17 - 32	18	17%	33%
	33 - 64	20	19%	52%
Cobbles	65 - 90	23	22%	74%
	91 - 128	15	14%	88%
	129 - 180	6	6%	93%
	181 - 255	2	2%	95%
Boulders	256 - 512	5	5%	100%
	TOTALS:	**106**		



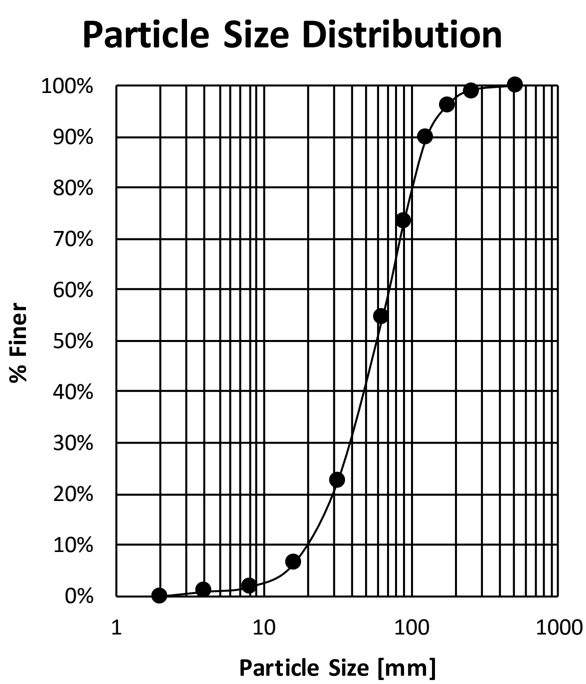


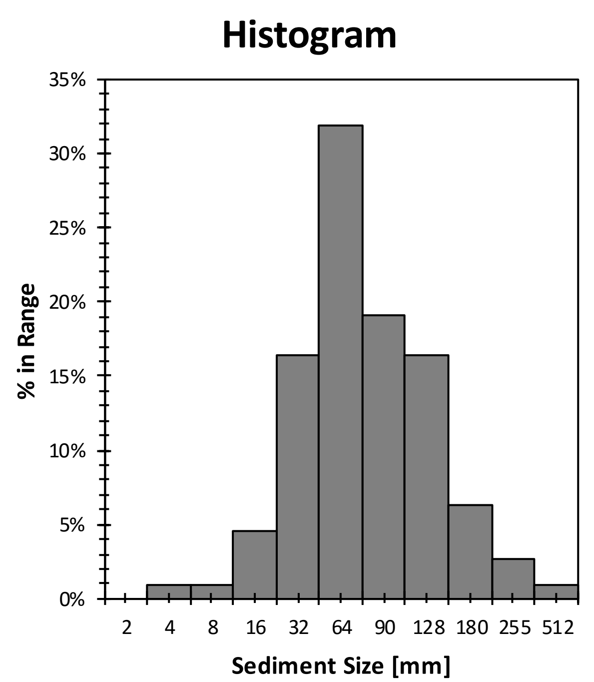
D_{10}	10.9	mm
D_{16}	16.0	mm
D_{50}	60.8	mm
D_{84}	118.0	mm
D_{90}	148.8	mm
D_{95}	243.8	mm

Pebble Count: GS-50

Site Name:	Near Fox Valley Rd and Railroad intersection
Location:	42°25'59.7"N 78°37'47.7"W
Date:	6/22/2016

	Particle Size (mm)	Total #	% in Range	% Finer
Sand and Silt	< 2	0	0%	0%
Gravels	2 - 4	1	1%	1%
	5 - 8	1	1%	2%
	9 - 16	5	5%	6%
	17 - 32	18	16%	23%
	33 - 64	35	32%	55%
Cobbles	65 - 90	21	19%	74%
	91 - 128	18	16%	90%
	129 - 180	7	6%	96%
	181 - 255	3	3%	99%
Boulders	256 - 512	1	1%	100%
	TOTALS:	**110**		





D_{10}	19.6	mm
D_{16}	25.4	mm
D_{50}	59.4	mm
D_{84}	114.1	mm
D_{90}	128.0	mm
D_{95}	168.9	mm