

**Annual Progress Report for 2010**

**Monitoring the Effectiveness and Validating Response to the Road  
Related Mitigation Practices Implemented on the Pikes Peak Highway**

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## **Executive Summary**

### **Monitoring the Effectiveness and Validating Response to the Road Related Mitigation Practices Implemented on the Pikes Peak Highway**

**C.A. Troendle, S. Winkler, J. VonLoh, and J. Derengowski**

This is the eighth annual report documenting the monitoring efforts on the Pikes Peak Highway as part of the Settlement Agreement between the Sierra Club and the United States Department of Agriculture, Forest Service in *Sierra Club v. Veneman*, Civil Action No. 98-M-662 (D. Colo.), (U.S. Department of Justice 2002). The original monitoring plan and subsequent amendments call for effectiveness monitoring, designed to determine how well the mitigation practices implemented contribute to meeting their objectives; and validation monitoring, designed to determine how the mitigation practices affect the riparian, wetland, and aquatic systems within the area of influence of the Pikes Peak Highway (USDA Forest Service 2002 and 2003). Meteorologically, 2010 was a relatively uneventful season allowing time for more routine extensive measurement and maintenance.

Effectiveness monitoring for the Pikes Peak Highway is focused on the 14-mile-long, 300-foot-wide highway corridor (150 feet each side of the highway centerline), starting at mile marker seven and continuing to the summit. The only resurfacing treatment used on the highway for mitigation purposes is asphalt paving. Approximately 9 miles of the highway have been paved since the onset of the mitigation project. In 2010, the highway crew continued work on Basin 6 (East Fork and West Fork of Beaver Creek Watersheds) including paving 2.27 miles of highway. Re-vegetation work including soil amendments, seeding, erosion control blankets, and tundra plugs was also completed. Construction and re-vegetation on the upper sediment pond located at the start of Basin 5 and the lower sediment pond at Devil's Playground in Basin 6 was completed and these sites will be monitored beginning in 2011. In addition 3,540 tons of gravel were added to the road surface and 24 tons of gravel were removed from the rock weirs (personal communication with Jack Glavan, City of Colorado Springs, Capital Projects Manager). Road surface data were gathered during the 2010 monitoring season on 7 of the original 11 road reaches. Road reach 154RX was paved in 2006 and road reaches 156RX, 158RX, and 160RX were paved in 2010 eliminating the need for further monitoring.

The field procedure for monitoring sediment accumulation in the rock weirs was modified in 2008 to simplify both instrument requirements for the survey and software requirements for subsequent data reduction and analysis as well as to allow for a more consistent comparison of volumetric change from survey to survey. A fixed area was defined and monumented within each rock weir to be surveyed each time, and compared from survey to survey or year to year. In 2009 and 2010, as part of the process of changing a protocol, several quality control and quality assurance checks have been implemented as a means of better defining errors that might be associated with the survey procedure. In an attempt to further assess survey resolution, we evaluated how closely the elevation of the same rock weir is estimated by repeated surveys.

Precipitation measurements from the three electronic rain gauges (Onset Computer Corp.) and the NRCS Snotel site, located at Glen Cove did not indicate rainfall amounts greater than average for 2010. In addition to the electronic rain gauges, standard non-recording rain gauges (All-Weather) were installed at each monitoring site to avoid loss of data should an electronic rain gauge fail. The standard rain gauges also provide a second index of precipitation amount for the sampling interval. Silt fences were not exposed to high runoff and erosion activities as in prior years, allowing time for the field crew to complete weekly surveys of each site. Silt fences from 13 cut slope and 28 fill slope sites were monitored in 2010. Three of the 55 fill slope silt fences were breached during the 2010 field season. All silt fence sites were visited on a weekly basis, sediment volume measured, and silt fences evaluated for repair or replacement.

Fifteen of the original 20 drainage ditches selected were surveyed in 2010. Site 092DD was paved in 2005, site 107DD was lined with shotcrete in 2006, and sites 155DD, 157DD, and 159DD were lined with shotcrete in 2010, eliminating the need for further monitoring. Most drainage ditches will be paved or lined with shotcrete once the highway is paved and will no longer need to be surveyed unless visual inspection provides evidence of failure, in which case cross sections will be established to document change. Six of the 15 remaining drainage ditches are treated (lined with erosion control fabric), and nine remain untreated. Three of the untreated drainage ditches are adjacent to road surfaces paved with recycled asphalt, but have no other treatment applied to the drainage ditch. Six of the untreated drainage ditches are associated with road reaches.

Fifty-six of the 117 conveyance channels were monitored in 2010. The sub-sample of 13 conveyance channels was measured in 2010 specifically to compare treated (7) and untreated (6) road sections. Eleven conveyance channels located below established rock weirs and one conveyance channel below sediment pond 199RW were surveyed in 2010. For safety reasons, conveyance channels 024CC, 099CC, 108CC, 114CC, 118CC, and 119CC are not surveyed due to the exposure of large boulders and the general instability of the slope following weir failure. The field crew will continue to monitor these sites every few years, by recording observations in the field notes and using photo monitoring to document changes in conveyance channel geometry, but the sites are not likely to be surveyed. Site 014CC was identified as a potential conveyance channel in 2003, but was never established as a monitoring site. Conveyance channel 015CC located above sediment pond 199RW was lined with shotcrete in 2003 eliminating the need for further monitoring, unless visual inspection provides evidence of failure, in which case cross sections will be established to document change. Conveyance channel 131CC was eliminated during construction of the new sediment pond located near mile marker 17 and 134CC was eliminated during construction of the new sediment pond located at the start of Basin 5. Because monitoring the remaining set of 113 conveyance channels is not feasible during each field season, the field crew will continue to survey a sub-sample of 40 conveyance channels each year and survey additional channels as time permits.

Twenty-eight sediment traps were monitored in 2010, including 26 rock weirs and 2 sediment ponds. Twenty sites were surveyed at least twice to monitor their effectiveness in trapping sediment from winter and summer runoff. The rock weirs were surveyed and sediment volume was measured in the silt fences located down slope of the rock weirs (14 rock weirs have associated silt fences). The silt fence below rock weir 202RW was extended in 2010 to capture

material by-passing the fence. Rock weir 162RW was cleaned out by the Highway Department this field season and surveyed for the first time since 2008. Of the 28 sites, 10 demonstrated some degree of failure, where water and sediment were seen piping under or through the rock weir, the rock weir was overtopped, or the rock weir was breached. In addition, the silt fences associated with 180RW and 202RW were breached in 2010. Rock weirs 236RW, 238RW, and 243RW were not surveyed due to breaching of the rock weir. The field crew will continue to monitor these sites every year, by recording observations in the field notes and using photo monitoring to document changes.

The primary focus of the validation monitoring is to address the condition of the riparian wetland and aquatic systems along the Pikes Peak Highway. Stream channel surveys were completed on Boehmer Creek, East Fork of Beaver Creek, Glen Cove Creek, North Catamount Creek, North Fork of Crystal Creek, Oil Creek, South Catamount Creek, Ski Creek, Severy Creek, and West Fork of Beaver Creek in 2010. In the past, stream channel surveys have included planview surveys, profile surveys, cross section surveys, thalweg surveys, bank erosion surveys, vegetation surveys, pebble counts, and grab samples. In 2010, stream channel surveys included only cross section surveys, thalweg surveys, bankfull surveys, vegetation surveys, pebble counts, and grab samples.

Numerous sediment grab samples were collected from the cut slope and fill slope silt fences, the rock weirs and their associated silt fences, and from the stream bars throughout the 2010 field season. A subset of these was selected to be analyzed in the laboratory for particle size distribution. The balance of samples will be analyzed only if the variability in the particle size distribution of the subset of samples chosen for initial analysis warrants additional analysis. Laboratory analyses for the 2010 field season have been completed and a summary of particle size distributions and graphs are presented in this report. Comparing the distribution of material captured in traps near the highway to sediment deposits (bars) in the streams will validate response to highway mitigation practices.

Included with the full report is a data DVD containing all survey data (field and post processing) plus digital photographs (recommended viewing) for all sites for the 2010 field season. The Annual Reports and data may also be accessed from:

<http://www.fs.fed.us/emc/rig/pikespeak/index.shtml>

## INTRODUCTION

The proposed actions presented in the Pikes Peak Highway Drainage, Erosion and Sediment Control Plan Environmental Assessment (Hydrosphere Resource Consultants 1999) were designed to achieve the following goals:

- Stabilize road surface materials, cut slopes, and fill slopes
- Reduce runoff velocities and dissipate erosive energy
- Collect runoff in armored ditches and conveyance channels
- Reduce erosion and sediment deposition in drainage channels
- Retain sediment in traps and ponds to reduce downstream sedimentation

In May 2001, a monitoring plan was approved as part of the Settlement Agreement between the Sierra Club and the United States Department of Agriculture, Forest Service in *Sierra Club v. Venneman*, Civil Action No. 98-M-662 (D. Colo.), (U.S. Department of Justice 2002). The monitoring plan outlines appropriate procedures for monitoring and documenting the effectiveness of mitigation practices in achieving the above desired goals (USDA Forest Service 2002). The monitoring effort, which includes implementation monitoring, effectiveness monitoring, and validation monitoring, began in 2003 and ends in 2017.

Implementation monitoring verifies that mitigation practices are properly implemented. Staffs from both the city of Colorado Springs and the U.S. Forest Service are responsible for this aspect of the monitoring program. Because all parties assume that mitigation practices will be properly implemented, successes or failures in design or implementation will be addressed in the annual monitoring reports only to the extent that they impact subsequent monitoring.

Effectiveness monitoring is intended to document whether or not the properly implemented mitigation practice is effective in achieving the desired goal(s) or purpose(s) for that practice. Effectiveness monitoring for the Pikes Peak Highway is focused on the 14-mile-long, 300-foot-wide highway corridor (150 feet each side of the highway centerline), starting at mile marker seven and continuing to the summit, and is intended to document how effective the mitigation practices are in reducing erosion and sedimentation from features such as the road surface, cut and fill slopes, drainage ditches and conveyance channels. Precipitation is also monitored to provide an index to the amount and erosive energy of rainfall events. Effectiveness monitoring is the cornerstone of the monitoring effort described in this report.

An equally critical component in the monitoring program is validation monitoring, which is intended to document the degree to which the properly implemented and effective mitigation practices ultimately influence the resource of concern. In this report, validation monitoring addresses the condition of the riparian, wetland, and aquatic systems adjacent to the Pikes Peak Highway and attempts to provide data to validate that discharge management and reductions in sedimentation from the highway do in fact result in improvements in the channel and riparian environment below.

Subsequent changes in the proposed action plan for road mitigation (Burke 2002) required amendment of the approved monitoring plan (USDA Forest Service 2003). Initially, a variety of

highway surface stabilization practices were proposed for road mitigation. Those were reduced to a single surfacing procedure, asphalt paving, eliminating the need for a monitoring design that incorporates multiple surface treatments. Rock weirs to detain the water and sediment exiting the highway corridor from all events up to the magnitude of the design storm are completed or under construction in selected locations. By design, sediment should settle out in the rock weir, where it can be measured directly, while water percolates through a porous berm. The addition of rock weirs eliminated the need to sample sediment concentrations in pond inflow and outflow as well as measure material trapped in the pond as originally stated in the monitoring plan. Additional revisions in the mitigation design concentrate road drainage from very long segments or reaches (as long as 2 miles) of both pavement and ditch line into fewer diversion points and conveyance channels, reducing the number of diversions off the highway and the number of proposed sampling sites.

Over time, the entire highway will be paved, rather than surfaced using a variety of treatments, which should significantly reduce or eliminate the potential for continued surface erosion to occur from the road surface. Current erosion rates from the gravel portion of the highway will continue to be monitored as called for in the approved monitoring plan, but once the road reach or section of road is paved it will be assumed that post mitigation erosion from the road surface is zero. As noted above, sediment pond design has been altered but monitoring will still focus on quantifying total sediment exported in the discharge water and the effectiveness of the mitigation practices in reducing that export. This report includes a brief description of the current monitoring protocol for each metric of concern and documents any changes in the monitoring protocol that may have occurred since the previous annual report.

The U.S. Forest Service oversees monitoring of the streams draining the basins below the highway to validate that discharge management and reductions in sedimentation from the highway result in improvements in the channel and riparian environment. A suite of tributaries in the Pikes Peak Watershed has been identified as either impacted or non-impacted by the presence and maintenance of the Pikes Peak Highway. North Catamount, South Catamount, Glen Cove, Oil, and Boehmer Creeks represent non-impacted streams. Ski, Severy, East Fork of Beaver, North Fork of Crystal, and West Fork of Beaver Creeks are all considered stream systems impacted by the highway. Depending on the magnitude of the reduction in the amount of sediment delivered to the stream system and changes in discharge amount and energy, it may be possible to document changes in channel morphology and riparian condition that occur as a consequence of improved highway management.

Approximately 9 miles of the highway have been paved since the onset of the mitigation project. In 2010, the highway crew continued work on Basin 6 (East Fork and West Fork of Beaver Creek Watersheds) including paving 2.27 miles of highway. Re-vegetation work including soil amendments, seeding, erosion control blankets, and tundra plugs was also completed. Construction and re-vegetation on the upper sediment pond located at the start of Basin 5 and the lower sediment pond at Devil's Playground in Basin 6 was completed and these sites will be monitored beginning in 2011. In addition 3,540 tons of gravel were added to the road surface and 24 tons of gravel were removed from the rock weirs (personal communication with Jack Glavan, City of Colorado Springs, Capital Projects Manager).

## **Site Location and Identification**

A 15 year study requires that monitoring sites be uniquely identified and periodically relocated. Each precipitation gauge, cut slope and fill slope, road reach, drainage ditch and conveyance channel, rock weir and sediment pond, and stream channel reach monitored as part of this study has been uniquely identified and located. Each site is marked as a waypoint in a geographic information system (GIS) platform with attributes for latitude, longitude, and altitude, as well as a unique code, to distinguish it in the field. The coding convention used for the effectiveness monitoring sites is a five-character alpha-numeric code comprised of a three-digit feature number followed by a two-letter feature identifier (e.g., for site 001FS where 001 is the feature number and FS identifies the feature, a fill slope). The validation monitoring sites also use a five-character coding convention in which four letters identify the stream name and the last digit identifies the stream reach (e.g., OILC1 = Oil Creek, Reach 1).

Every feature being monitored has at least three benchmarks or control points used to locate the feature and obtain repeated, spatially similar, three-dimensional surveys, as appropriate. The benchmarks or control points are monumented by 2.5 foot lengths of 0.5 inch rebar pounded into the ground and topped with plastic yellow caps. Aluminum nursery tags wired to the rebar identify the individual benchmarks or control points (e.g., CP01). Every feature surveyed has at least three points with which to register the survey, although some features in close proximity may share control points.

In 2010, conveyance channels 131CC and 134CC were eliminated during construction of two new sediment ponds located near mile marker 17 and at the start of Basin 5. Site names, locations, and feature descriptions can be found in Appendix A. Note that Appendix A provides a complete list of all waypoints established since the project began in 2003; not all of the sites listed were sampled during the 2010 monitoring season. A USGS topographic map that documents the location of each monitoring site is presented in Appendix B.

## **OBJECTIVE**

The objective of this report is to document the data collected and progress made in the effectiveness and validation monitoring of the mitigation practices implemented on the Pikes Peak Highway during the 2010 field season. Each annual report beginning in 2007 consists of a description of the protocol used to monitor each metric of concern as defined by the monitoring plan or its amendment, and a summary of the data collected for that particular year. It should be realized that, by design, not all metrics or sampling locations will be monitored every year. As a result, some reports will contain site data not presented in other reports. A full data set from all years is available in the data archive. It should also be noted that it was not the intent of the settlement agreement to include analysis of the data beyond a quality assurance and quality control assessment of the monitoring effort. Therefore the annual report will state the intended purpose for collecting the data and present the data in a format useful for subsequent analysis.



## **EFFECTIVENESS MONITORING**

The road mitigation practices implemented by the city of Colorado Springs are intended to control erosion and manage the erosive energy of surface water discharge from the Pikes Peak Highway. Effectiveness monitoring consists of documenting the impact that various mitigation practices have on the erosion and sedimentation processes that occur within the road corridor. Erosion rates and sediment volumes are primarily indexed using a combination of survey techniques and sediment traps (silt fences and rock weirs). Grab samples of sediment and water are analyzed to document particle size distributions of deposited material and sediment concentration in discharge water leaving the site. Precipitation is also monitored to provide an index to the amount and erosive energy of rainfall events.

The following sections describe the metrics being monitored and the data collected in order to document the effectiveness of mitigation. The standard protocol for identifying and numbering the various sample sites is presented up front, followed by a description of the monitoring sites and metrics.

### **Precipitation**

Three tipping bucket rain gauges (Onset Computer Corp.) equipped with event data loggers (HOBO) were installed at the beginning of the field season to index precipitation over the elevation range of the monitored portion of the highway. Although precipitation is not a response variable, it is a significant causal variable in evaluating the effectiveness of mitigation. Rain gauge 075RG is located just uphill from the Halfway Picnic Area near mile marker 10 at an elevation of 10,109 feet. This is at the upper end of Priority Basin 2, in the subalpine zone. Rain gauge 076RG is located near the Elk Park Trailhead (No. 652) at the boundary between the subalpine and the alpine zones at 11,810 feet elevation. Rain gauge 077RG is located near the Devil's Playground and well into the alpine area at 13,069 feet elevation. Rain gauges installed for this study operate from early May, or as soon as the field crew starts for the season, until late September or early October when the crew finishes for the year. Data loggers record a date-time stamp for each tip of the rain gauge bucket (1 tip = 0.01 inches) from which volume, duration, and intensity (or rate) of each rainfall event can be determined.

In 2010, new event data loggers (HOBO) for the three tipping bucket rain gauges (Onset Computer Corp.) were installed. In addition, to avoid loss of data should a tipping bucket rain gauge fail, a standard, non-recording rain gauge (All-Weather) was added to each site. The standard rain gauges also provide a second index of precipitation amount for the sampling interval.

Total seasonal precipitation (May 7 – September 30, 2010) for the three monitoring sites for both the electronic and standard rain gauges is listed in Table 1. The data logger in the electronic rain gauge 077RG malfunctioned part way through the season and did not provide any usable data for August and September. In 2010, seasonal totals varied between the three sites with the mid-elevation receiving the most precipitation (Figure 1). Daily and incremental precipitation is presented in Appendix C and the basic rain gauge data (date-time stamp) is presented on the data DVD accompanying the report.

Table 1. Location, precipitation accumulation, and dates of operation for electronic and standard rain gauges on Pikes Peak, 2010.

Gauge ID	Latitude (hddd°mm.mmm)	Longitude (hddd°mm.mmm)	Altitude (ft)	Total Precipitation Electronic (in)	Total Precipitation Standard (in)	Dates of Operation 2010
075RG	N38 53.797	W105 03.890	10,109	10.57	11.37	5/7–9/30
076RG	N38 52.582	W105 03.970	11,810	11.30	12.22	5/7–9/30
077RG	N38 51.783	W105 03.999	13,069	N/A †	11.30	5/7–9/30
† Total unavailable as data was not collected for August and September due to instrument malfunction.						

In addition to the three sites established as part of this study, a Natural Resources Conservation Service (NRCS) Snotel site located at Glen Cove, between rain gauges 075RG and 076RG at an elevation of 11,469 feet, has precipitation data available for the entire year. Data for the NRCS Snotel site can be accessed at:

<http://www.wcc.nrcs.usda.gov/snotel/snotel.pl?sitenum=1057&state=co>

## Highway Surface Stabilization

Historically, thousands of cubic yards of gravel material have been added to the Pikes Peak Highway road surface annually as part of the continuing maintenance program. Most of this material has since migrated elsewhere; either washed down the ditch line during snowmelt or following rainfall events or cast over the side onto the fill slope and the hillside below during road grading procedures. This material has been perceived to be the primary source for the sediment deposited in the streams (Chavez et al. 1993). The primary emphasis in the road mitigation practices is to reduce the volume of material available to be eroded (supply) and to manage the discharge water (energy) to reduce sediment transport. Initially a variety of alternate surfacing options were proposed.

As noted earlier, and as documented in amendments to the monitoring plan, the design of the monitoring protocol, appropriate for estimating road erosion, has been significantly modified to reflect changes to the road bed stabilization practices implemented on the highway. Current plans call for paving the entire highway with asphalt; therefore, road-related monitoring has been reduced to indexing the dynamics of the volume of material stored on the surface of untreated road reaches, with the assumption that erosion, or changes in storage, from the paved segments will be zero.

As a surrogate for estimating actual erosion rates, road surface elevation for selected road reaches is being monitored over time to document erosion rates, or changes in the volume of material stored on untreated road segments. Uniform road reaches have been selected with survey cross sections permanently established at five intervals along each selected road reach (i.e., approximately one cross section per 20 meters of road). The road cross sections are periodically surveyed to provide the basis for estimating the degree of erosion or deposition occurring in the road reach they represent. Individual road cross sections have been

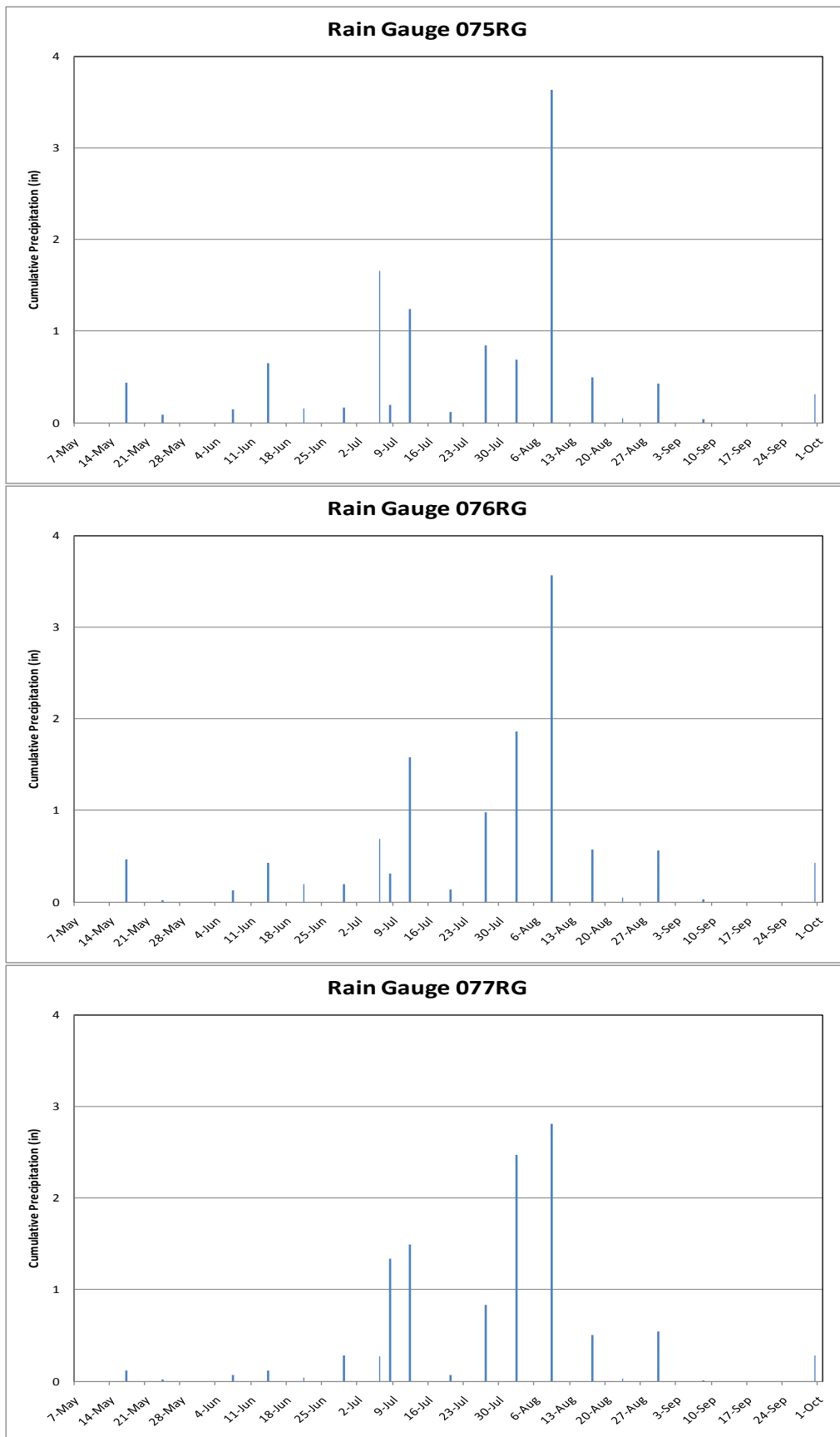


Figure 1. Incremental precipitation for the three standard rain gauges on Pikes Peak, 2010.

monumented using a 2.5 foot piece of rebar driven into the road surface at the upper edge of the fill slope. In addition, permanently monumented baseline elevation points (benchmarks) have been established for each road reach and are used as references for each cross section. Monitoring consists of surveying the surface elevation of the road cross sections, relative to the benchmark for the road reach.

Either the average elevation of the cross section, or the survey transect, can be compared for different surveys to determine changes in the volume of material stored, or changes in surface configuration that may have occurred between measures. Averaging the response for the five cross sections and multiplying that by the area of the road reach (estimated as average length times average width) yields an estimate of the change in the volume of material stored on the road reach during the interval between measurements.

It is critical that any addition of gravel or other material to the monitored road surfaces be documented and included in the mass balance. All maintenance activity in monitored road reaches should also be documented and considered in evaluating changes. Ideally, monitoring consists of at least one survey of each road reach during the field season, although it is not critical to survey every road reach every year. However, whenever possible, it is of value to take additional measurements on specific road reaches before and after planned maintenance.

Road surface data were gathered during the 2010 monitoring season on 7 of the original 11 road reaches. Road reach 154RX was paved in 2006 and road reaches 156RX, 158RX, and 160RX were paved in 2010 eliminating the need for further monitoring. In addition, 3,540 tons of gravel were added to the road surface (personal communication with Jack Glavan, City of Colorado Springs, Capital Projects Manager). All road reaches are associated with a corresponding drainage ditch except for 060RX. Table 2 contains a summary of road cross section monitoring sites measured in 2010. Cross section graphs for each road segment can be found in Appendix D. Photographs and survey data for all sites are available on the accompanying data DVD.

Table 2. Summary of road cross section monitoring sites surveyed on Pikes Peak, 2010.

Site ID	Basin #	Watershed	Survey Date
044RX	7	NCRY	8/19/2010
047RX	7	SKIC	9/9/2010
050RX	7	SKIC	7/1/2010
056RX	7	SKIC	7/1/2010
060RX †	7	SKIC	8/23/2010
062RX	7	SKIC	8/4/2010
072RX	7	SKIC	9/9/2010

† Only road reach without a corresponding drainage ditch.

## Stabilizing Cut and Fill Slopes

Erosion from cut and fill slopes along the highway may provide a continuous source of sediment to wetland, riparian, and aquatic systems. It is expected that highway mitigation practices will reduce sediment movement from these slopes in two ways. First, stabilizing the road bed through paving should also stabilize the angle of repose of adjacent cut and fill slopes, eliminating the constant adjustments that occur in the angle of repose of those slopes following

changes to the plane of the road bed. Second, paving will eliminate the need for the continual addition of road base material, the primary source of material that erodes onto fill slopes and hillsides. Effectiveness will be estimated by comparing differences in the amount and timing of sediment trapped in silt fences at the base of treated and untreated cut and fill slopes.

A 30 foot silt fence placed at the base of the slope of interest is used to trap sediment. Periodic measurements of the volume of material trapped behind the fence (i.e., after spring snowmelt and again after each large rainfall event) provide an index of the amount of material being eroded from the slope above the fence. Each silt fence is routinely visited to ensure timely measurement and maintenance. Should the silt fence fill to the point of reduced efficiency or fail during the period between measurements, the fence will either be repaired, replaced, cleaned out, or relocated to a new monitoring site. Initially (2003 and 2004), the volume trapped was determined from surveys of the surface behind the fence before and after the sediment was removed. Currently, the volume of trapped sediment behind the silt fence is determined by removing the accumulated material and measuring the amount removed by placing it in graduated containers for a measure of total volume. A sub-sample of the material removed is collected for laboratory analysis to determine total weight per unit volume and particle size distribution.

On cut slopes, erosion is monitored using two silt fences per site: one is placed across the base of the cut slope just above the ditch line to capture the sediment coming off the cut slope (lower fence); a second is placed on the upper edge of the cut slope to intercept and trap the sediment delivered to the cut slope from the undisturbed hill slope above (upper fence). This partitioning allows separation of the contribution of the cut slope to the road or ditch line from that of the undisturbed hill slope above. The latter measurement also provides an index of natural erosion rates. The contributing area of the lower fence is represented by a rectangle above the fence that spans the width of the fence and extends to just below the upper fence to the toe of the undisturbed slope. The contributing area of the upper fence is more difficult to define and depends on the topographic features of the hill slope above. Contributing area for both lower and upper fences has been determined and measured for all cut slope monitoring sites. Currently, 23 cut slope silt fences have been installed at 13 sites. They are proportionally divided between the treated (paved) and untreated portions of the highway. The sampling design includes cut slopes located in road segments that will be treated at differing times in the future, ensuring a wide range in the variability of conditions sampled both before and after highway mitigation.

Cut slope silt fences were not exposed to high runoff and erosion activity in 2010. As a result, the field crew was able to complete weekly surveys of the 23 silt fences (13 sites). Notes were taken in the field to document the condition of the silt fence during each site visit. In the *SiteSummary.xls file* on the data DVD, site visit and survey dates are annotated with the condition of the silt fence, any repairs or replacements that were done to maintain the silt fence and an indication if the fence was breached prior to the survey date. The sediment volume for each cut slope silt fence was recorded in the *SiteSummary.xls file* only if there was sediment accumulation in the cut slope silt fence. All other silt fence site visits would have had zero sediment accumulation. A summary of cut slope site visits, and sediment accumulation in cut slope silt fences for the 2010 monitoring season are presented in Appendix E. All cut slope data and photographs for the 2010 season are available on the accompanying data DVD.

A similar design has been implemented for monitoring the effectiveness of mitigation practices intended to minimize erosion from fill slopes. The design includes the use of two silt fences per site: one is placed at the base of the fill slope to trap what originates from the fill slope (upper fence); a second is placed at the base of the hill slope on which the fill slope resides or at the boundary of the 150 foot corridor associated with the road right-of-way, whichever is the shorter distance (lower fence). The second fence is offset from the first fence and presumably not influenced by the upper fence. This pattern allows for trapping the eroded material as it leaves the fill slope as well as trapping the sediment being delivered off-site or down slope. Material trapped in the lower fence includes natural erosion from the slope below the fill slope as well as material contributed from the fill slope and transported to the boundary of the corridor. In this way, not only will the on-site effectiveness of the mitigation practice as it effects fill slope erosion be evaluated, but an estimate of the amount of eroded material from the fill slope that is attenuated downslope will also be obtained. The contributing area of the upper fill slope fence spans the width of the fence and extends upslope to the edge of the road bed. The contributing area of the lower fence is defined by the width of the lower fence and the distance to the upper fence. However, like the fences above cut slopes, the actual contributing area of the lower fence is influenced by the topographic features of the hill slope. Contributing area for both the lower and upper fences has been determined and measured for all fill slope monitoring sites. Currently, 56 fill slope silt fences have been installed at 28 sites. Again, the sites are distributed between treated and untreated sections of the highway. Determination of the volume of material trapped behind the fill slope silt fences is accomplished in the same manner as that for the cut slope fences.

As with the cut slope silt fences, accumulation in the fill slope silt fences did not exhibit high runoff and erosion activity in 2010, allowing time for the field crew to complete weekly surveys of each site. Three of the 56 silt fences were breached during the 2010 field season. Notes were taken in the field to document the condition of the silt fence during each site visit. In the *SiteSummary.xls file* on the data DVD, site visit and survey dates are annotated with the condition of the silt fence, any repairs or replacements that were done to maintain the silt fence and an indication if the fence was breached prior to the survey date. The sediment volume for the fill slope silt fences was recorded in the *SiteSummary.xls file* only if there was sediment accumulation in the fill slope silt fence. All other silt fence site visits had zero sediment accumulation. A summary of fill slope site visits, and sediment accumulation in fill slope silt fences for the 2010 monitoring season can be found in Appendix F. All fill slope data and photographs for 2010 are available on the accompanying data DVD.

Numerous sediment grab samples were collected from material trapped in the cut slope and fill slope silt fences throughout the 2010 field season. A subset of these was selected to be analyzed in the laboratory for particle size distribution. The balance of samples will be analyzed only if the variability in the particle size distribution of the subset of samples chosen for initial analysis warrants additional analysis. Laboratory analyses for the 2010 grab samples have been completed and a summary of particle size distributions and graphs are presented in Appendix G and on the accompanying data DVD.

Initially, the monitoring plan anticipated taking measurements of the accumulation behind all silt fences two to three times per year. The actual number of measurements taken is dependent on

many factors including; winter snowpack, soil moisture, number of rainfall events, and availability of crew members to clean out silt fences while completing other tasks. Estimates of human induced erosion and sediment delivery (from cut slope, fill slope, and silt fences located down slope near the streamside or boundary of the 150 foot corridor), can be compared with estimates of “natural movement” estimated from what is trapped in the silt fencing placed above cut slopes for periods before and after mitigation to determine the effectiveness of the practice and other best management practices (BMPs) on reducing human induced erosion.

Using silt fences to monitor sediment transport has proven to be difficult where silt fences cross rock surfaces—frequent breaching and fence failure have occurred over the course of the study. Silt fences fail most frequently where fence material cannot be reliably fastened to rock surfaces, particularly at the base of cut slopes at higher elevations. As a corrective measure, the sampling protocol was revised for three cut slope monitoring sites (102CS, 123CS, and 141CS) that cross rock surfaces. The lower cut slope silt fences on each of these sites have been replaced with two permanent survey cross sections (labeled A and B), one established at the vegetation line just below the upper fence and a second established 1/3 of the distance between the top of the cut slope and the road. The cross sections are the same length as the original fence and are monumented with rebar at each end. Monitoring consists of surveying the surface elevation, relative to the benchmark, of the cut slope cross section. The silt fence at the top of the cut slope has been maintained at all three sites. This adjustment results in 23 silt fences and 6 cross sections, located on 13 sites. This procedural change is intended to provide a qualitative estimate of cut slope erosion in situations where a quantitative estimate is not feasible. Cross section graphs for cut slope monitoring sites that correspond to the survey dates presented in Table 3 can be found in Appendix H. Photographs and survey data for all sites are available on the accompanying data DVD.

Table 3. Summary of cut slope monitoring sites surveyed on Pikes Peak, 2010.

Site ID	Basin #	Watershed	Survey Dates	
102CS	6	WBVR	7/9/2010	9/13/2010
123CS	6	WBVR	7/9/2010	9/13/2010
141CS	6	WBVR	6/21/2010	9/13/2010

## Armoring Drainage Channels

Drainage channels, which include both the drainage ditches along roads and the conveyance channels below culverts, were to be lined (armored) with riprap or concrete to control further erosion and deposition of sediment as mitigation progressed. However, instead of armoring roadside drainage ditches, all reaches except those meeting the criteria stated in the latest U.S. Forest Service Design Review (Burke 2002) are or will be lined with shotcrete, lined with erosion control fabric, or left untreated.

Effectiveness monitoring consists of selecting a sample of the fabric-lined and unlined drainage ditches, establishing cross sections in the channels to be periodically surveyed, and using measured changes in cross sectional area to determine if erosion or deposition is reduced or increased in armored channels relative to unarmored channels. Once drainage ditches are paved or lined with shotcrete, they will no longer be surveyed. If visual inspection provides evidence of failure, cross sections will be re-established and surveys completed to document change.

Conveyance channels are those features that drain water away from the road system to the streams below. For the most part, they are not physically treated or stabilized as part of the road mitigation effort, but road management practices may greatly alter the amount of discharge and sediment delivered to the conveyance channels. The monitoring technique is similar for both ditches and conveyance channels, but the sample size differs.

### **Drainage Ditches**

Most of the drainage ditches selected for monitoring align with the road reaches selected for monitoring. Additional drainage ditches were selected independently of the road reaches, as needed, to complete the desired road slope/contributing area/armoring material matrix. As with the road surface erosion transects, five cross sectional transects per segment of drainage channel (lined, not lined) were established (labeled A–E except for site 188DD, which has eight cross sections labeled A–H). For each cross section, a reference pin was located at the base of the cut slope on the inside of the ditch; a second pin was located on the edge of the road surface, if possible. Asphalt nails were used in the paved road surfaces to mark the end point if road conditions prohibited installation of rebar. The effectiveness of the lining methods in reducing erosion and deposition can be determined by obtaining cross section information at control sites for several years prior to treatment. This information will be useful in the future as new drainage ditch segments are lined.

Fifteen of the original 20 drainage ditches selected were surveyed in 2010. Site 092DD was paved in 2005, site 107DD was lined with shotcrete in 2006, and sites 155DD, 157DD, and 159DD were lined with shotcrete in 2010, eliminating the need for further monitoring. Most drainage ditches will be paved or lined with shotcrete once the highway is paved and will no longer need to be surveyed unless visual inspection provides evidence of failure, in which case cross sections will be established to document change. Six of the 15 remaining drainage ditches are treated (lined with erosion control fabric), and nine remain untreated. Three of the untreated drainage ditches are adjacent to road surfaces paved with recycled asphalt, but have no other treatment applied to the drainage ditch. Six of the untreated drainage ditches are associated with road reaches. Drainage ditch survey cross sections that correspond to the survey dates presented in Table 4 can be found in Appendix I. Drainage ditch survey data and photographs for 2010 are available on the accompanying data DVD.

### **Conveyance Channels**

Monitoring the effectiveness of mitigation practices on conveyance channels also represents a critical component in the monitoring program. Many of these channels have eroded into gullies and may have contributed to the sediment load in the adjacent wetland, riparian, and aquatic systems. From mile marker seven to the summit, 115 conveyance channels were identified and surveyed during the first 3 years of this monitoring effort. Two additional channels were identified and surveyed in 2009. It is not possible to survey all 117 conveyance channels on an annual basis. Instead, as many conveyance channels as possible are surveyed each year. A fixed sub-sample of at least 13 conveyance channels are surveyed every year to compare the effects of treated (7) and untreated (6) road segments. Conveyance channels located below the rock weirs



are also surveyed annually. If the rock weirs fail (as has been observed), changes in conveyance channel geometry may occur. Effectiveness of the rock weir can be evaluated in part by comparing the erosion rate in the conveyance channels located or initiated below the rock weirs with erosion rates observed in other conveyance channels located in proximity to treated and untreated road segments. Every conveyance channel is surveyed using a series of three cross sections located within the 150 foot boundary of the highway corridor (labeled A–C except for site 232CC, which has five cross sections labeled A–E).

Table 4. Description of road treatments above drainage ditches, treatments for drainage ditches, and drainage ditch survey dates on Pikes Peak, 2010.

Site ID	Basin #	Watershed	Road Treatment	Ditch Treatment	Survey Date
005DD	1	Lower SKIC	Asphalt	Erosion Control Fabric	6/24/2010
010DD	1	Lower SKIC	Asphalt	Erosion Control Fabric	7/9/2010
042DD	7	NCRY	Gravel	Untreated	8/19/2010
046DD	7	SKIC	Gravel	Untreated	9/9/2010
051DD	7	SKIC	Gravel	Untreated	7/1/2010
057DD	7	SKIC	Gravel	Untreated	7/1/2010
061DD	7	SKIC	Gravel	Untreated	8/4/2010
071DD	7	SKIC	Gravel	Untreated	9/9/2010
080DD	7	GLEN	Gravel, Recycled Asphalt	Untreated	6/20/2010
082DD	7	GLEN	Gravel, Recycled Asphalt	Untreated	6/13/2010
085DD	7	GLEN	Gravel, Recycled Asphalt	Untreated	6/13/2010
182DD	2	SKIC	Asphalt	Erosion Control Fabric	6/24/2010
188DD	2	NCRY	Asphalt	Erosion Control Fabric	7/9/2010
195DD	2	SKIC	Asphalt	Erosion Control Fabric	6/19/2010
205DD	2	SKIC	Asphalt	Erosion Control Fabric	7/9/2010

Fifty-six of the 117 conveyance channels were monitored in 2010 (Table 5). The fixed sub-sample of 13 conveyance channels was measured in 2010 specifically to compare treated (7) and untreated (6) road sections. Eleven conveyance channels located below established rock weirs and one conveyance channel below sediment pond 199RW were surveyed in 2010. For safety reasons, conveyance channels 024CC, 099CC, 108CC, 114CC, 118CC, and 119CC are not surveyed due to the exposure of large boulders and the general instability of the slope following past rock weir failure. The field crew will continue to monitor these sites every few years, by recording observations in the field notes and using photo monitoring to document changes in conveyance channel geometry, but the sites are not likely to be surveyed. Conveyance channel 015CC located above sediment pond 199RW was lined with shotcrete in 2003 eliminating the need for further monitoring unless visual inspection provides evidence of failure, in which case cross sections will be established to document change. Conveyance channel 131CC was eliminated during construction of the new sediment pond located near mile marker 17 and 134CC was eliminated during construction of the new sediment pond located at the start of Basin 5.

Because monitoring the remaining set of 113 conveyance channels is not feasible during each field season, the field crew will continue to survey a sub-sample of 40 conveyance channels each year and survey additional channels as time permits. Cross sections for the conveyance channels listed in Table 5 are presented in Appendix J. At first glance, graphs of the conveyance channel cross sections presented in Appendix J may appear counter intuitive, as the low point in the cross section may be at the right or left end pin. This presentation is not an error. Not all conveyance

channels were formed as a result of natural drainage processes. Many were formed as the result of road related discharges and the flow path is across the slope rather than downslope, thus causing rills to form across the slope. Conveyance channel survey data and photographs for 2010 are available on the accompanying data DVD.

Table 5. Road treatments associated with conveyance channels, treatments applied to conveyance channels, and conveyance channel survey dates on Pikes Peak, 2010.

Site ID	Basin #	Watershed	Road Treatment	Channel Treatment	Survey Date
004CC	1	Lower NCRY	Asphalt	Rock Apron	6/14/2010
012CC	2	SKIC	Asphalt, Fabric Ditch	Rock Weir	5/27/2010
016CC	2	NCRY	Asphalt, Shotcrete Ditch	Culvert Plugged	6/13/2010
017CC	2	SKIC	Asphalt, Fabric Ditch	Culvert Plugged	6/13/2010
018CC	2	NCRY	Asphalt, Shotcrete Ditch	Untreated	6/20/2010
019CC	2	SKIC	Asphalt, Fabric Ditch	Culvert Plugged	6/20/2010
020CC	2	NCRY	Asphalt, Shotcrete Ditch	Culvert Plugged	6/20/2010
021CC	2	NCRY	Asphalt, Shotcrete Ditch	Culvert Plugged	6/14/2010
022CC	2	NCRY	Asphalt, Shotcrete Ditch	Culvert Plugged	6/13/2010
023CC	2	NCRY	Asphalt	Culvert Plugged	6/12/2010
024CC †	2	SKIC	Asphalt, Fabric Ditch	Culvert Plugged	6/14/2010
030CC	2	NCRY	Asphalt, Fabric Ditch	Rock Weir	6/14/2010
037CC	7	NCRY	Gravel	Untreated	6/11/2010
040CC	1	Lower NCRY	Asphalt, Curb, Fabric Ditch	Straw Logs	6/8/2010
058CC	7	SKIC	Gravel	Untreated	6/8/2010
063CC	7	SKIC	Gravel	Untreated	6/8/2010
070CC	7	SKIC	Gravel	Untreated	6/9/2010
089CC	3	SKIC	Asphalt, Shotcrete Ditch	Rock Weir	7/2/2010
094CC	3	SKIC	Asphalt	Culvert Plugged	7/19/2010
104CC	6	WBVR	Asphalt, Shotcrete Ditch	Untreated	7/1/2010
114CC †	4	FRENCH	Asphalt, Shotcrete Ditch	Rock Weir	8/4/2010
120CC	6	WBVR	Asphalt, Shotcrete Ditch	Sediment Pond	7/8/2010
121CC	6	WBVR	Asphalt, Shotcrete Ditch	Untreated	7/1/2010
122CC	6	WBVR	Asphalt, Shotcrete Ditch	Untreated	7/1/2010
125CC	6	WBVR	Asphalt, Shotcrete Ditch	Untreated	9/8/2010
126CC	6	WBVR	Asphalt, Shotcrete Ditch	Untreated	6/29/2010
127CC	6	WBVR	Asphalt, Shotcrete Ditch	Untreated	9/2/2010
129CC	6	EBVR	Asphalt, Shotcrete Ditch	Untreated	9/2/2010
130CC	6	EBVR	Asphalt, Shotcrete Ditch	Culvert Plugged	6/29/2010
131CC ∞	6	EBVR	Asphalt, Shotcrete Ditch	Sediment Pond	6/11/2010
132CC	6	EBVR	Asphalt, Shotcrete Ditch	Untreated	9/1/2010
133CC	6	EBVR	Asphalt, Shotcrete Ditch	Untreated	6/23/2010
134CC ∞	5	EBVR	Asphalt, Shotcrete Ditch	Sediment Pond	6/11/2010
135CC	5	BHMR	Asphalt, Shotcrete Ditch	Untreated	8/3/2010
136CC	5	BHMR	Asphalt, Shotcrete Ditch	Untreated	6/23/2010
137CC	5	BHMR	Asphalt, Shotcrete Ditch	Untreated	6/23/2010
138CC	5	BHMR	Asphalt, Shotcrete Ditch	Untreated	6/11/2010
139CC	6	EBVR	Asphalt, Shotcrete Ditch	Sediment Pond	6/29/2010
140CC	6	EBVR	Asphalt, Shotcrete Ditch	Untreated	8/2/2010
175CC	1	Lower NCRY	Asphalt, Curb	Rock Apron	6/30/2010
184CC	2	SKIC	Asphalt, Shotcrete Ditch	Sediment Pond	6/4/2010
211CC	2	SKIC	Asphalt, Fabric Ditch	Untreated	6/11/2010

Site ID	Basin #	Watershed	Road Treatment	Channel Treatment	Survey Date
213CC	6	FRENCH	Asphalt, Shotcrete Ditch	Untreated	9/2/2010
214CC	5	BHMR	Asphalt, Shotcrete Ditch	Untreated	6/16/2010
215CC	5	BHMR	Asphalt, Shotcrete Ditch	Untreated	6/23/2010
219CC	1	Lower SKIC	Asphalt, Shotcrete Ditch	Rock Weir	8/2/2010
220CC	1	Lower SKIC	Asphalt, Fabric Ditch	Rock Weir	6/18/2010
221CC	1	Lower NCRY	Asphalt, Shotcrete Ditch	Rock Weir	6/21/2010
222CC	1	Lower NCRY	Asphalt, Shotcrete Ditch	Rock Weir	6/21/2010
223CC	1	Lower SKIC	Asphalt, Fabric Ditch	Rock Weir	6/18/2010
224CC	2	NCRY	Asphalt, Asphalt Ditch	Rock Weir	6/8/2010
229CC	2	NCRY	Asphalt, Fabric Ditch	Rock Weir	6/12/2010
230CC	2	NCRY	Asphalt, Fabric Ditch	Rock Weir	6/10/2010
232CC	7	GLEN	Gravel	Untreated	9/28/2010
244CC	2	NCRY	Asphalt, Shotcrete Ditch	Untreated	6/4/2010
245CC	2	NCRY	Asphalt, Asphalt Ditch	Untreated	6/29/2010
† Survey not completed due to instability of the site. Photographs taken and observations recorded in the field notebook. ∞ Site no longer exists. Replaced with sediment pond. Photographs taken and observations recorded in the field notebook.					

## Sediment Traps (Sediment Ponds and Rock Weirs)

The original mitigation plan called for building sediment ponds designed to trap sediment while allowing water to exit as a stream. Initially, the proposed monitoring consisted of periodic pond surveys to index sediment accumulation as well as measurement of the suspended sediment concentrations in discharge entering and exiting the pond. The combination of sediment accumulation in the pond plus the sediment exiting the pond in the outflow was intended to provide an estimate of total sediment transport. In accordance with the revised mitigation design, rock weirs capable of detaining all the water and sediment discharged from the road segment for events up to the design storm are being constructed. The current monitoring strategy assumes that the rock weirs detain all discharge long enough for the sediment to settle out, while the water percolates out of the rock weir through the porous berm. Measuring sediment accumulation in the rock weir will index total sediment movement. In the event the rock weir does not detain all the storm discharge delivered to it (actual discharge exceeds the design discharge or the rock weirs fail to function properly), silt fences have been installed on the downhill side of the rock weirs to trap sediment carried in surface discharge passing over or through the berm. A silt fence is preferred over grab samples of discharge because any overflow or through flow that occurs is most likely to be diffused and not concentrated. Also, using a silt fence provides a measure of total transport. The measurement protocol for these silt fences is the same as that employed for the cut and fill slope silt fences.

The field procedure for monitoring sediment accumulation in the rock weirs was modified in 2008 to simplify both instrument requirements for the survey and software requirements for subsequent data reduction and analysis as well as to allow for a more consistent comparison of volumetric change from survey to survey. A fixed area was defined and monumented within each rock weir to be surveyed each time, and compared from survey to survey or year to year.

Prior to 2008, the area surveyed within each rock weir had not been predefined. Although the criteria for selecting the area to be surveyed within each rock weir was well defined in the survey protocol, the area actually surveyed as well as the number and distribution of survey points within that area were not necessarily consistent from one survey to the next. Much was left to the discretion of the field crew. As part of each survey (spring, fall, and as needed during the summer), the field crew would identify areas of sediment accumulation within the rock weirs and, although virtually all of the rock weir area was surveyed, sampling points were concentrated in the vicinity of the areas of deposition and more widely spaced over the balance of the rock weir area. The survey capabilities of the Trimble Robotics Total Station, which is used for all surveying on the Pikes Peak Project, records the geospatially correct location of survey points for virtually any survey pattern, so utilizing a variable sampling scheme did not create a problem. In order to compensate for the variable distribution of survey points, an AutoCAD package was used to develop a 0.5 foot Digital Terrain Model (DTM) for the surface of the sediment pond. This provided a very high resolution description of the topographic variability in the survey data collected in the vicinity of active deposition without requiring similar resolution (and sample size) in areas perceived to have had little or no activity. This DTM could then be intersected with the DTM for earlier or subsequent surveys to obtain an estimate of volumetric change between surveys. The procedure called for any non-overlapping areas to be clipped from either survey as needed, and resulted in two overlapping surfaces of equal size. The volumetric difference between the two intersected surfaces represented the estimate of the volumetric change in sediment accumulation that occurred in the rock weir during the interval between surveys. Although valid, it became apparent that this protocol had several drawbacks specific to this study that included: 1) dependence on the Trimble Robotics Total Station, 2) risk of inconsistent survey data, and 3) dependence on an AutoCAD package and associated technical skills that may or may not be available in the future.

First, the choice of survey tools was limited to automated systems such as the Trimble Robotics Total Station, limiting alternative instrument choices while requiring a specific level of technical expertise in the field crew. Second, because the area to be surveyed within each rock weir had not been predefined, the perimeter of the DTM's for individual surveys were not necessarily identical when intersected. Therefore, the clipping process that became necessary introduced the risk of inconsistent or lost information. Fortunately, the field crew leader was the same for each year of monitoring up to 2007 so disparities in survey areas are in fact minimal. Lastly, the protocol required the use of an AutoCAD package to develop and intersect the three dimensional surfaces used to estimate sediment accumulation. This required software and technical skills not readily available within the project, requiring that the data reduction be outsourced to other consultants.

In 2008 the field procedures for surveying the rock weirs were modified. First, each rock weir was visited and the perimeter of the critical portion of the sediment accumulating pond was identified and monumented with rebar. These monumented locations were then referenced to the three benchmark locations (control points) already established for each rock weir. An attempt was made to define the area to be surveyed in rectangular form, but sometimes five or six sides were needed to most efficiently define the perimeter of the area of interest. In every case, the area selected for a given rock weir encompassed all the areas surveyed prior to 2008. It should be noted that all unstable areas identified to be within the rock weir were also included in the

survey area to ensure that migration of material from one location within the rock weir to another were balanced out in the survey and not construed to be additions or losses in accumulation between surveys. Because the permanent survey area defined for each rock weir encompasses the area of every previous survey, no loss of historic data will occur as a result of the change in procedure.

After the survey perimeter was defined, one side was arbitrarily selected as the baseline for the survey. Depending on the size and shape of the rock weir area of interest, a rectangular survey grid system was established that originates from the baseline and uniformly and consistently covers the rock weir area. Survey lines initiate from the baseline at uniform intervals, and cross the rock weir perpendicular to the baseline, and extend to the opposite boundary line. Survey points along each line are also uniformly spaced. The spacing of both survey lines and survey points on a survey line vary with rock weir size. An example schematic for rock weir 008RW is shown in Figure 2. Lines located perpendicular to the baseline and survey points along the line may result in a 1 X 1, 1 X 2, 2 X 1, 2 X 2, or comparable survey grid depending on the area and shape of the rock weir. The objective was to locate several hundred survey points, uniformly distributed in each rock weir that would be revisited at each survey. This approach has several advantages over the original survey protocol. First, surveying using a fixed grid system allows obtaining a simple estimate of elevation of the rock weir area relative to the control points for each survey. Following this protocol is not particularly instrument specific, nor is data reduction as software or skill dependant as the initial protocol. Second, because the area to be surveyed is fixed, repeated measures allow for a more uniform comparison of volumetric change from survey to survey and surveys are not biased by field crew changes or interpretations.

Changing the survey protocol may result in some loss of resolution (sampling intensity) in the areas of most active accumulation. However, because the current rock weir area is fixed and the same approximate points will be surveyed each time, that loss should be minimal and offset by greater consistency from survey to survey. Changing the field procedure does not preclude the use of AutoCAD packages for data analysis. However, if an AutoCAD package is not used to process the data, the average elevation of the rock weir surface can be obtained by determining the average elevation of the survey points. The volumetric change between any two surveys can be estimated by multiplying the difference in the average geo-referenced elevations for the two surveys by the area of the rock weir.

As part of the process of changing a protocol, several quality control and quality assurance checks have been implemented as a means of better defining errors that might be associated with the survey procedure. The concerns were; 1) whether or not the initial survey grid system selected for each rock weir was adequate to define the average elevation of the surface, 2) whether or not observed discrepancies in the total number of points observed in the successive surveys of the same pond were significant, and 3) whether or not measurement error associated with defining the reference elevation used for the feature of interest caused a significant error. Two rock weirs (234RW and 243RW) were chosen for evaluation in 2008.

In order to assess whether or not the initial survey grid system selected for each rock weir was adequate to define the average elevation of the rock weir, the elevation of two rock weirs (234RW and 243RW) was estimated for two different surveys using all the survey points for

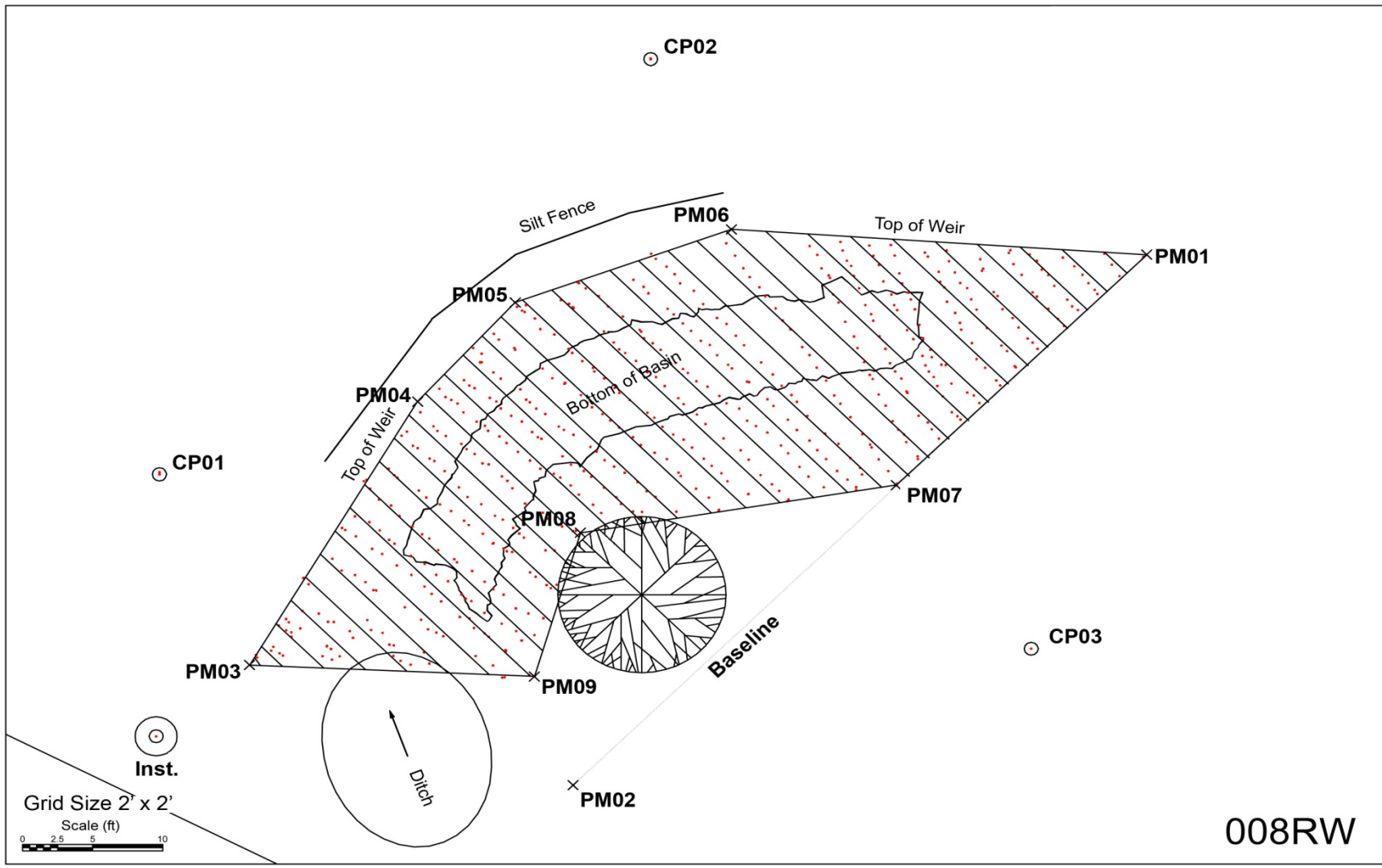


Figure 2. Schematic map of rock weir 008RW defining a fixed area, baseline, perimeter points and survey grid on Pikes Peak, 2008.

each weir and again using half of the total survey points. With the possible exception of the survey for 234RW on June 14, 2008, the estimates of average elevation were quite consistent when based on either all or only half (every other) of the survey points (Table 6) implying that using a survey grid system is appropriate but may have some potential for introducing error.

Table 6. Change in elevation of the rock weirs as indexed by rock weirs 234RW and 243RW on Pikes Peak, 2008.

Rock Weir	Survey Date	Number of Survey Points	Average Elevation Based on all Points (ft)	Average Elevation Based on half the Points (ft)
234RW	6/14/2008	747	12,100.93	12,100.02
234RW	8/20/2008	652	12,100.14	12,100.14
243RW	7/16/2008	422	12,896.97	12,896.96
243RW	8/29/2008	451	12,896.90	12,896.88

In the case of 234RW, the two successive surveys imply a decrease in sediment accumulation occurred between June 14, and August 20, 2008 (Table 6). A decrease in rock weir elevation would imply a decrease in accumulation, if settling or scouring occurred during the interim between measurements. Settling, or a lowering of the surface elevation of the material in the weir, may occur as a result of compaction, organic matter decomposition, or subsequent scour and does represent a potential weakness in using volumetric changes in accumulation to estimate sediment volume. The discrepancy could also reflect survey error. In either case, the negative change reflects a resolution error in the measurement protocol, regardless of the cause.

In 2009 and 2010, in an attempt to further assess survey resolution, we evaluated how closely the elevation of the same rock weir is estimated by repeated surveys. Rock weir 003RW was chosen for evaluation. Two separate surveys of 003RW were completed on both June 12, 2009 and June 3, 2010 by the two person crew. In each case, the instrument was setup and the survey of the rock weir was completed. The crew members alternated responsibility in setting up the instrument and conducting the survey. The surveys conducted on June 12, 2009 were compared to a survey completed on September 26, 2008. The surveys conducted on June 3, 2010 were compared to a survey completed on September 24, 2009 (Table7). The intent of the repeated survey was to develop some insight into the degree that error might play in the estimate of change in volume. The results shed some light on the overall resolution of the measurement protocol.

Table 7. Change in elevation of rock weir 003RW as indexed by successive surveys Pikes Peak, 2009 and 2010.

Survey	Rock Weir Area (sq ft)	Number of Points in Survey	Average Elevation of the points (ft)	Elevation Change between successive surveys (ft)	Volume Change (cu ft)
003RW_092608	521	318	8991.38		
003RW_061209_1	521	343	8991.22	-0.16	-83.36
003RW_061209_2	521	339	8991.30	-0.08	-41.68
003RW_092409	521	368	8991.16		
003RW_060310_1	521	340	8991.18	0.02	10.42
003RW_060310_2	521	318	8991.21	0.05	26.05

First, as was the case for 243RW during the summer of 2008 (Table 6), the average elevation of 003RW decreased during the interval from September 26, 2008 to June 12, 2009 (Table 7). However, the estimated decrease, based on either elevation or volume, varied depending on which of the June 12, 2009 surveys were used as the basis for comparison. In this comparison, the estimate of change between fall and summer differed by 50 percent depending on which of the two 2009 surveys is used as the base for comparison. The average elevation of 003RW increased during the interval from September 24, 2009 to June 3, 2010 (Table 7). However, the estimated increase, based on either elevation or volume, also varied depending on which of the June 3, 2010 surveys were used as the basis for comparison. In this comparison, the estimate of change between fall and summer differed by 40 percent depending on which of the two 2010 surveys is used as the base for comparison. This finding provides some insight as to the relative resolution in the estimate of sediment accumulation that can be derived using this procedure. It should be noted that although the percent error seems high, the volume of sediment is quite low.

The second observation that may contribute to error is the slight discrepancy that exists in the total number of survey points in each of the successive surveys of the same pond, even though the same survey grid was followed. For example, 368 points were surveyed in 003RW on September 24, 2009 while 340 points were surveyed on June 3, 2010 in survey 1 and 318 points were surveyed in survey 2. The reason for the discrepancy is not clear, other than possible survey error. Steps were taken to address this discrepancy during the 2010 field season, although there is no indication that this discrepancy affected the 2008/2009 and 2009/2010 survey comparisons.

As noted in earlier reports, there is an additional error in the surveys of the rock weirs (and all other surveys as well) that is associated with defining the reference benchmarks for each feature. The benchmarks are used to orient the Trimble Robotics Total Station as to the elevation and the geospatial location of the feature being surveyed. Field experience in the use of the Total Station indicates that the measurement error in defining the reference elevation for the feature of interest, based on the use of three benchmarks, is 0.01 feet or less. This error could contribute to some of the discrepancies observed in Table 6.

As with the road surface erosion transects, the two sediment ponds are surveyed using a series of cross sections (labeled A–E for 199RW and labeled A–C for 234 RW) to estimate volumetric changes in sediment accumulation. In those few cases where there is a defined inflow and outflow to a pond, water samples to estimate trap efficiency can be grab sampled from the inlet and outlet of the ponds as originally planned. Surveys of the sediment traps should be completed after spring snowmelt and again after significant rainfall events, perhaps a total of four times per year. In addition, surveys taken before and after rock weir cleaning can be used to estimate the total volume or amount of material removed and this cumulative estimate can be used to verify appropriateness of the incremental surveys.

As noted above, any conveyance channels that appear to be present below the rock weirs are monitored. If the rock weirs fail, as some did in 2009, any changes in the conveyance channel geometry that may result will be documented. If the rock weirs are effective in reducing the erosive energy of the discharge, the reduction in erosion in the conveyance channels can be documented by comparing response in channels draining treated and untreated road segments.



In 2010, construction and re-vegetation on the upper sediment pond located at the start of Basin 5 and the lower sediment pond at Devil's Playground in Basin 6 was completed and these sites will be monitored beginning in 2011 (personal communication with Jack Glavan, City of Colorado Springs, Capital Projects Manager). Twenty-eight sediment traps were monitored in 2010, including 26 rock weirs and two sediment ponds. Twenty sites were surveyed at least twice to monitor their effectiveness in trapping sediment from winter and summer runoff. The rock weirs were surveyed and sediment volume was measured in the silt fences located down slope of the rock weirs (14 rock weirs have associated silt fences). The silt fence below rock weir 202RW was extended in 2010 to capture material by-passing the fence. Rock weir 162RW was cleaned out by the Highway Department this field season and surveyed for the first time since 2008. Of the 28 sites, 10 demonstrated some degree of failure, where water and sediment were seen piping under or through the rock weir, the rock weir was overtopped, or the rock weir was breached. In addition, the silt fences associated with 180RW and 202RW were breached in 2010. Rock weirs 236RW, 238RW, and 243RW were not surveyed due to breaching of the rock weir. The field crew will continue to monitor these sites every year, by recording observations in the field notes and using photo monitoring to document changes. As noted earlier for silt fences on the cut and fill slopes, the data from the breached rock weirs or sediment fences may underestimate total sediment production. Survey dates for the rock weirs and sediment ponds are presented in Table 8.

A summary of rock weir silt fence site visits, and sediment accumulation in rock weir silt fences and the rock weirs for the 2010 monitoring season, as well as sediment pond cross sections from 2010 are presented in Appendix K.

The average elevations for the rock weir surfaces were obtained by determining the average elevation of the survey points. The volumetric change between the two surveys was then estimated by multiplying the difference in the average geo-referenced elevations for the two surveys by the area of the rock weir (Appendix K). As noted earlier, the negative values imply a decrease in estimate of sediment accumulation between two surveys. Sediment trap data and photographs for 2010 are available on the accompanying data DVD.

Grab samples of the sediment retained in both the rock weirs and silt fences below the weirs were collected each time the weirs were surveyed or the fences cleaned. As noted earlier, a subset of these grab samples was selected for analysis of particle size distribution. The balance of samples will be analyzed only if the variability in the particle size distribution of the subset of samples chosen for initial analysis warrants additional analysis. In addition, water samples to determine suspended sediment were collected from the inflow and outflow of the major sediment pond 199RW. Laboratory analyses for the 2010 grab samples have been completed and a summary of particle size distributions and graphs are presented in Appendix L and on the accompanying data DVD. Laboratory analyses on the suspended sediment samples for the 2010 field season are also presented in Appendix L and on the accompanying data DVD.

Table 8. Management practices implemented above sediment traps, and sediment trap survey dates on Pikes Peak, 2010.

Site ID	Basin #	Watershed	Management Practice	Survey Dates	
002RW	1	Lower SKIC	Untreated Ditch	5/25/2010	9/21/2010
003RW	1	Lower SKIC	Shotcrete Ditch	6/3/2010	9/21/2010
006RW	1	Lower SKIC	Erosion Control Fabric Ditch	5/26/2010	9/22/2010
008RW	1	Lower NCRY	Shotcrete Ditch	6/4/2010	9/20/2010
009RA	1	Lower SKIC	Erosion Control Fabric Ditch	5/26/2010	9/21/2010
152RW	2	SKIC	Erosion Control Fabric Ditch	5/27/2010	9/28/2010
153RW	2	SKIC	Erosion Control Fabric Ditch	5/27/2010	9/15/2010
161RW	2	NCRY	Asphalt Curb and Ditch	5/25/2010	9/15/2010
162RW	2	NCRY	Asphalt Ditch	9/20/2010	
176RW	2	NCRY	Erosion Control Fabric Ditch	5/27/2010	9/29/2010
178RW	2	NCRY	Erosion Control Fabric Ditch	6/18/2010	9/29/2010
179RW	2	NCRY	Erosion Control Fabric Ditch	6/18/2010	9/30/2010
180RW	2	NCRY	Erosion Control Fabric Ditch	6/18/2010	9/14/2010
181RW	2	NCRY	Erosion Control Fabric Ditch	6/19/2010	9/20/2010
199RW	2	SKIC	Shotcrete Ditch	7/19/2010	9/30/2010
200RW	1	Lower NCRY	Asphalt Curb and Ditch	6/4/2010	9/29/2010
201RW	2	NCRY	Asphalt Curb and Ditch	6/4/2010	9/29/2010
202RW	2	SKIC	Asphalt Ditch	5/26/2010	9/15/2010
233RW	3	SKIC	Shotcrete Ditch	6/19/2010	9/14/2010
234RW	3	SVRY	Shotcrete Ditch	6/19/2010	
236RW †	3	SKIC	Shotcrete Ditch	6/19/2010	
237RW	3	SKIC	Shotcrete Ditch	7/16/2010	8/31/2010
238RW †	3	SKIC	Shotcrete Ditch	6/19/2010	
239RW	3	FRENCH	Shotcrete Ditch	9/1/2010	
240RW	3	SKIC	Shotcrete Ditch	6/19/2010	9/14/2010
241RW	4	FRENCH	Shotcrete Ditch	8/4/2010	
242RW	4	SKIC	Shotcrete Ditch	9/1/2010	
243RW †	4	SKIC	Shotcrete Ditch	6/19/2010	

† Survey not completed due to rock weir breach. Photographs taken and observations recorded in the field notebook.

## VALIDATION MONITORING

Validating the effect of road restoration practices on aquatic, wetland, and riparian conditions is more difficult than determining the effectiveness of mitigation practices in reducing erosion and sedimentation at specific locations on site or close to the highway. On-site response to the mitigation practices should be direct, dramatic, and occur in real time. Off-site response, such as in the stream channels, is likely to be more diffused, less dramatic, cumulative in nature, and subject to changes in condition elsewhere in the watershed, all of which make validation of response to mitigation difficult. The watersheds of concern have been subject to road related impacts for more than 80 years. Any road-related degradation in the channel systems is the aggregate result of long-term, road-related discharge and sediment pulses. The interruption of those pulses as a result of road mitigation practices might be too subtle to be detectable in the near term, therefore creating a challenge in selecting the most appropriate indicator metric.

The scale chosen for validation monitoring is that of the stream channel reach. Within each stream reach selected, channel morphology, bed and bank particle size distribution, bank erosion, and vegetation diversity is monitored and characterized. A suite of tributaries in the Pikes Peak Watershed has been identified as either impacted or non-impacted by the presence and maintenance of the Pikes Peak Highway. North Catamount, South Catamount, Glen Cove, Oil, and Boehmer Creeks represent non-impacted streams. Ski, Severy, East Fork of Beaver, North Fork of Crystal, and West Fork of Beaver Creeks are all considered stream systems impacted by the highway. Stream reaches have been selected in each of the 10 streams, and periodic monitoring will be conducted in each stream reach for the entire 15 year study period. Oil Creek has only one monitored stream reach because the upper portion of the stream is on private land and not accessible. Glen Cove Creek has only one stream reach because it is a small tributary of South Catamount Creek, which has three stream reaches. All other streams have two stream reaches. Because response can be expected to be gradual, it is not necessary that all streams be measured every year; however, annual measurement is encouraged if time permits.

The monitoring assumption is that stream channel adjustments that might occur in the impacted stream reaches following road mitigation practices will not occur on either the reference stream reaches (those not influenced by the highway) or in the impacted streams draining the portions of highway that have not received mitigation. However, this does not imply that differences that may have existed at the start of the monitoring program between the five reference and the five impacted stream systems were the consequence of road-related impacts. Rather, any long-term trends in convergence or divergence in the comparison of conditions in the impacted and the control stream reaches following road mitigation will be evaluated as potential indicators of stream channel response to highway mitigation practices.

The techniques proposed by Harrelson et al. (1994) were used to establish the stream channel reference sites. Selected stream reaches are at least 100 meters in length and contain several meander lengths or riffle-pool-riffle complexes. In 2005, two additional reaches were established in response to the diversion wall built on Ski Creek to divert all alpine runoff into Glen Cove Creek. Glen Cove Creek is a tributary to South Catamount Creek, and enters upstream from the two reference stream reaches on South Catamount Creek. The diversion on

Ski Creek will increase discharge into both Glen Cove and South Catamount Creeks and additional monitoring seemed warranted.

## **Stream Channel Cross Sections**

Five channel cross sections have been located and permanently referenced in each of the stream reaches, following the selection and installation criteria in Harrelson et al. (1994). The purpose for the cross sections is to document changes in channel cross sectional geometry that may occur over time. Five cross sections in a 100 meter stream reach should be adequate to provide an indication of change in channel cross section geometry, should it occur naturally or as the consequence of mitigation. In addition to the cross sections, longitudinal surveys of the channel thalweg through the stream reach are conducted to document surface water and thalweg slope and location (Harrelson et al. 1994). Over time, changes in geometry such as width to depth ratios in the cross sections, thalweg elevation and location in the floodplain, longitudinal profile, or channel gradient may reflect a response to road mitigation impacts on sediment supply or discharge energy when compared to responses in the control reaches. If possible, cross sections should be surveyed each fall so that changes in channel geometry can be documented on an annual basis. Because it can be expected that channel responses to the road mitigation practices will not be as robust as other metrics, it is not critical that each stream be surveyed each year.

Stream survey cross sections were completed on Boehmer Creek, East Fork of Beaver Creek, Glen Cove Creek, North Catamount Creek, North Fork of Crystal Creek, Oil Creek, South Catamount Creek, Ski Creek, Severy Creek, and West Fork of Beaver Creek. The stream surveys did not include bank erosion surveys, or planview surveys. Stream channel cross sections from the 2010 monitoring season can be found in Appendix M. Stream channel cross section and thalweg survey data for 2010 are available on the accompanying data DVD.

## **Bank Erosion**

Bank erosion is being documented through the channel cross section surveys. If the channel is actively down cutting or migrating laterally, the change is an index of bank erosion. Additional bed and bank features are also displayed in a map of the stream reach (Harrelson et al., 1994) and through the use of permanent photo points. In each stream reach, measuring and comparing the lengths of bank that are stable versus lengths of bank that are actively eroding also provides an index of the proportion of eroding banks. If the stream reach contains areas of significant bank erosion, bank pins will be installed to measure the lateral rate of erosion. Installation of such pins is only warranted if erosion appears to be active and severe in certain locations within the stream reach or if the onset of bank erosion begins to occur during the monitoring period. Over the long-term, the five cross sections located within a 100 meter stream reach should index channel and bank stability by documenting changes in channel geometry and location. Secondary measures such as thalweg surveys and bank erosion monitoring should help document any further change.

In 2010, measurements specific to bank erosion consisted of channel cross section surveys, thalweg surveys, and photographic documentation. Visual indications were that bank erosion

was not significant enough to warrant installation of bank pins to measure the lateral rate of erosion.

## **Particle Size Distribution**

Assuming that road mitigation practices are effective in reducing discharge energy and sediment delivery to the channel system, and that no offsetting responses occur, the percentage of fine particles in the stream channel bed can be expected to decrease over time. A greater percentage of the stream bed is likely to be composed of larger particles as the fine particles are winnowed out and not replaced. The composition of the sediment trapped behind silt fences, and deposited in rock weirs and in bars on the stream reaches is assessed through the collection of grab samples and analyzed in the laboratory for particle size distribution. Comparing the particle size distribution in material captured in traps near the highway with sediment deposits (bars) in the streams and pebble counts taken in the stream channel should validate response to highway mitigation practices.

## **Pebble Counts**

Pebble counts in each stream reach are conducted during each survey using the Bevenger and King Pebble Count Procedure (Bevenger and King, 1995). The procedure calls for a zigzag sampling pattern that passes through the stream reach, crossing from bank to bank. Three hundred particles are sampled in each survey and one survey per field season is completed in each of the stream reaches. To help support this aspect of the validation monitoring, the particle size distribution of the material caught in silt fences and in the rock weir sediment traps is available for comparison to the bed material in the streams.

Stream pebble counts were completed on Boehmer Creek, East Fork of Beaver Creek, Glen Cove Creek, North Catamount Creek, North Fork of Crystal Creek, South Catamount Creek, Ski Creek, Severy Creek and West Fork of Beaver Creek. A stream pebble count was not completed on Oil Creek as a lightning storm necessitated leaving the site prematurely. A summary of the stream channel particle size distribution from the pebble counts is presented in Table 9. Stream pebble count particle size distribution graphs from the 2010 monitoring season can be found in Appendix N and on the accompanying data DVD.

## **Grab Samples**

Sediment grab samples were collected from bars at Boehmer Creek, East Fork of Beaver Creek, Glen Cove Creek, North Catamount Creek, North Fork of Crystal Creek, Oil Creek, South Catamount Creek, Ski Creek, Severy Creek and West Fork of Beaver Creek. Comparing the distribution of material captured in traps near the highway to sediment deposits (bars) in the streams might be useful in validating response to highway mitigation practices. Laboratory analyses for the 2010 grab samples have been completed and a summary of stream channel particle size distributions of bar samples and graphs for 2010 is presented in Appendix O and on the accompanying data DVD.

Table 9. Summary of particle size distribution of pebble counts in stream channels on Pikes Peak, 2010.

Site Name	Site ID	Date	Particle Size Distribution					
			D15	D35	D50	D84	D95	D100
Boehmer Creek Reach 1	BHMR1	9/25/2010	0.125	1.190	3.274	24.233	36.714	41.0
Boehmer Creek Reach 2	BHMR2	9/25/2010	0.666	1.230	1.703	7.469	22.739	27.0
East Fork Beaver Creek Reach 1	EBVR1	9/26/2010	0.606	2.236	3.639	7.512	10.259	14.0
East Fork Beaver Creek Reach 2	EBVR2	9/26/2010	0.865	3.676	5.804	10.956	14.938	20.0
Glen Cove Reach 1	GLEN1	7/20/2010	0.788	1.781	2.781	7.836	12.665	17.0
North Catamount Creek Reach 1	NCAT1	7/13/2010	2.101	4.559	6.131	10.557	13.347	15.0
North Catamount Creek Reach 2	NCAT2	7/13/2010	1.890	4.361	6.312	13.465	24.091	28.0
North Fork Crystal Creek Reach 1	NCRY1	7/12/2010	0.304	1.354	2.551	9.832	23.142	31.0
North Fork Crystal Creek Reach 2	NCRY2	7/12/2010	0.296	1.182	2.054	6.634	11.303	21.0
Oil Creek Reach 1	OILC1	8/5/2010	1.052	2.856	4.463	11.857	24.153	30.0
South Catamount Creek Reach 1	SCAT1	7/29/2010	2.625	4.871	6.586	12.723	16.338	25.0
South Catamount Creek Reach 2	SCAT2	7/21/2010	0.091	1.168	3.314	10.733	16.425	20.0
South Catamount Creek Reach 3	SCAT3	7/20/2010	2.244	4.251	5.294	8.556	10.898	15.0
Ski Creek Reach 1	SKIC1	7/21/2010	0.756	4.204	6.479	13.545	17.878	21.0
Ski Creek Reach 2	SKIC2	7/12/2010	0.376	2.339	4.958	12.264	17.033	19.0
Severy Creek Reach 1	SVRY1	7/23/2010	0.422	1.464	2.431	6.826	11.765	18.0
Severy Creek Reach 2	SVRY2	7/23/2010	1.406	8.525	17.169	45.220	48.454	50.0
West Fork Beaver Creek Reach 1	WBVR1	9/4/2010	2.014	5.610	7.435	12.594	16.294	20.0
West Fork Beaver Creek Reach 2	WBVR2	9/4/2010	1.508	3.278	4.750	10.148	37.383	44.0

## Vegetation

Vegetation photo points established at the top of the left and right banks (facing downstream) at each cross section have been monumented and are intended to document changes in vegetation type, density, and percent cover over time as riparian and wetland areas recover (Hall 2002). Vegetation is grouped into general categories of moss, grass, sedge, forb, or shrub to document vegetation presence. Percent cover is estimated for the top of bank area 1.5 feet on either side of the center line of the cross section. This monitoring is not intended to determine the degree of departure that current conditions might reflect relative to a reference value. Monitoring will document the evolution or transition that occurs as the disturbed streams respond to the effects of road mitigation and will allow for comparison of any trends to those that occur in the control stream reaches.

The riparian vegetation summary from the 2010 monitoring season is presented in Appendix P. Vegetation data and photographs from 2010 are available on the accompanying data DVD.

## **SUMMARY**

Meteorologically, the 2010 field season was relatively uneventful with no dominate storm events allowing more time for routine monitoring and maintenance, as well as more thorough quality assurance and quality control assessments. A total of 150 features were monitored during the 2010 field season, many of which were visited more than once.

In addition to the three electronic rain gauges (Onset Computer Corp.), standard, non-recording rain gauges (All-Weather) were installed in 2010 at each monitoring site to avoid loss of data should an electronic rain gauge fail. The standard rain gauges also provide a second index of precipitation amount for the sampling interval.

The field procedure for monitoring sediment accumulation in the rock weirs was modified in 2008 to simplify both instrument requirements for the survey and software requirements for subsequent data reduction and analysis as well as to allow for a more consistent comparison of volumetric change from survey to survey. A fixed area was defined and monumented within each rock weir to be surveyed each time, and compared form survey to survey or year to year. In 2009 and 2010, the changes were more completely documented and a more thorough error analysis completed.

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# Appendix A

## Site Locations for Effectiveness and Validation Monitoring

2010

**Site Locations for Effectiveness and Validation Monitoring on Pikes Peak, 2010†**

<b>Site ID</b>	<b>Latitude (hddd°mm.mmm)</b>	<b>Longitude (hddd°mm.mmm)</b>	<b>Altitude (ft)</b>	<b>Feature Description</b>
001FS	N38 55.211	W105 02.238	9410	Fill Slope
002RW	N38 55.224	W105 02.264	9410	Rock Weir/Apron
003RW	N38 55.200	W105 02.258	9416	Rock Weir/Apron
004CC	N38 55.132	W105 02.278	9431	Conveyance Channel
005DD	N38 55.087	W105 02.415	9447	Drainage Ditch
006RW	N38 55.109	W105 02.482	9415	Rock Weir/Apron
007FS	N38 55.094	W105 02.520	9414	Fill Slope
008RW	N38 55.075	W105 02.554	9417	Rock Weir/Apron
009RA	N38 55.046	W105 02.655	9443	Rock Weir/Apron
010DD	N38 54.907	W105 02.734	9457	Drainage Ditch
011CS	N38 54.909	W105 02.730	9459	Cut Slope
012CC	N38 54.748	W105 03.060	9528	Conveyance Channel
013CC	N38 54.730	W105 03.068	9525	Conveyance Channel
015CC	N38 54.603	W105 03.174	9547	Conveyance Channel
016CC	N38 54.602	W105 03.111	9525	Conveyance Channel
017CC	N38 54.510	W105 03.246	9565	Conveyance Channel
018CC	N38 54.472	W105 03.298	9576	Conveyance Channel
019CC	N38 54.457	W105 03.384	9599	Conveyance Channel
020CC	N38 54.345	W105 03.383	9637	Conveyance Channel
021CC	N38 54.299	W105 03.461	9668	Conveyance Channel
022CC	N38 54.288	W105 03.552	9692	Conveyance Channel
023CC	N38 54.272	W105 03.583	9701	Conveyance Channel
024CC	N38 54.289	W105 03.638	9715	Conveyance Channel
025CC	N38 54.258	W105 03.697	9744	Conveyance Channel
026CC	N38 54.232	W105 03.643	9752	Conveyance Channel
027CC	N38 54.183	W105 03.652	9771	Conveyance Channel
028CC	N38 54.149	W105 03.714	9818	Conveyance Channel
029CC	N38 54.145	W105 03.816	9856	Conveyance Channel
030CC	N38 54.134	W105 03.828	9855	Conveyance Channel
031CC	N38 54.130	W105 03.829	9861	Conveyance Channel
032CC	N38 54.159	W105 03.836	9858	Conveyance Channel
033CC	N38 54.106	W105 03.854	9886	Conveyance Channel
034CC	N38 54.037	W105 03.896	9940	Conveyance Channel
035CC	N38 53.909	W105 04.000	10060	Conveyance Channel
036CC	N38 53.866	W105 03.875	10126	Conveyance Channel
037CC	N38 53.821	W105 03.855	10217	Conveyance Channel
038CC	N38 53.759	W105 03.787	10254	Conveyance Channel
039FS	N38 54.910	W105 02.812	9455	Fill Slope
040CC	N38 54.914	W105 02.789	9464	Conveyance Channel
041CP	N38 53.807	W105 03.893	10072	Road Survey Control Point
042DD	N38 53.719	W105 03.746	10161	Drainage Ditch
043FS	N38 53.726	W105 03.764	10180	Fill Slope
044RX	N38 53.726	W105 03.763	10183	Road Cross Section
045CS	N38 53.657	W105 03.868	10266	Cut Slope

Site ID	Latitude (hddd°mm.mmm)	Longitude (hddd°mm.mmm)	Altitude (ft)	Feature Description
046DD	N38 53.658	W105 03.868	10268	Drainage Ditch
047RX	N38 53.658	W105 03.868	10268	Road Cross Section
048FS	N38 53.651	W105 03.880	10275	Fill Slope
049CS	N38 53.592	W105 04.020	10406	Cut Slope
050RX	N38 53.593	W105 04.020	10404	Road Cross Section
051DD	N38 53.593	W105 04.021	10397	Drainage Ditch
052FS	N38 53.593	W105 04.021	10401	Fill Slope
053CC	N38 53.560	W105 04.127	10478	Conveyance Channel
054CC	N38 53.579	W105 04.148	10448	Conveyance Channel
055FS	N38 53.612	W105 04.095	10445	Fill Slope
056RX	N38 53.614	W105 04.096	10442	Road Cross Section
057DD	N38 53.613	W105 04.095	10445	Drainage Ditch
058CC	N38 53.513	W105 04.057	10512	Conveyance Channel
059CS	N38 53.353	W105 04.222	10697	Cut Slope
060RX	N38 53.354	W105 04.219	10691	Road Cross Section
061DD	N38 53.221	W105 04.381	10808	Drainage Ditch
062RX	N38 53.216	W105 04.381	10805	Road Cross Section
063CC	N38 53.223	W105 04.394	10803	Conveyance Channel
064CC	N38 53.448	W105 04.155	10634	Conveyance Channel
065CC	N38 53.382	W105 04.192	10679	Conveyance Channel
066CC	N38 53.336	W105 04.243	10701	Conveyance Channel
067CC	N38 53.297	W105 04.299	10736	Conveyance Channel
068CC	N38 53.251	W105 04.305	10841	Conveyance Channel
069CC	N38 53.019	W105 04.287	10989	Conveyance Channel
070CC	N38 52.956	W105 04.276	11028	Conveyance Channel
071DD	N38 52.972	W105 04.285	11017	Drainage Ditch
072RX	N38 52.972	W105 04.285	11015	Road Cross Section
073ST	N38 52.879	W105 04.311	11062	Sediment Trap
074FS	N38 52.927	W105 04.272	11053	Fill Slope
075RG	N38 53.797	W105 03.890	10109	Precipitation Gauge
076RG	N38 52.582	W105 03.970	11810	Precipitation Gauge
077RG	N38 51.783	W105 03.999	13069	Precipitation Gauge
078CS	N38 53.331	W105 04.275	10478	Cut Slope
079FS	N38 52.882	W105 04.382	11254	Fill Slope
080DD	N38 52.865	W105 04.391	11256	Drainage Ditch
081CC	N38 52.943	W105 04.415	11194	Conveyance Channel
082DD	N38 52.787	W105 04.376	11284	Drainage Ditch
083FS	N38 52.777	W105 04.362	11288	Fill Slope
084CC	N38 52.796	W105 04.471	11360	Conveyance Channel
085DD	N38 52.786	W105 04.410	11313	Drainage Ditch
086FS	N38 52.602	W105 04.390	11447	Fill Slope
087CS	N38 52.435	W105 04.432	11542	Cut Slope
088FS	N38 52.388	W105 04.549	11590	Fill Slope
089CC	N38 52.391	W105 04.555	11580	Conveyance Channel
090CS	N38 52.366	W105 04.540	11604	Cut Slope
091CC	N38 52.402	W105 04.414	11643	Conveyance Channel

Site ID	Latitude (hddd°mm.mmm)	Longitude (hddd°mm.mmm)	Altitude (ft)	Feature Description
092DD	N38 52.432	W105 04.204	11781	Drainage Ditch
093FS	N38 52.399	W105 04.401	11642	Fill Slope
094CC	N38 52.540	W105 04.069	11873	Conveyance Channel
095CC	N38 52.452	W105 04.205	11787	Conveyance Channel
096CC	N38 52.379	W105 04.217	11746	Conveyance Channel
097CC	N38 52.381	W105 04.310	11678	Conveyance Channel
098FS	N38 52.265	W105 03.995	12242	Fill Slope
099CC	N38 52.131	W105 04.046	12319	Conveyance Channel
100CC	N38 52.133	W105 03.936	12353	Conveyance Channel
101FS	N38 52.097	W105 03.875	12390	Fill Slope
102CS	N38 51.641	W105 04.063	12963	Cut Slope
103FS	N38 51.491	W105 04.021	12950	Fill Slope
104CC	N38 51.444	W105 03.894	12923	Conveyance Channel
105FS	N38 51.062	W105 03.694	13083	Fill Slope
106CC	N38 52.082	W105 03.858	12251	Conveyance Channel
107DD	N38 52.044	W105 03.824	12312	Drainage Ditch
108CC	N38 51.994	W105 03.769	12362	Conveyance Channel
109CC	N38 52.027	W105 03.825	12393	Conveyance Channel
110CC	N38 52.062	W105 03.914	12448	Conveyance Channel
111CC	N38 52.051	W105 03.992	12511	Conveyance Channel
112CC	N38 52.049	W105 03.933	12531	Conveyance Channel
113CC	N38 52.002	W105 03.873	12577	Conveyance Channel
114CC	N38 51.956	W105 03.840	12601	Conveyance Channel
115CC	N38 51.977	W105 03.995	12692	Conveyance Channel
116CC	N38 51.940	W105 04.080	12736	Conveyance Channel
117CC	N38 51.925	W105 04.141	12777	Conveyance Channel
118CC	N38 51.912	W105 04.177	12797	Conveyance Channel
119CC	N38 51.914	W105 04.032	12850	Conveyance Channel
120CC	N38 51.823	W105 04.090	12876	Conveyance Channel
121CC	N38 51.439	W105 03.804	12877	Conveyance Channel
122CC	N38 51.347	W105 03.789	12920	Conveyance Channel
123CS	N38 51.361	W105 03.782	12920	Cut Slope
124FS	N38 51.362	W105 03.788	12931	Fill Slope
125CC	N38 51.238	W105 03.806	12986	Conveyance Channel
126CC	N38 51.158	W105 03.789	13031	Conveyance Channel
127CC	N38 51.032	W105 03.697	13064	Conveyance Channel
128FS	N38 50.930	W105 03.732	13072	Fill Slope
129CC	N38 50.897	W105 03.662	13068	Conveyance Channel
130CC	N38 50.900	W105 03.177	13183	Conveyance Channel
131CC	N38 50.940	W105 03.382	13088	Conveyance Channel
132CC	N38 50.840	W105 03.274	13217	Conveyance Channel
133CC	N38 50.768	W105 03.213	13282	Conveyance Channel
134CC	N38 50.671	W105 03.035	13401	Conveyance Channel
135CC	N38 50.285	W105 02.872	13677	Conveyance Channel
136CC	N38 50.299	W105 02.931	13624	Conveyance Channel
137CC	N38 50.260	W105 02.755	13733	Conveyance Channel

Site ID	Latitude (hddd°mm.mmm)	Longitude (hddd°mm.mmm)	Altitude (ft)	Feature Description
138CC	N38 50.221	W105 02.605	13805	Conveyance Channel
139CC	N38 50.774	W105 03.110	13370	Conveyance Channel
140CC	N38 50.730	W105 03.195	13327	Conveyance Channel
141CS	N38 51.043	W105 03.690	13103	Cut Slope
152RW	N38 54.912	W105 02.837	9444	Rock Weir/Apron
153RW	N38 54.741	W105 03.066	9457	Rock Weir/Apron
154RX	N38 52.040	W105 03.817	12112	Road Cross Section
155DD	N38 51.245	W105 03.803	12917	Drainage Ditch
156RX	N38 51.244	W105 03.799	12922	Road Cross Section
157DD	N38 51.074	W105 03.684	13100	Drainage Ditch
158RX	N38 51.074	W105 03.683	13099	Road Cross Section
159DD	N38 51.610	W105 04.072	13091	Drainage Ditch
160RX	N38 51.611	W105 04.072	13066	Road Cross Section
161RW	N38 54.720	W105 03.055	9516	Rock Weir/Apron
162RW	N38 54.887	W105 02.854	9518	Rock Weir/Apron
163RA	N38 54.665	W105 03.115	9528	Rock Weir/Apron
175CC	N38 55.104	W105 02.532	9437	Conveyance Channel
176RW	N38 54.146	W105 03.795	9838	Rock Weir
177FS	N38 55.302	W105 02.224	9323	Fill Slope
178RW	N38 54.142	W105 03.821	9839	Rock Weir
179RW	N38 54.127	W105 03.852	9851	Rock Weir
180RW	N38 54.055	W105 03.903	9906	Rock Weir
181RW	N38 54.025	W105 03.918	9919	Rock Weir
182DD	N38 54.895	W105 02.860	9430	Drainage Ditch
183FS	N38 54.675	W105 03.109	9453	Fill Slope
184CC	N38 54.708	W105 03.363	9308	Conveyance Channel
185CS	N38 54.536	W105 03.246	9532	Cut Slope
186FS	N38 54.524	W105 03.242	9538	Fill Slope
187FS	N38 54.281	W105 03.658	9711	Fill Slope
188DD	N38 54.075	W105 03.892	9894	Drainage Ditch
189CC	N38 54.073	W105 03.886	9887	Conveyance Channel
190CC	N38 54.095	W105 03.869	9871	Conveyance Channel
191CC	N38 54.117	W105 03.854	9855	Conveyance Channel
192CS	N38 54.183	W105 03.677	9786	Cut Slope
193FS	N38 54.821	W105 02.983	9507	Fill Slope
194FS	N38 54.811	W105 03.004	9506	Fill Slope
195DD	N38 54.827	W105 02.983	9505	Drainage Ditch
196FS	N38 54.872	W105 02.900	9497	Fill Slope
197CS	N38 54.364	W105 03.383	9640	Cut Slope
198FS	N38 54.497	W105 03.254	9560	Fill Slope
199RW	N38 54.688	W105 03.389	9326	Sediment Pond
200RW	N38 55.261	W105 02.246	9418	Rock Weir
201RW	N38 54.805	W105 03.021	9522	Rock Weir
202RW	N38 54.619	W105 03.132	9450	Rock Weir
203FS	N38 54.603	W105 03.139	9517	Fill Slope
204FS	N38 54.273	W105 03.572	9707	Fill Slope

Site ID	Latitude (hddd°mm.mmm)	Longitude (hddd°mm.mmm)	Altitude (ft)	Feature Description
205DD	N38 54.022	W105 03.927	9983	Drainage Ditch
206CC	N38 54.689	W105 03.097	9506	Conveyance Channel
207CC	N38 51.664	W105 04.062	12962	Conveyance Channel
208CC	N38 52.754	W105 04.445	11172	Conveyance Channel
209CC	N38 52.647	W105 04.411	11365	Conveyance Channel
210CC	N38 54.059	W105 03.916	9849	Conveyance Channel
211CC	N38 54.130	W105 03.844	9853	Conveyance Channel
212CC	N38 53.149	W105 04.311	10893	Conveyance Channel
213CC	N38 50.964	W105 03.391	13046	Conveyance Channel
214CC	N38 50.234	W105 02.661	13198	Conveyance Channel
215CC	N38 50.356	W105 02.792	13375	Conveyance Channel
216CC	N38 55.263	W105 02.236	9289	Conveyance Channel
217CC	N38 55.255	W105 02.232	9284	Conveyance Channel
218CC	N38 55.226	W105 02.268	9359	Conveyance Channel
219CC	N38 55.202	W105 02.262	9371	Conveyance Channel
220CC	N38 55.108	W105 02.482	9411	Conveyance Channel
221CC	N38 55.107	W105 02.482	9305	Conveyance Channel
222CC	N38 55.070	W105 02.554	9319	Conveyance Channel
223CC	N38 55.048	W105 02.657	9394	Conveyance Channel
224CC	N38 54.878	W105 02.852	9493	Conveyance Channel
225CC	N38 54.917	W105 02.840	9441	Conveyance Channel
226CC	N38 54.796	W105 03.010	9431	Conveyance Channel
227CC	N38 54.706	W105 03.053	9480	Conveyance Channel
228CC	N38 54.746	W105 03.078	9431	Conveyance Channel
229CC	N38 54.140	W105 03.788	9774	Conveyance Channel
230CC	N38 54.028	W105 03.912	9902	Conveyance Channel
231CC	N38 54.050	W105 03.908	9910	Conveyance Channel
232CC	N38 52.583	W105 04.557	11399	Conveyance Channel
233RW	N38 52.383	W105 04.560	11074	Rock Weir
234RW	N38 52.502	W105 03.924	11915	Rock Weir
235CC	N38 52.504	W105 03.920	11928	Conveyance Channel
236RW	N38 52.185	W105 04.066	12177	Rock Weir
237RW	N38 52.398	W105 04.393	11219	Sediment Pond
238RW	N38 52.131	W105 04.048	12340	Rock Weir
239RW	N38 52.008	W105 03.774	12517	Rock Weir
240RW	N38 52.048	W105 03.990	12644	Rock Weir
241RW	N38 51.976	W105 03.834	12686	Rock Weir
242RW	N38 51.903	W105 04.176	12851	Rock Weir
243RW	N38 51.919	W105 04.043	12900	Rock Weir
244CC	N38 54.487	W105 03.232	9569	Conveyance Channel
245CC	N38 54.872	W105 02.900	9497	Conveyance Channel
BHMR1	N38 48.951	W105 03.040	11885	Boehmer Creek 1
BHMR2	N38 49.061	W105 03.027	11995	Boehmer Creek 2
EBVR1	N38 49.832	W105 03.612	12156	East Fork Beaver Creek 1
EBVR2	N38 49.907	W105 03.598	12190	East Fork Beaver Creek 2
GLEN1	N38 54.457	W105 04.690	9519	Glen Cove Creek 1



Site ID	Latitude (hddd°mm.mmm)	Longitude (hddd°mm.mmm)	Altitude (ft)	Feature Description
NCAT1	N38 54.746	W105 05.994	9415	North Catamount Creek 1
NCAT2	N38 54.402	W105 06.106	9519	North Catamount Creek 2
NCRY1 <sup>∞</sup>	N38 54.418	W105 03.199	9453	North Fork Crystal Creek 1 & 2
OILC1	N38 48.449	W105 06.511	10505	Oil Creek 1
SCAT1	N38 55.035	W105 04.112	9368	South Catamount Creek 1
SCAT2	N38 54.974	W105 04.181	9345	South Catamount Creek 2
SCAT3	N38 54.316	W105 04.899	9412	South Catamount Creek 3
SKIC1	N38 54.975	W105 04.078	9418	Ski Creek 1
SKIC2	N38 53.767	W105 03.987	10035	Ski Creek 2
SVRY1	N38 52.467	W105 03.039	10732	Severy Creek 1
SVRY2	N38 52.472	W105 03.339	10926	Severy Creek 2
WBVR1	N38 48.181	W105 05.710	10726	West Fork Beaver Creek 1
WBVR2	N38 48.349	W105 05.591	10698	West Fork Beaver Creek 2
† Not all sites were sampled during the 2010 field season. <sup>∞</sup> North Fork Crystal Creek Reach 2 (NCRY2) is located 200 ft upstream from NCRY1.				



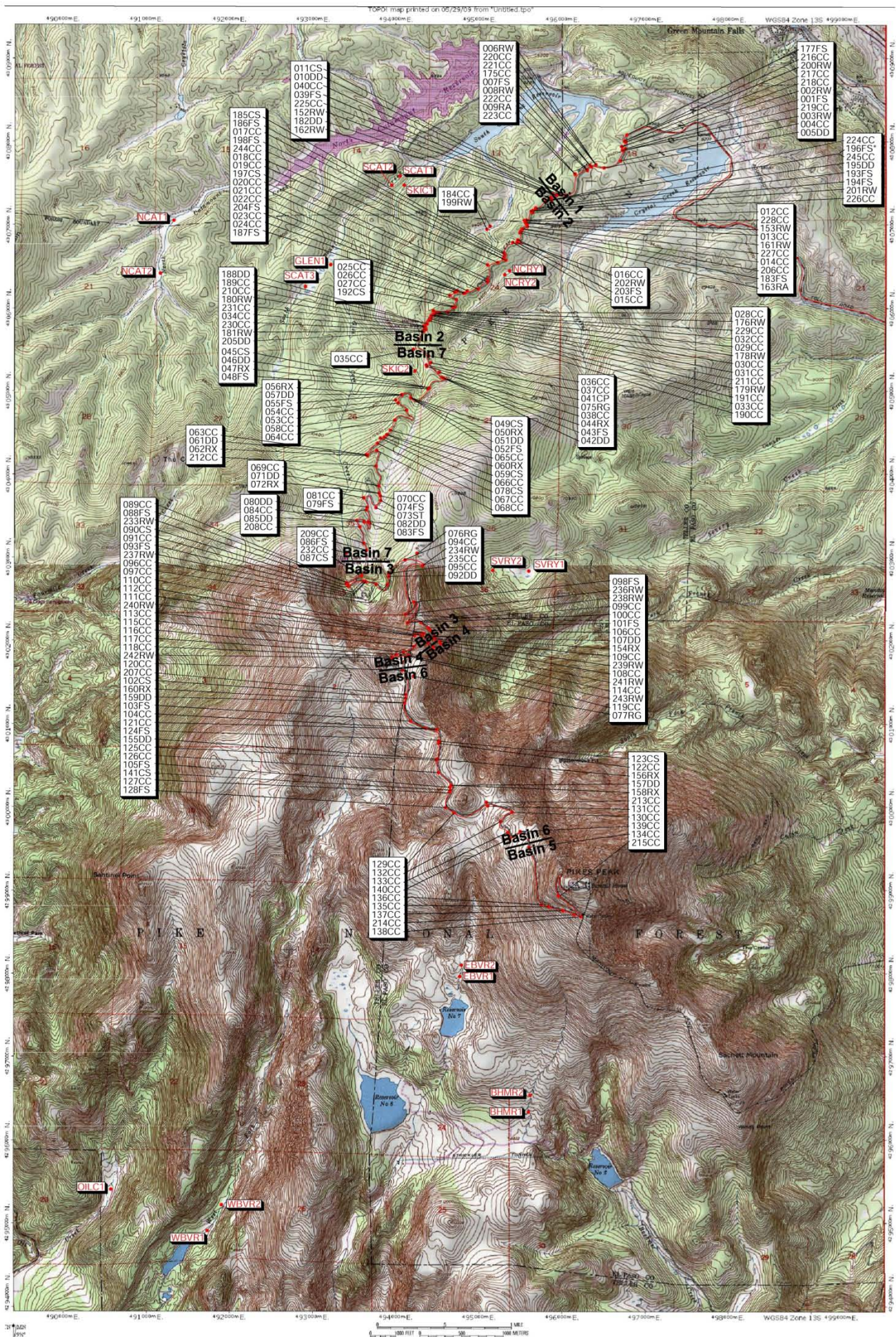
# Appendix B

## USGS Topographic Map

### Site Locations for Effectiveness and Validation Monitoring

2010







# Appendix C

## Daily Precipitation and Incremental Precipitation

2010

### Daily Precipitation for Electronic Rain Gauges on Pikes Peak, 2010

Date	075RG (Altitude 10,109') Precipitation (in)	076RG (Altitude 11,810') Precipitation (in)	077RG † (Altitude 13,069') Precipitation (in)
5/7/2010	0	0	0
5/8/2010	0	0	0
5/9/2010	0	0	0
5/10/2010	0	0	0
5/11/2010	0.01	0	0
5/12/2010	0.11	0.13	0.02
5/13/2010	0.11	0.07	0.01
5/14/2010	0	0.13	0
5/15/2010	0.2	0.18	0.01
5/16/2010	0.01	0.01	0.01
5/17/2010	0	0.02	0
5/18/2010	0	0	0
5/19/2010	0	0.01	0
5/20/2010	0	0	0
5/21/2010	0	0	0
5/22/2010	0	0	0
5/23/2010	0	0	0
5/24/2010	0	0	0
5/25/2010	0	0	0
5/26/2010	0	0	0
5/27/2010	0	0	0
5/28/2010	0	0	0
5/29/2010	0	0	0
5/30/2010	0	0	0
5/31/2010	0	0	0
6/1/2010	0	0	0
6/2/2010	0	0	0
6/3/2010	0.01	0	0
6/4/2010	0	0	0
6/5/2010	0.06	0.09	0.02
6/6/2010	0.06	0.01	0.01
6/7/2010	0	0	0
6/8/2010	0	0	0
6/9/2010	0	0	0
6/10/2010	0	0	0.01
6/11/2010	0	0	0.01
6/12/2010	0.24	0.1	0.03
6/13/2010	0.38	0.25	0.06
6/14/2010	0	0.02	0
6/15/2010	0.14	0.19	0.03
6/16/2010	0	0	0
6/17/2010	0	0	0
6/18/2010	0	0	0
6/19/2010	0	0	0

<b>Date</b>	<b>075RG (Altitude 10,109') Precipitation (in)</b>	<b>076RG (Altitude 11,810') Precipitation (in)</b>	<b>077RG † (Altitude 13,069') Precipitation (in)</b>
6/20/2010	0	0	0
6/21/2010	0	0	0
6/22/2010	0	0	0
6/23/2010	0	0	0
6/24/2010	0	0	0
6/25/2010	0	0.06	0.08
6/26/2010	0	0.06	0.08
6/27/2010	0	0.03	0.04
6/28/2010	0	0.03	0.04
6/29/2010	0	0.01	0.01
6/30/2010	0	0	0
7/1/2010	0.05	0.05	0
7/2/2010	0.06	0.08	0.04
7/3/2010	0	0.02	0
7/4/2010	1.27	0.38	0.02
7/5/2010	0.16	0.14	0.04
7/6/2010	0	0	0
7/7/2010	0.15	0.28	1.3
7/8/2010	0.01	0	0.01
7/9/2010	0.93	1.14	1.05
7/10/2010	0	0.01	0.05
7/11/2010	0.23	0.39	0.31
7/12/2010	0.03	0.02	0.03
7/13/2010	0	0	0
7/14/2010	0	0	0
7/15/2010	0	0	0
7/16/2010	0	0	0
7/17/2010	0.01	0.06	0.01
7/18/2010	0.04	0.04	0.01
7/19/2010	0.04	0.03	0
7/20/2010	0	0.02	0
7/21/2010	0.68	0.01	0.68
7/22/2010	0.09	0.28	0.10
7/23/2010	0	0.01	0
7/24/2010	0.01	0.04	0
7/25/2010	0	0	0
7/26/2010	0	0	0
7/27/2010	0	0	0
7/28/2010	0.02	0.15	N/A
7/29/2010	0.04	0.41	N/A
7/30/2010	0.38	0.41	N/A
7/31/2010	0.07	0.66	N/A
8/1/2010	0.12	0.19	N/A
8/2/2010	0.03	0.05	N/A
8/3/2010	1.4	1.34	N/A
8/4/2010	1.19	1.15	N/A

<b>Date</b>	<b>075RG (Altitude 10,109') Precipitation (in)</b>	<b>076RG (Altitude 11,810') Precipitation (in)</b>	<b>077RG † (Altitude 13,069') Precipitation (in)</b>
8/5/2010	0.62	0.57	N/A
8/6/2010	0.07	0.08	N/A
8/7/2010	0	0	N/A
8/8/2010	0.29	0.29	N/A
8/9/2010	0.03	0.01	N/A
8/10/2010	0.27	0.35	N/A
8/11/2010	0	0	N/A
8/12/2010	0.15	0.14	N/A
8/13/2010	0	0	N/A
8/14/2010	0	0	N/A
8/15/2010	0	0	N/A
8/16/2010	0.03	0.05	N/A
8/17/2010	0	0	N/A
8/18/2010	0	0	N/A
8/19/2010	0.05	0.04	N/A
8/20/2010	0	0.01	N/A
8/21/2010	0	0	N/A
8/22/2010	0	0	N/A
8/23/2010	0	0	N/A
8/24/2010	0.43	0.53	N/A
8/25/2010	0	0	N/A
8/26/2010	0	0	N/A
8/27/2010	0	0	N/A
8/28/2010	0	0	N/A
8/29/2010	0	0	N/A
8/30/2010	0	0	N/A
8/31/2010	0	0	N/A
9/1/2010	0	0	N/A
9/2/2010	0	0	N/A
9/3/2010	0	0	N/A
9/4/2010	0	0	N/A
9/5/2010	0	0	N/A
9/6/2010	0	0	N/A
9/7/2010	0.03	0.02	N/A
9/8/2010	0	0	N/A
9/9/2010	0	0	N/A
9/10/2010	0	0	N/A
9/11/2010	0	0	N/A
9/12/2010	0	0	N/A
9/13/2010	0	0	N/A
9/14/2010	0	0	N/A
9/15/2010	0	0	N/A
9/16/2010	0	0	N/A
9/17/2010	0	0	N/A
9/18/2010	0	0	N/A
9/19/2010	0	0	N/A



<b>Date</b>	<b>075RG (Altitude 10,109') Precipitation (in)</b>	<b>076RG (Altitude 11,810') Precipitation (in)</b>	<b>077RG † (Altitude 13,069') Precipitation (in)</b>
9/20/2010	0	0	N/A
9/21/2010	0	0	N/A
9/22/2010	0.26	0.43	N/A
9/23/2010	0	0.02	N/A
9/24/2010	0	0	N/A
9/25/2010	0	0	N/A
9/26/2010	0	0	N/A
9/27/2010	0	0	N/A
9/28/2010	0	0	N/A
9/29/2010	0	0	N/A
9/30/2010	0	0	N/A
<b>Total</b>	<b>10.57</b>	<b>11.30</b>	<b>N/A</b>
<i>† No usable data collected for August and September due to equipment malfunction.</i>			

### Incremental Precipitation for Standard Rain Gauges on Pikes Peak, 2010

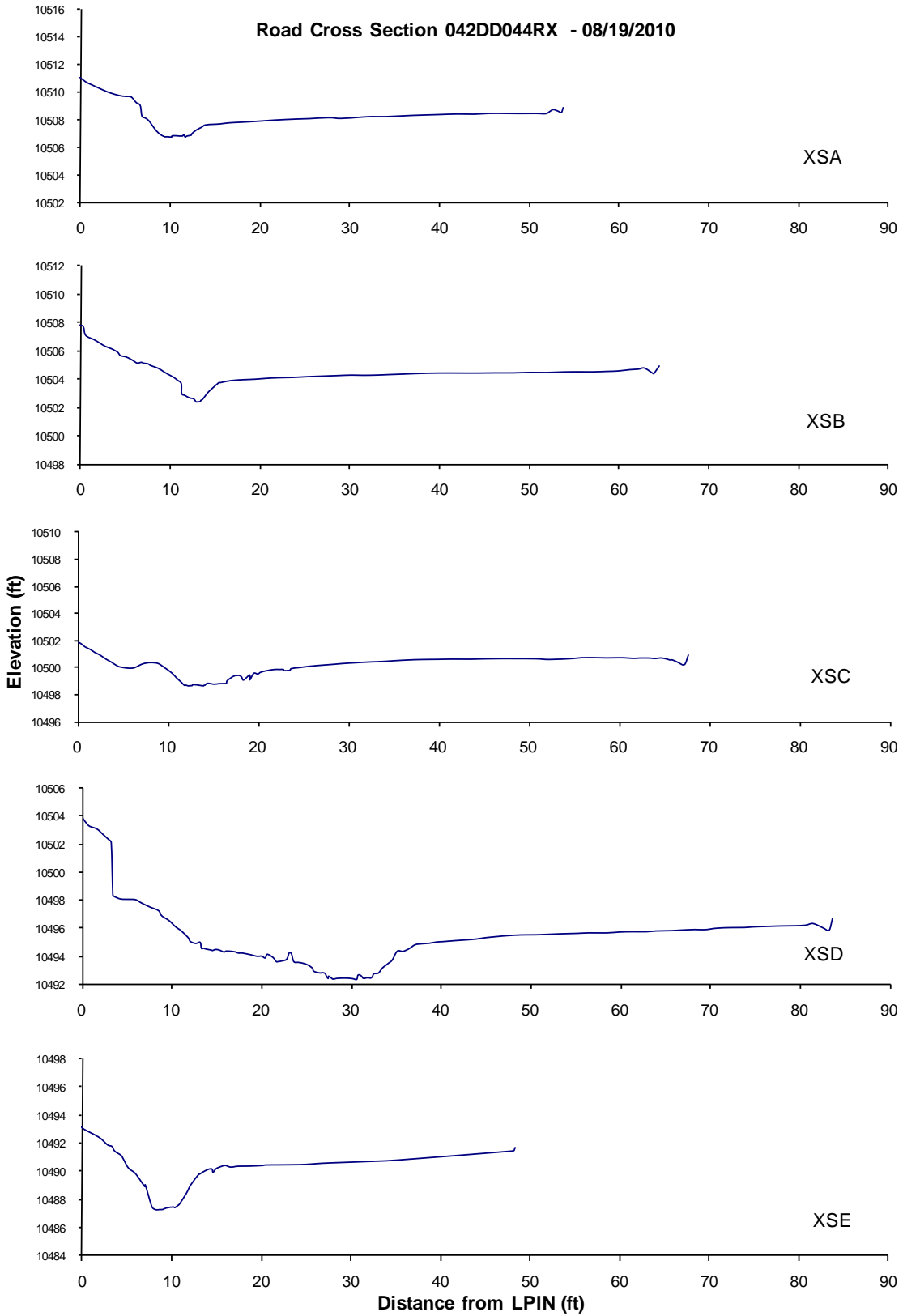
Date	075RG (Altitude 10,109') Precipitation (in)	076RG (Altitude 11,810') Precipitation (in)	077RG (Altitude 13,069') Precipitation (in)
5/17/10	0.44	0.47	0.12
5/24/10	0.09	0.02	0.02
6/2/10	0.00	0.00	0.00
6/7/10	0.15	0.13	0.07
6/14/10	0.65	0.43	0.12
6/21/10	0.16	0.20	0.04
6/29/10	0.17	0.20	0.28
7/6/10	1.66	0.69	0.27
7/8/10	0.20	0.31	1.34
7/12/10	1.24	1.58	1.49
7/20/10	0.12	0.14	0.07
7/27/10	0.84	0.98	0.83
8/2/10	0.69	1.86	2.47
8/9/10	3.63	3.57	2.81
8/17/10	0.50	0.57	0.51
8/23/10	0.05	0.05	0.03
8/30/10	0.43	0.56	0.54
9/8/10	0.04	0.03	0.01
9/13/10	0.00	0.00	0.00
9/21/10	0.00	0.00	0.00
9/30/10	0.31	0.43	0.28
<b>Total</b>	<b>11.37</b>	<b>12.22</b>	<b>11.30</b>

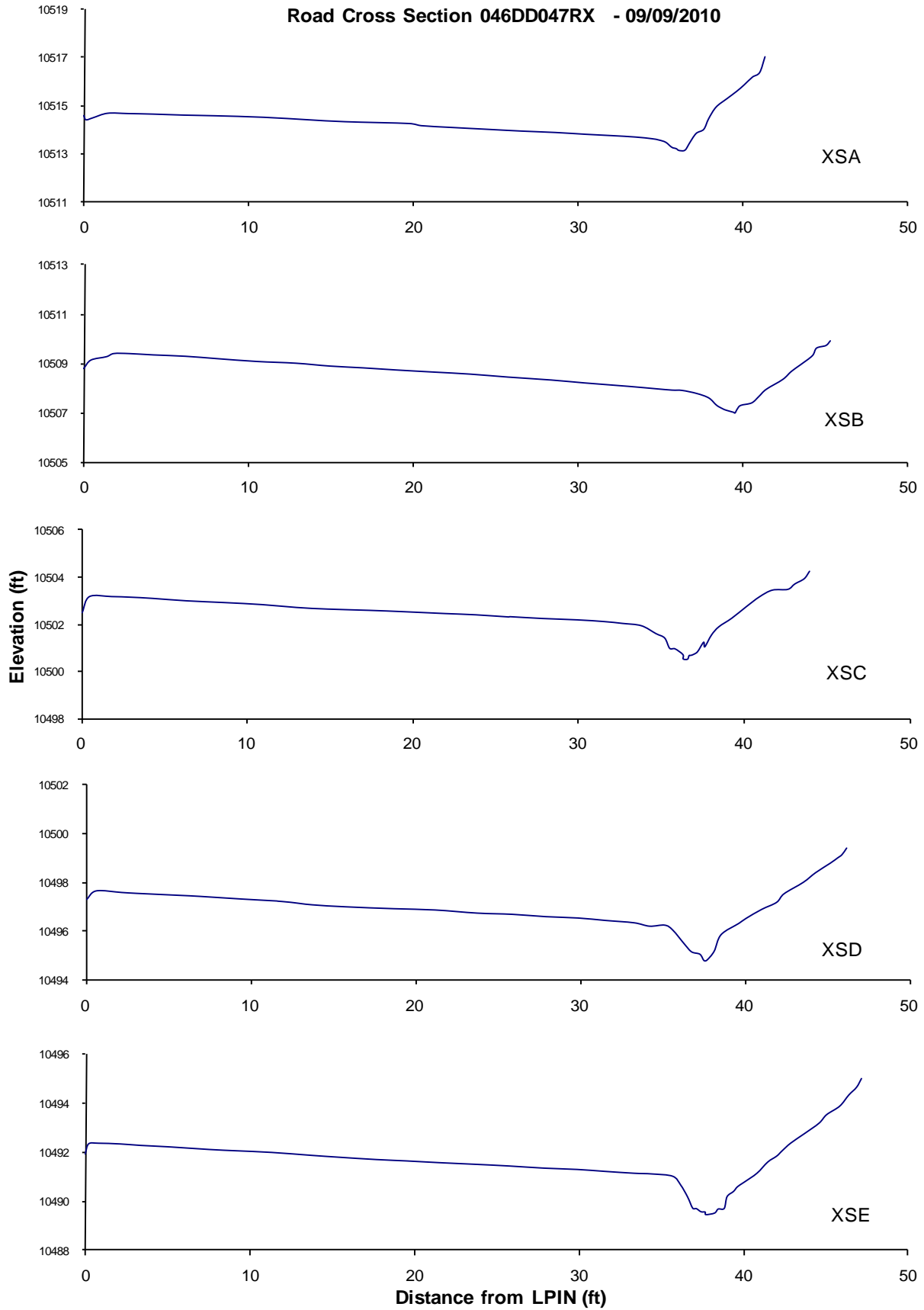
# Appendix D

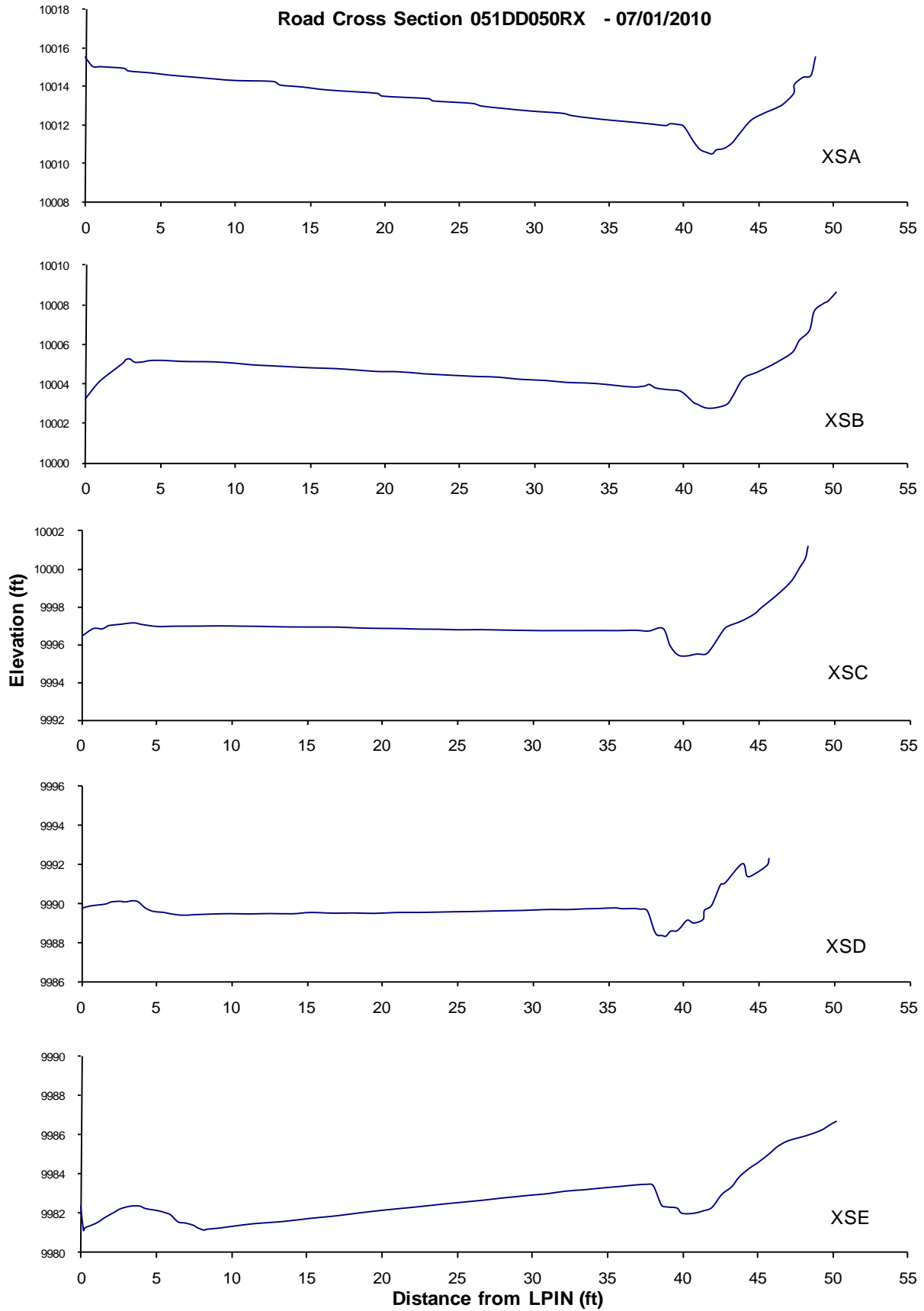
## Road Reach

### Cross Section Graphs

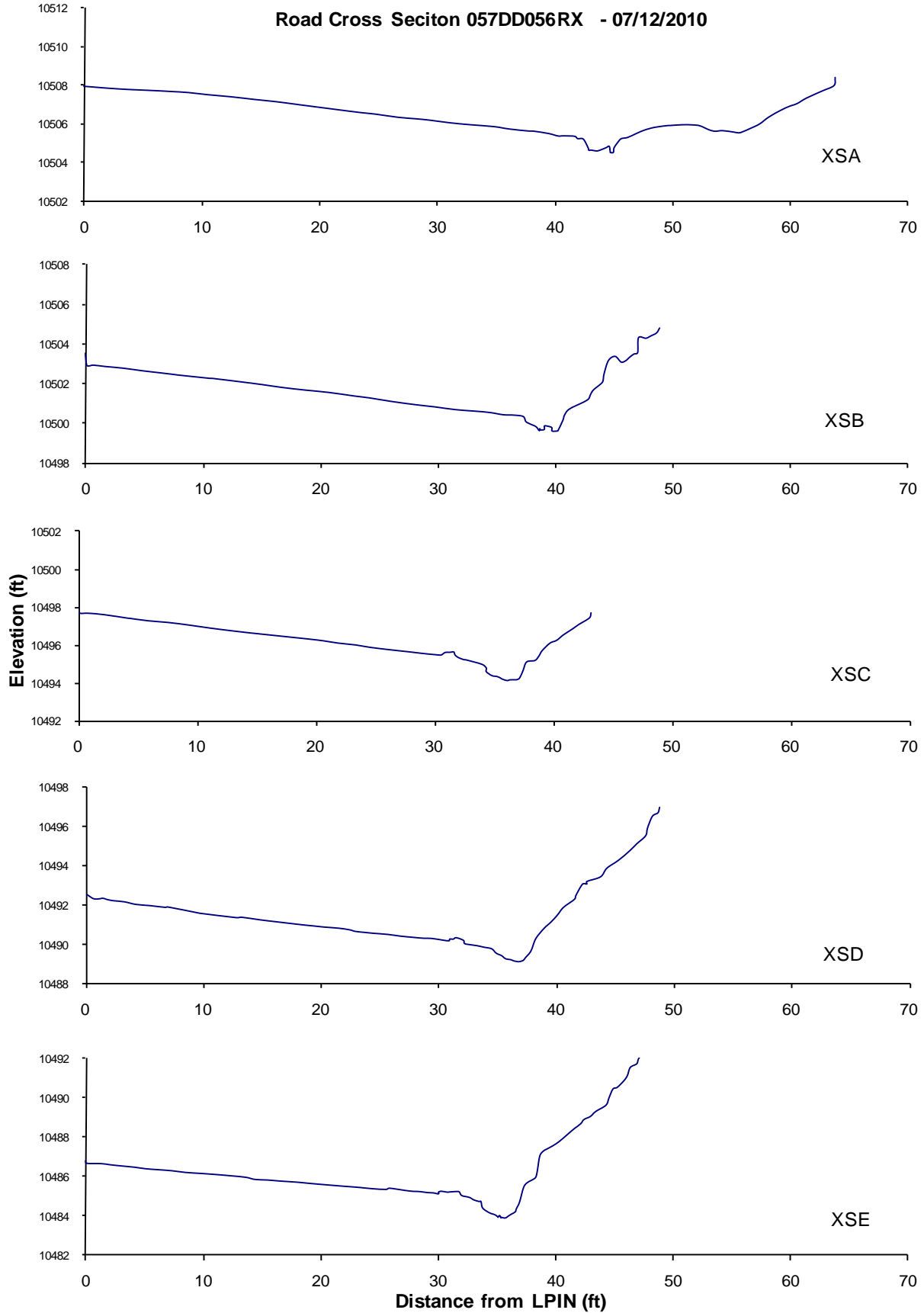
2010

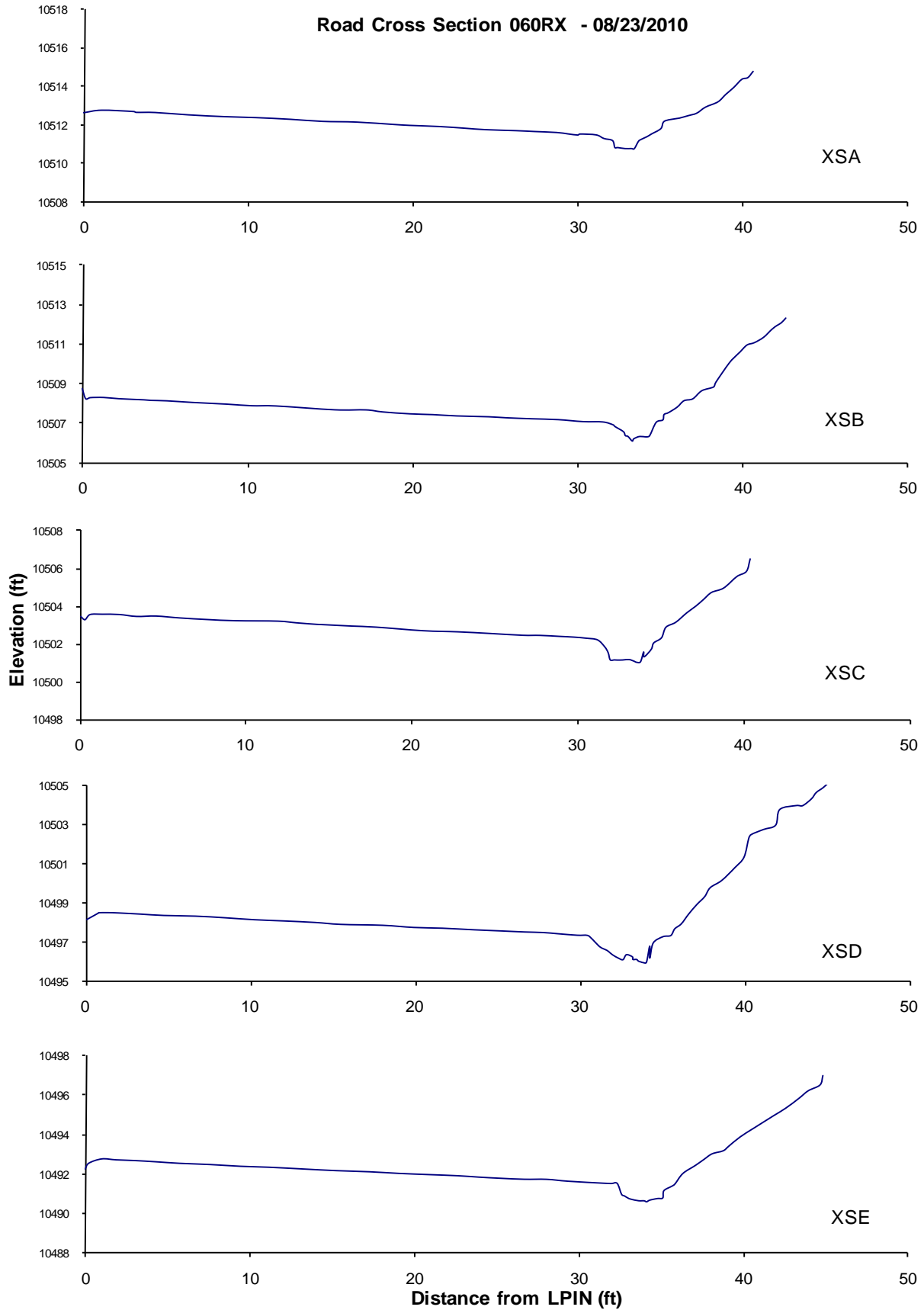




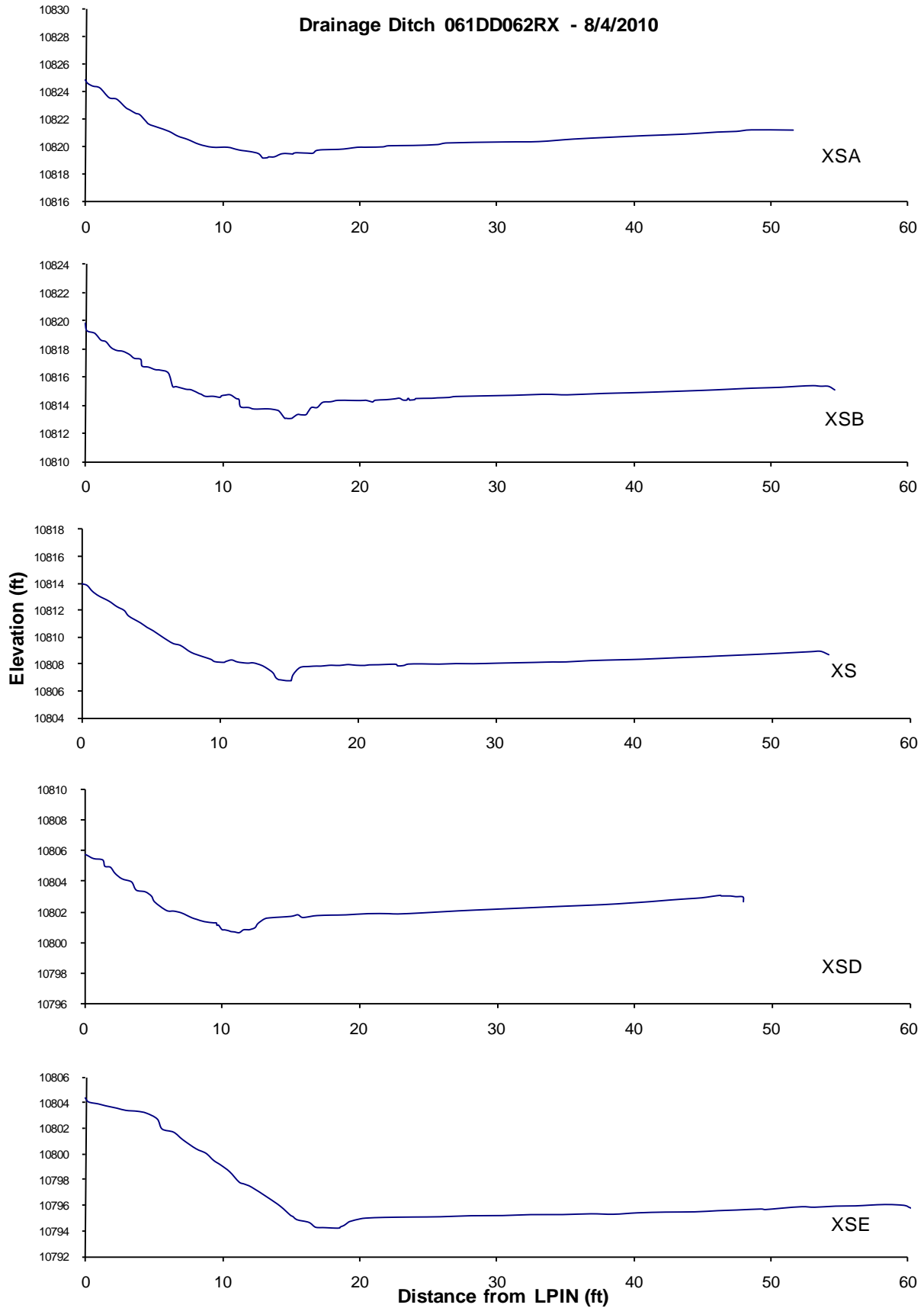


Road Cross Section 057DD056RX - 07/12/2010

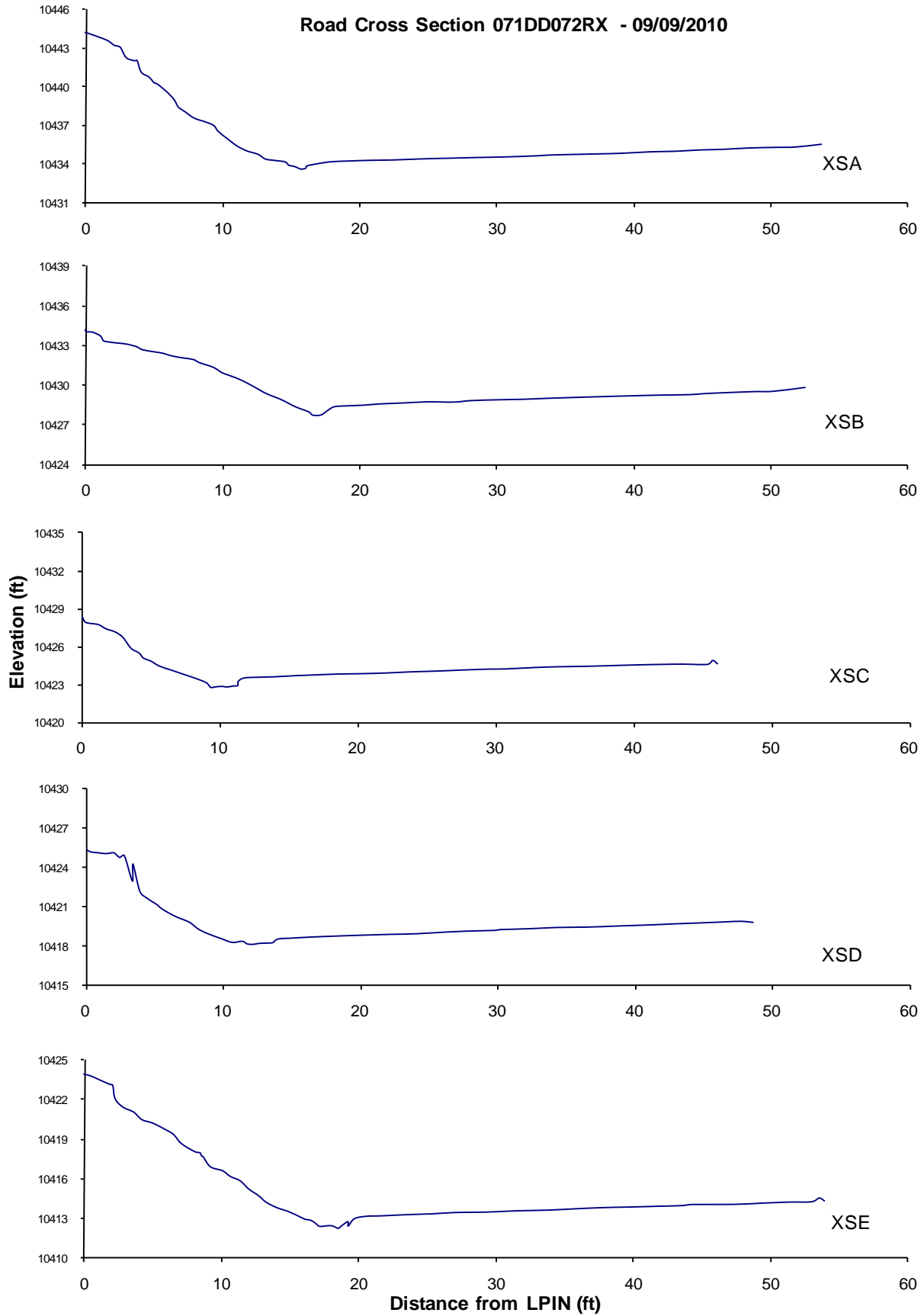








Road Cross Section 071DD072RX - 09/09/2010



# Appendix E

## Cut Slope

### Site Visit Dates and Sediment Accumulation

2010

**Site Visit Dates of Cut Slope Silt Fences on Pikes Peak, 2010**

Site ID	Cut Slope Site Visit Dates 2010																
	5/7	5/10	5/17	5/24	6/7	6/21	7/6	7/9	7/16	7/26	7/27	8/9	8/11	8/12	9/8	9/13	10/4
011CS	X	X	X	X	X	X	X	X	X	X		X			X		X
045CS	X		X	X	X	X	X		X	X		X			X		X
049CS	X		X	X	X	X	X		X	X			X		X		X
059CS	X		X	X	X	X	X		X	X		X			X		X
078CS	X		X	X	X	X	X		X	X		X			X		X
087CS	X		X	X	X	X	X		X	X		X			X		X
090CS	X		X	X	X	X	X		X	X		X			X		X
102CS	X		X	X	X	X	X	X	X	X		†			X	X	X
123CS	X		X	X	X	X	X	X	X	X		†			X	X	X
141CS	X		X	X	X	X	X		X	X		†			X	X	X
185CS	X		X	X	X	X	X		X		X			X	X		X
192CS	X		X	X	X	X	X		X	X				X	X		X
197CS	X		X	X	X	X	X		X	X		X			X		X

† Unable to access site due to paving.

## Sediment Accumulation in Cut Slope Silt Fences on Pikes Peak, 2010

Site ID	Location	Date	Volume (ft <sup>3</sup> )	Grab Sample
185CS	Lower Fence	5/7/10	0.13	Yes
185CS	Upper Fence	5/7/10	0.13	Yes
192CS	Lower Fence	5/7/10	0.94	Yes
192CS	Upper Fence	5/7/10	0.53	Yes
197CS	Lower Fence	5/7/10	0.27	Yes
011CS	Lower Fence	5/10/10	0.40	Yes
045CS	Lower Fence	5/17/10	0.27	Yes
049CS	Lower Fence	5/17/10	0.33	Yes
049CS	Upper Fence	5/17/10	0.13	Yes
197CS	Lower Fence	5/24/10	0.27	Yes
087CS	Lower Fence	6/7/10	0.40	Yes
087CS	Upper Fence	6/7/10	0.07	Yes
090CS	Lower Fence	6/21/10	0.07	Yes
123CS	Upper Fence	6/21/10	0.13	Yes
141CS	Upper Fence	6/21/10	0.20	Yes
192CS	Lower Fence	6/21/10	0.40	Yes
045CS	Lower Fence	7/6/10	0.33	Yes
078CS	Lower Fence	7/6/10	0.13	Yes
011CS	Lower Fence	7/9/10	0.40	Yes
045CS	Lower Fence	7/26/10	0.27	Yes
059CS	Lower Fence	7/26/10	0.87	Yes
078CS	Lower Fence	7/26/10	0.33	Yes
185CS	Lower Fence	7/27/10	0.33	Yes
185CS	Upper Fence	7/27/10	0.07	Yes
078CS	Lower Fence	8/9/10	0.74	Yes
087CS	Lower Fence	8/9/10	1.47	Yes
049CS	Lower Fence	8/11/10	2.47	Yes
049CS	Upper Fence	8/11/10	0.13	Yes
185CS	Lower Fence	8/12/10	0.53	Yes
192CS	Lower Fence	8/12/10	7.35	Yes
192CS	Upper Fence	8/12/10	0.07	Yes
011CS	Lower Fence	9/8/10	2.47	Yes
059CS	Lower Fence	9/8/10	0.87	Yes
197CS	Lower Fence	9/8/10	3.88	Yes
102CS	Upper Fence	9/13/10	0.07	Yes
123CS	Upper Fence	9/13/10	0.20	Yes
141CS	Upper Fence	9/13/10	0.87	Yes



# Appendix F

## Fill Slope Site Visit Dates and Sediment Accumulation

2010

### Site Visit Dates of Fill Slope Silt Fences on Pikes Peak, 2010

Site ID	Fill Slope Site Visit Dates 2010																	
	5/7	5/10	5/17	5/18	5/24	6/7	6/21	7/6	7/16	7/18	7/26	7/27	7/28	8/9	8/11	8/12	9/8	10/4
001FS	X		X		X	X	X	X	X		X			X			X	X
007FS	X		X		X	X	X	X	X		X			X			X	X
039FS	X	X	X		X	X	X	X	X		X			X			X	X
043FS	X		X	X	X	X	X	X		X	X					X	X	X
048FS	X		X		X	X	X	X		X	X			X			X	X
052FS	X		X	X	X	X	X	X		X		X			X		X	X
055FS	X		X		X	X	X	X		X	X				X		X	X
074FS	X		X		X	X	X	X	X		X					X	X	X
079FS	X		X		X	X	X	X	X		X			X			X	X
083FS	X		X		X	X	X	X	X		X				X		X	X
086FS	X		X		X	X	X	X	X		X			X			X	X
088FS	X		X		X	X	X	X	X		X			X			X	X
093FS	X		X		X	X	X	X	X		X			X			X	X
098FS	X		X		X	X	X	X	X		X			X			X	X
101FS	X		X		X	X	X	X	X		X			X			X	X
103FS	X		X		X	X	X	X	X		X			†			X	X
105FS	X		X		X	X	X	X	X		X			†			X	X
124FS	X		X		X	X	X	X	X		X			†			X	X
128FS	X		X		X	X	X	X	X		X			†			X	X
177FS	X		X		X	X	X	X	X		X			X			X	X
183FS	X		X		X	X	X	X	X		X			X			X	X
186FS	X	X	X		X	X	X	X	X		X					X	X	X
187FS	X		X		X	X	X	X	X		X		X	X			X	X
193FS	X	X	X		X	X	X	X	X		X			X			X	X
194FS	X	X	X		X	X	X	X	X		X			X			X	X
198FS	X		X	X	X	X	X	X	X		X					X	X	X
203FS	X		X		X	X	X	X	X		X					X	X	X
204FS	X		X		X	X	X	X	X		X		X			X	X	X

† Unable to access site due to paving.



**Sediment Accumulation in Fill Slope Silt Fences on Pikes Peak, 2010**

<b>Site ID</b>	<b>Location</b>	<b>Date</b>	<b>Volume (ft<sup>3</sup>)</b>	<b>Grab Sample</b>
001FS	Upper Fence	5/7/10	0.20	Yes
001FS	Lower Fence	5/7/10	0.13	Yes
177FS	Upper Fence	5/7/10	0.47	Yes
198FS	Upper Fence	5/7/10	0.13	Yes
203FS	Upper Fence	5/7/10	0.47	Yes
204FS	Upper Fence	5/7/10	0.80	Yes
204FS	Lower Fence	5/7/10	0.07	Yes
186FS	Lower Fence	5/10/10	0.27	Yes
193FS	Upper Fence	5/10/10	0.33	Yes
194FS	Upper Fence	5/10/10	0.13	Yes
001FS	Upper Fence	5/17/10	0.07	Yes
187FS	Upper Fence	5/17/10	0.20	Yes
043FS	Upper Fence	5/18/10	4.75	Yes
043FS	Lower Fence	5/18/10	0.13	Yes
052FS	Upper Fence	5/18/10	5.35	Yes
052FS	Lower Fence	5/18/10	0.13	Yes
055FS	Upper Fence	5/24/10	1.00	Yes
043FS	Upper Fence	6/7/10	0.33	Yes
074FS	Upper Fence	6/7/10	2.14	Yes
079FS	Upper Fence	6/7/10	2.41	Yes
083FS	Upper Fence	6/7/10	1.14	Yes
083FS	Lower Fence	6/7/10	0.07	Yes
086FS	Upper Fence	6/7/10	2.41	Yes
088FS	Lower Fence	6/7/10	0.13	Yes
048FS	Upper Fence	6/21/10	6.95	Yes
048FS	Lower Fence	6/21/10	0.53	Yes
052FS	Upper Fence	6/21/10	0.54	Yes
055FS	Upper Fence	6/21/10	0.61	Yes
093FS	Upper Fence	6/21/10	0.33	Yes
098FS	Upper Fence	6/21/10	3.14	Yes
101FS	Upper Fence	6/21/10	4.68	Yes
101FS	Lower Fence	6/21/10	0.80	Yes
105FS	Upper Fence	6/21/10	6.42	Yes
124FS	Upper Fence	6/21/10	2.01	Yes
124FS	Lower Fence	6/21/10	0.20	Yes
128FS	Upper Fence	6/21/10	0.27	Yes
001FS	Upper Fence	7/6/10	0.74	Yes
048FS	Upper Fence	7/6/10	0.27	Yes

Site ID	Location	Date	Volume (ft <sup>3</sup> )	Grab Sample
074FS	Upper Fence	7/6/10	0.27	Yes
083FS	Upper Fence	7/6/10	0.40	Yes
093FS	Upper Fence	7/6/10	0.60	Yes
074FS	Upper Fence	7/16/10	4.28	Yes
079FS	Upper Fence	7/16/10	4.41	Yes
086FS	Upper Fence	7/16/10	0.67	Yes
043FS	Upper Fence	7/18/10	15.37	Yes
048FS	Upper Fence	7/18/10	5.61	Yes
052FS	Upper Fence	7/18/10	1.20	Yes
055FS	Upper Fence	7/18/10	5.48	Yes
043FS	Upper Fence	7/26/10	2.94	Yes
048FS	Upper Fence	7/26/10	2.54	Yes
048FS	Lower Fence	7/26/10	0.20	Yes
074FS	Upper Fence	7/26/10	5.08	Yes
074FS	Lower Fence	7/26/10	0.67	Yes
079FS	Upper Fence	7/26/10	4.41	Yes
083FS	Upper Fence	7/26/10	7.29	Yes
083FS	Lower Fence	7/26/10	0.13	Yes
086FS	Upper Fence	7/26/10	2.81	Yes
183FS	Upper Fence	7/26/10	0.27	Yes
193FS	Upper Fence	7/26/10	0.40	Yes
203FS	Upper Fence	7/26/10	0.74	Yes
204FS	Upper Fence	7/26/10	0.27	Yes
001FS	Upper Fence	7/27/10	0.33	Yes
052FS	Upper Fence	7/27/10	2.01	Yes
177FS	Upper Fence	7/27/10	0.27	Yes
048FS	Upper Fence	8/9/10	8.89	Yes
048FS	Lower Fence	8/9/10	0.53	Yes
086FS	Upper Fence	8/9/10	15.24	No
086FS	Lower Fence	8/9/10	2.14	Yes
088FS	Lower Fence	8/9/10	3.74	No
093FS	Upper Fence	8/9/10	4.21	Yes
093FS	Lower Fence	8/9/10	0.07	Yes
098FS	Upper Fence	8/9/10	0.80	Yes
101FS	Lower Fence	8/9/10	0.33	Yes
052FS	Upper Fence	8/11/10	9.76	Yes
052FS	Lower Fence	8/11/10	0.53	Yes
055FS	Upper Fence	8/11/10	16.84	Yes
083FS	Upper Fence	8/11/10	21.93	Yes

<b>Site ID</b>	<b>Location</b>	<b>Date</b>	<b>Volume (ft<sup>3</sup>)</b>	<b>Grab Sample</b>
083FS	Lower Fence	8/11/10	2.01	Yes
039FS	Upper Fence	8/12/10	4.41	Yes
043FS	Upper Fence	8/12/10	13.50	Yes
074FS	Upper Fence	8/12/10	16.04	Yes
074FS	Lower Fence	8/12/10	0.07	Yes
186FS	Upper Fence	8/12/10	7.49	Yes
186FS	Lower Fence	8/12/10	0.80	Yes
198FS	Upper Fence	8/12/10	1.07	Yes
198FS	Lower Fence	8/12/10	0.13	Yes
203FS	Upper Fence	8/12/10	3.21	Yes
204FS	Upper Fence	8/12/10	1.40	Yes
001FS	Upper Fence	9/8/10	1.87	Yes



# Appendix G

## Cut and Fill Slope

### Particle Size Distribution and Graphs

2010

**Summary of Cut Slope Particle Size Distribution from Sieve Analysis of Grab Samples on Pikes Peak, 2010**

			<b>Particle Size Distribution–Grab Samples 2010</b>					
<b>Site Name</b>	<b>ID</b>	<b>Date</b>	<b>D15</b>	<b>D35</b>	<b>D50</b>	<b>D84</b>	<b>D95</b>	<b>D100</b>
Pikes Peak Highway - Cut Slope	011CS Lower Fence	7/9/2010	1.404	4.078	6.226	12.462	15.832	20.0
Pikes Peak Highway - Cut Slope	049CS Lower Fence	5/17/2010	0.032	0.526	2.716	11.165	32.566	43.0
Pikes Peak Highway - Cut Slope	049CS Upper Fence	5/17/2010	0.025	0.307	0.930	2.394	3.930	16.0
Pikes Peak Highway - Cut Slope	078CS Lower Fence	7/26/2010	0.035	0.588	1.747	8.336	13.573	20.0
Pikes Peak Highway - Cut Slope	087CS Lower Fence	6/7/2010	0.666	2.723	5.917	28.617	37.151	41.0
Pikes Peak Highway - Cut Slope	087CS Upper Fence	6/7/2010	0.025	0.310	0.787	5.037	16.406	27.0
Pikes Peak Highway - Cut Slope	102CS Upper Fence	9/13/2010	0.108	0.868	1.370	4.080	7.376	14.0
Pikes Peak Highway - Cut Slope	141CS Upper Fence	9/13/2010	0.025	0.312	0.984	4.024	6.909	13.0
Pikes Peak Highway - Cut Slope	185CS Lower Fence	7/27/2010	0.779	2.999	5.184	10.203	15.847	17.0
Pikes Peak Highway - Cut Slope	185CS Upper Fence	7/27/2010	0.064	0.642	0.977	2.961	5.583	15.0
Pikes Peak Highway - Cut Slope	192CS Lower Fence	8/12/2010	1.073	1.610	2.433	7.308	10.814	17.0
Pikes Peak Highway - Cut Slope	192CS Upper Fence	8/12/2010	0.853	3.170	4.897	10.140	14.732	23.0

### Summary of Fill Slope Particle Size Distribution from Sieve Analysis of Grab Samples on Pikes Peak, 2010

			Particle Size Distribution–Grab Samples 2010					
Site Name	ID	Date	D15	D35	D50	D84	D95	D100
Pikes Peak Highway - Fill Slope	001FS Upper Fence	7/27/2010	0.088	0.830	1.399	4.004	6.676	15.0
Pikes Peak Highway - Fill Slope	039FS Upper Fence	8/12/2010	0.504	1.203	1.901	5.064	8.313	14.0
Pikes Peak Highway - Fill Slope	048FS Lower Fence	8/9/2010	0.038	0.566	1.059	3.617	5.515	10.0
Pikes Peak Highway - Fill Slope	048FS Upper Fence	8/9/2010	0.047	0.621	1.112	4.480	7.117	19.0
Pikes Peak Highway - Fill Slope	052FS Lower Fence	5/18/2010	0.067	0.675	1.066	2.639	4.596	10.0
Pikes Peak Highway - Fill Slope	052FS Upper Fence	5/18/2010	0.074	0.825	1.552	6.099	11.304	20.0
Pikes Peak Highway - Fill Slope	074FS Lower Fence	7/26/2010	0.024	0.264	0.690	2.186	3.884	15.0
Pikes Peak Highway - Fill Slope	074FS Upper Fence	7/26/2010	0.058	0.703	1.231	3.825	7.528	23.0
Pikes Peak Highway - Fill Slope	074FS Lower Fence	8/12/2010	0.020	0.170	0.591	1.866	2.793	7.0
Pikes Peak Highway - Fill Slope	083FS Lower Fence	6/7/2010	0.054	0.676	1.179	3.573	6.457	19.0
Pikes Peak Highway - Fill Slope	083FS Upper Fence	6/7/2010	0.084	0.833	1.516	5.356	14.519	30.0
Pikes Peak Highway - Fill Slope	093FS Upper Fence	7/6/2010	1.427	4.679	8.423	25.815	32.744	37.0
Pikes Peak Highway - Fill Slope	098FS Upper Fence	8/9/2010	1.450	3.286	4.957	12.756	21.662	31.0
Pikes Peak Highway - Fill Slope	101FS Lower Fence	6/21/2010	0.980	1.977	3.052	8.356	34.781	41.0
Pikes Peak Highway - Fill Slope	101FS Upper Fence	6/21/2010	0.895	3.208	5.191	12.178	20.087	30.0
Pikes Peak Highway - Fill Slope	124FS Lower Fence	6/21/2010	0.504	1.297	2.120	6.095	10.287	20.0
Pikes Peak Highway - Fill Slope	124FS Upper Fence	6/21/2010	0.408	1.414	2.478	8.526	20.867	27.0
Pikes Peak Highway - Fill Slope	177FS Upper Fence	5/7/2010	0.606	2.160	4.472	18.221	35.102	43.0
Pikes Peak Highway - Fill Slope	186FS Lower Fence	8/12/2010	0.272	1.121	1.866	5.129	7.853	14.0
Pikes Peak Highway - Fill Slope	186FS Upper Fence	8/12/2010	0.095	0.961	1.713	5.317	8.402	15.0
Pikes Peak Highway - Fill Slope	193FS Upper Fence	7/26/2010	0.721	2.380	4.070	10.357	18.451	42.0
Pikes Peak Highway - Fill Slope	204FS Lower Fence	5/7/2010	0.100	0.959	1.786	5.360	8.723	17.0
Pikes Peak Highway - Fill Slope	204FS Upper Fence	5/7/2010	0.093	0.818	1.395	4.560	7.432	12.0

**Sieve Analysis Worksheet**

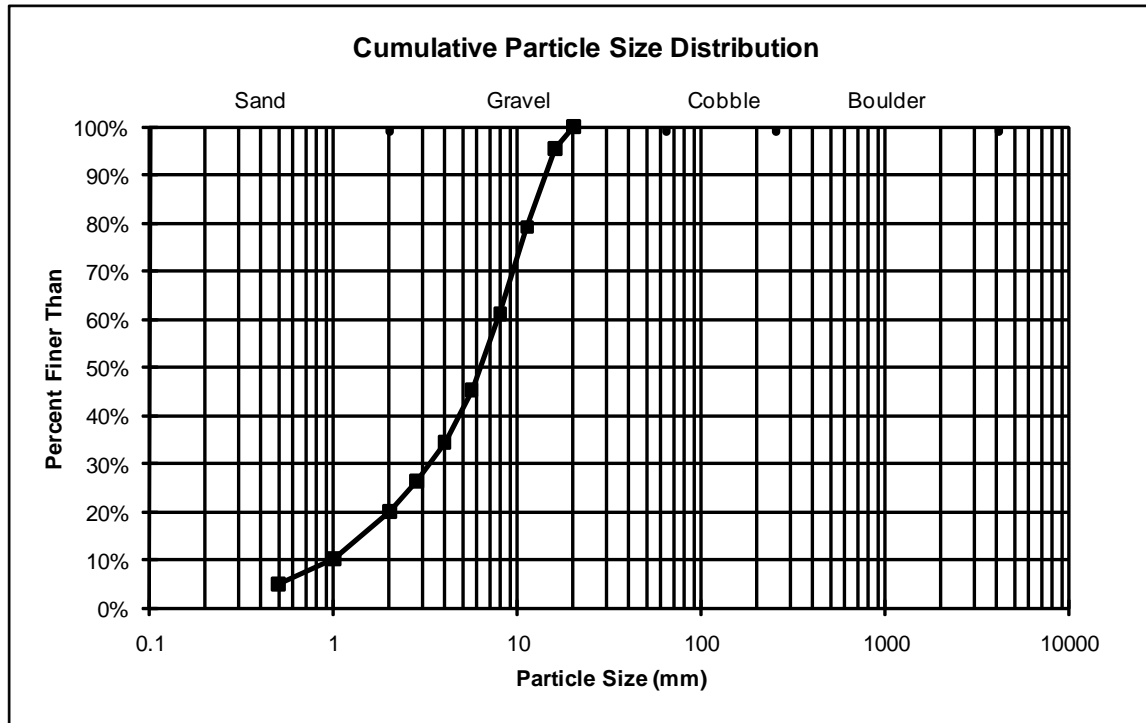
Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	53.10	5.0%	
0.5	55.80	5.2%	5.0%
1.0	104.60	9.8%	10.2%
2.0	68.10	6.4%	20.0%
2.8	85.40	8.0%	26.4%
4.0	117.30	11.0%	34.4%
5.6	166.70	15.6%	45.4%
8.0	193.50	18.1%	61.0%
11.2	175.00	16.4%	79.1%
16.0	48.20	4.5%	95.5%
20.0	*		100.0%
32.0			-
45.0			-
64.0			-
90			-
128			-
181			-
256			-
362			-
512			-
1024			-
2048			-
4096			-
Total	1067.70		

\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

**SITE NAME:** Pike's Peak Highway - Cut Slope  
**ID NUMBER:** 011CS Lower Fence  
**DATE:** 7/9/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	1.404	4.078	6.226	12.462	15.832	20.0





**Sieve Analysis Worksheet**

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	271.10	34.6%	
0.5	38.90	5.0%	34.6%
1.0	53.30	6.8%	39.6%
2.0	30.80	3.9%	46.4%
2.8	31.70	4.1%	50.4%
4.0	53.00	6.8%	54.4%
5.6	81.50	10.4%	61.2%
8.0	98.00	12.5%	71.6%
11.2	41.10	5.3%	84.1%
16.0	16.60	2.1%	89.4%
22.4	25.00	3.2%	91.5%
32.0	41.60	5.3%	94.7%
43.0	*		100.0%
64.0			-
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	782.60		

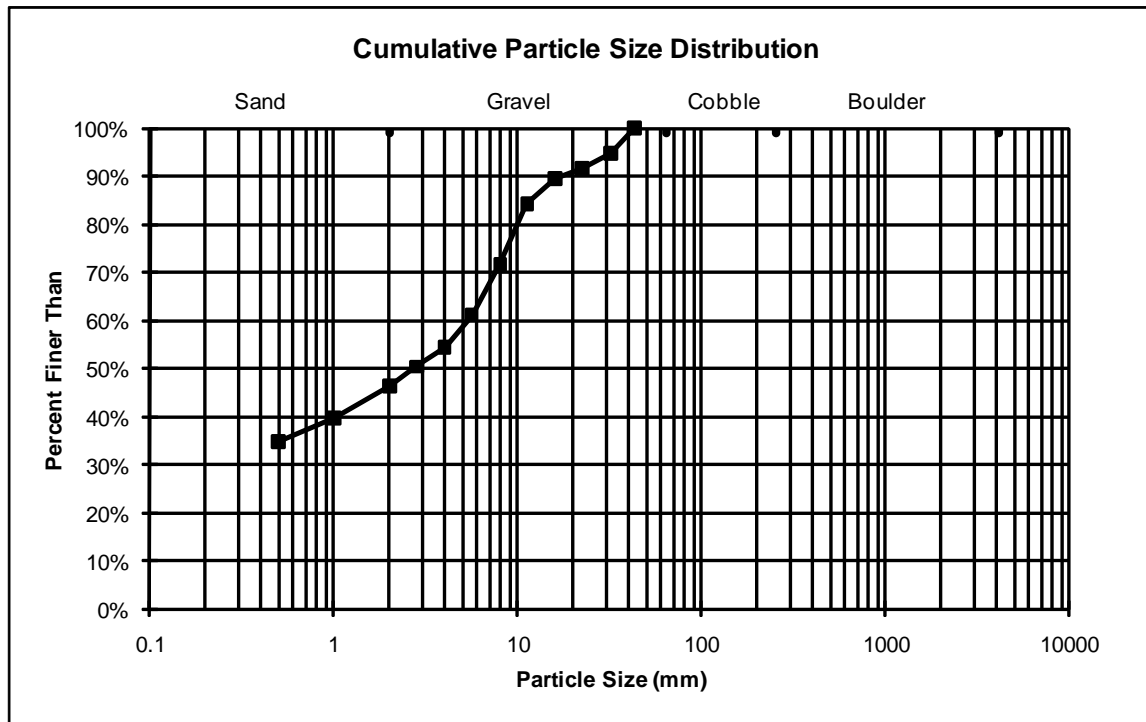
\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:**

Grab Sample of 2010 Sediment Accumulation

**SITE NAME:** Pike's Peak Highway - Cut Slope  
**ID NUMBER:** 049CS Lower Fence  
**DATE:** 5/17/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.032	0.526	2.716	11.165	32.566	43.0



**Sieve Analysis Worksheet**

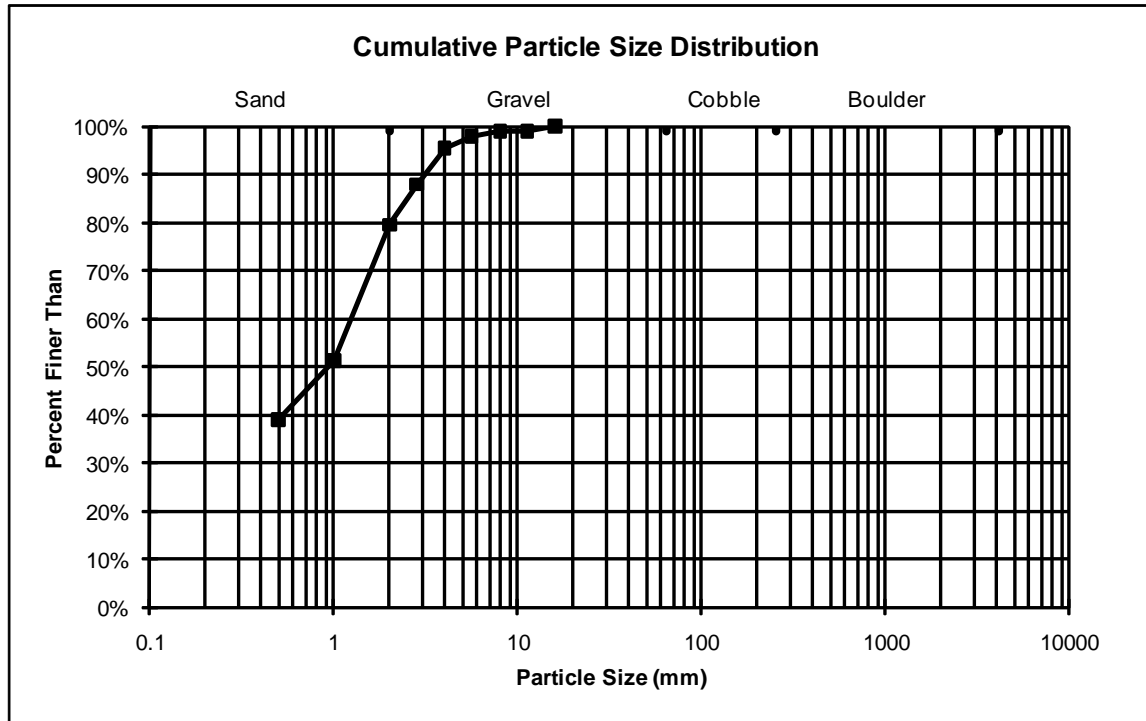
Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	423.50	38.9%	
0.5	134.90	12.4%	38.9%
1.0	307.30	28.2%	51.3%
2.0	91.00	8.4%	79.5%
2.8	81.40	7.5%	87.9%
4.0	27.00	2.5%	95.4%
5.6	12.40	1.1%	97.9%
8.0	0.80	0.1%	99.0%
11.2	10.20	0.9%	99.1%
16.0	*		100.0%
22.4			-
32.0			
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1088.50		

\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

**SITE NAME:** Pike's Peak Highway - Cut Slope  
**ID NUMBER:** 049CS Upper Fence  
**DATE:** 5/17/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.025	0.307	0.930	2.394	3.930	16.0



**Sieve Analysis Worksheet**

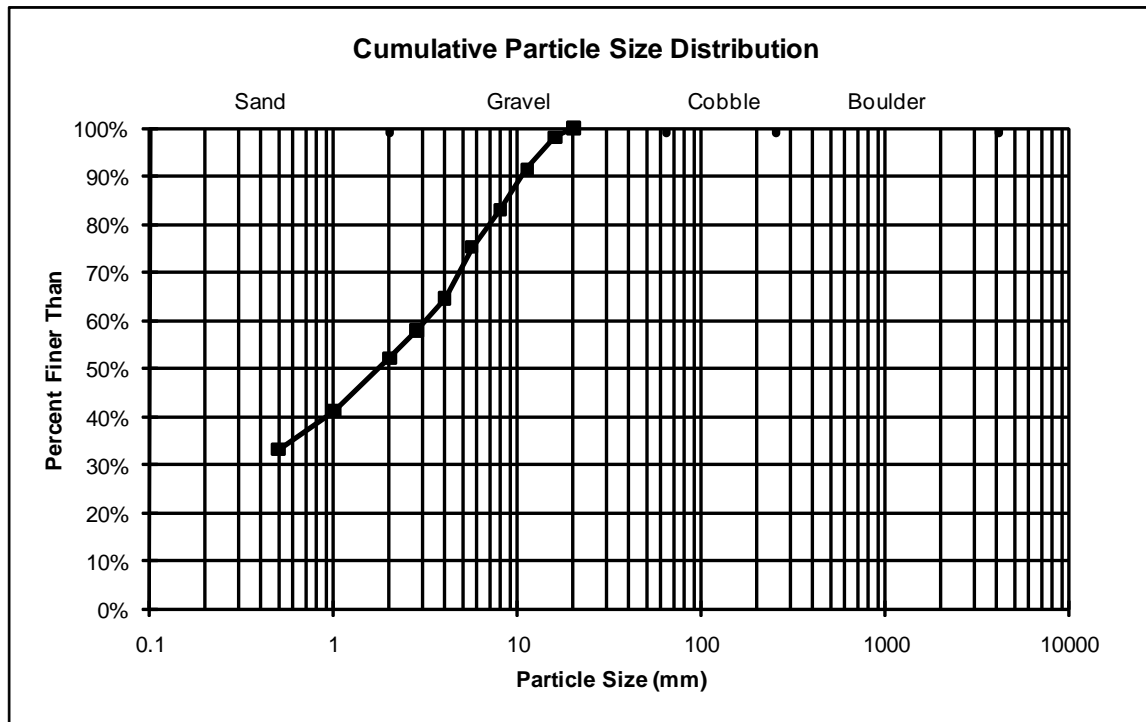
Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	311.80	33.1%	
0.5	75.70	8.0%	33.1%
1.0	103.20	11.0%	41.2%
2.0	53.70	5.7%	52.1%
2.8	62.30	6.6%	57.8%
4.0	101.20	10.8%	64.5%
5.6	73.00	7.8%	75.2%
8.0	79.40	8.4%	83.0%
11.2	62.80	6.7%	91.4%
16.0	18.10	1.9%	98.1%
20.0	*		100.0%
32.0			-
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	941.20		

\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

**SITE NAME:** Pike's Peak Highway - Cut Slope  
**ID NUMBER:** 078CS Lower Fence  
**DATE:** 7/26/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.035	0.588	1.747	8.336	13.573	20.0



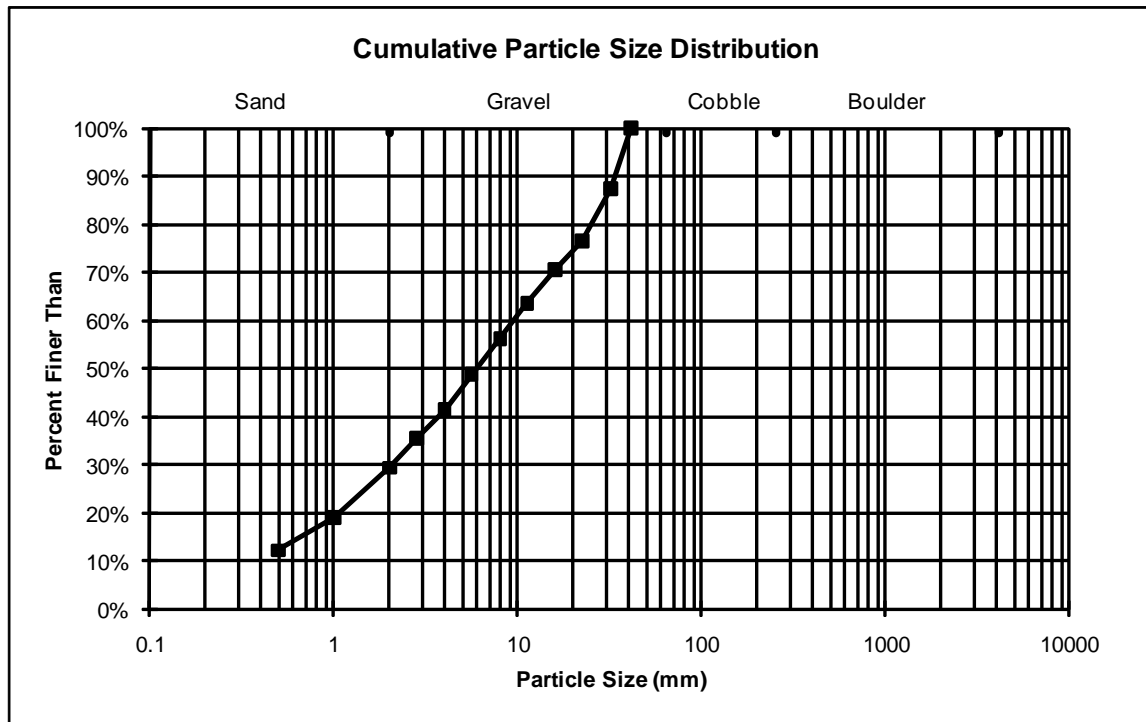
**Sieve Analysis Worksheet**

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	132.20	12.1%	
0.5	75.20	6.9%	12.1%
1.0	112.30	10.3%	19.0%
2.0	67.10	6.2%	29.4%
2.8	64.80	5.9%	35.5%
4.0	80.80	7.4%	41.5%
5.6	79.10	7.3%	48.9%
8.0	80.90	7.4%	56.1%
11.2	75.10	6.9%	63.6%
16.0	65.50	6.0%	70.5%
22.4	119.30	11.0%	76.5%
32.0	136.90	12.6%	87.4%
41.0	*		100.0%
64.0			-
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1089.20		

**SITE NAME:** Pike's Peak Highway - Cut Slope  
**ID NUMBER:** 087CS Lower Fence  
**DATE:** 6/7/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.666	2.723	5.917	28.617	37.151	41.0



\*Measured value of the largest particle in the sample and not a sieve weight

**Sieve Analysis Worksheet**

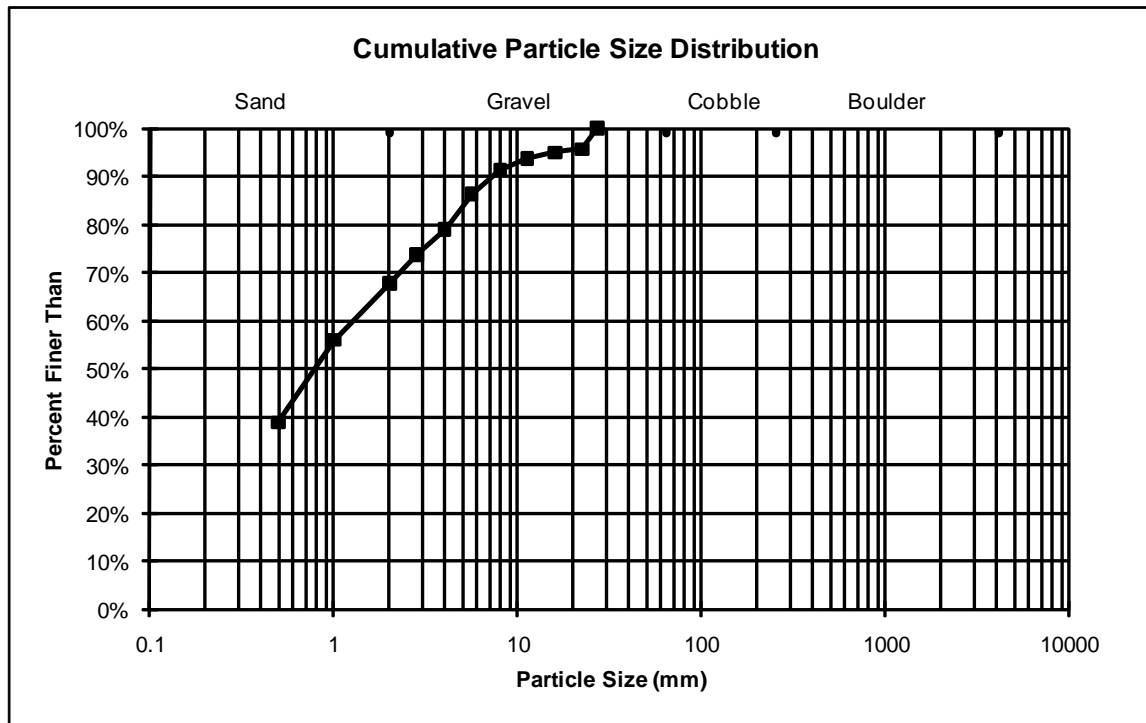
Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	265.00	38.8%	
0.5	116.70	17.1%	38.8%
1.0	80.80	11.8%	55.9%
2.0	40.50	5.9%	67.7%
2.8	36.20	5.3%	73.7%
4.0	50.00	7.3%	79.0%
5.6	34.80	5.1%	86.3%
8.0	15.40	2.3%	91.4%
11.2	8.80	1.3%	93.7%
16.0	4.90	0.7%	94.9%
22.4	29.60	4.3%	95.7%
27.0	*		100.0%
45.0			-
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	682.70		

\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

**SITE NAME:** Pike's Peak Highway - Cut Slope  
**ID NUMBER:** 087CS Upper Fence  
**DATE:** 6/7/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.025	0.310	0.787	5.037	16.406	27.0



**Sieve Analysis Worksheet**

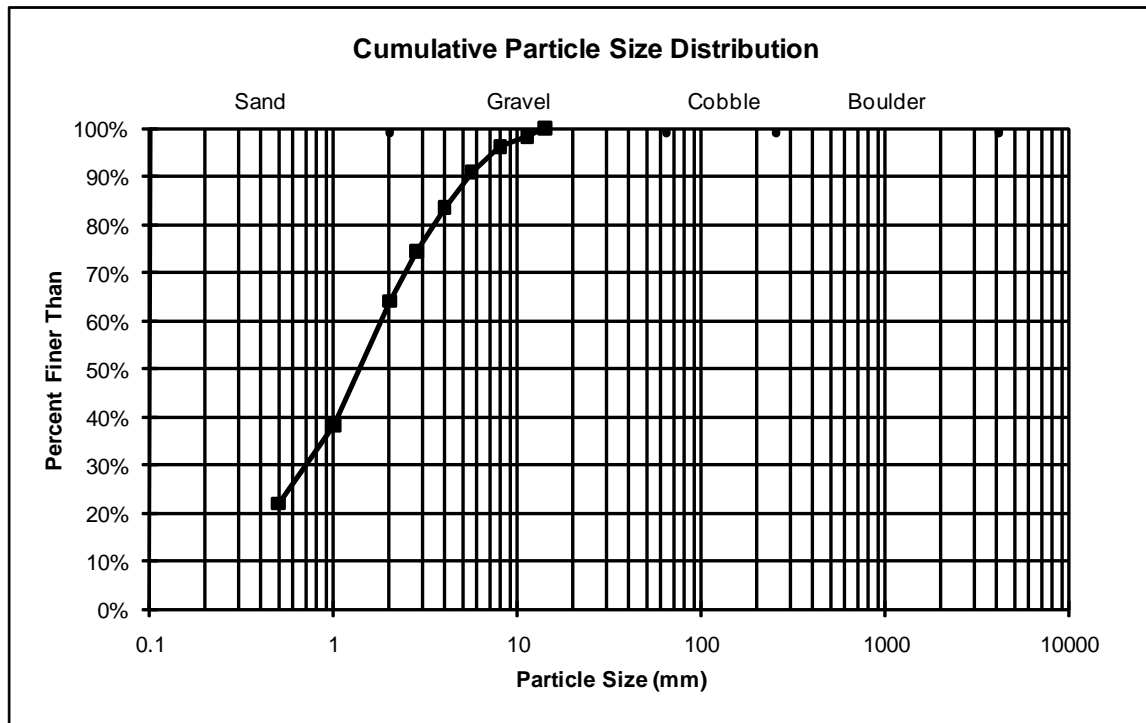
Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	156.90	21.9%	
0.5	117.50	16.4%	21.9%
1.0	183.60	25.7%	38.3%
2.0	74.60	10.4%	64.0%
2.8	65.50	9.2%	74.4%
4.0	52.70	7.4%	83.6%
5.6	37.70	5.3%	90.9%
8.0	14.70	2.1%	96.2%
11.2	12.50	1.7%	98.3%
14.0	*		100.0%
22.4			-
32.0			
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	715.70		

\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

**SITE NAME:** Pike's Peak Highway - Cut Slope  
**ID NUMBER:** 102CS Upper Fence  
**DATE:** 9/13/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.108	0.868	1.370	4.080	7.376	14.0



**Sieve Analysis Worksheet**

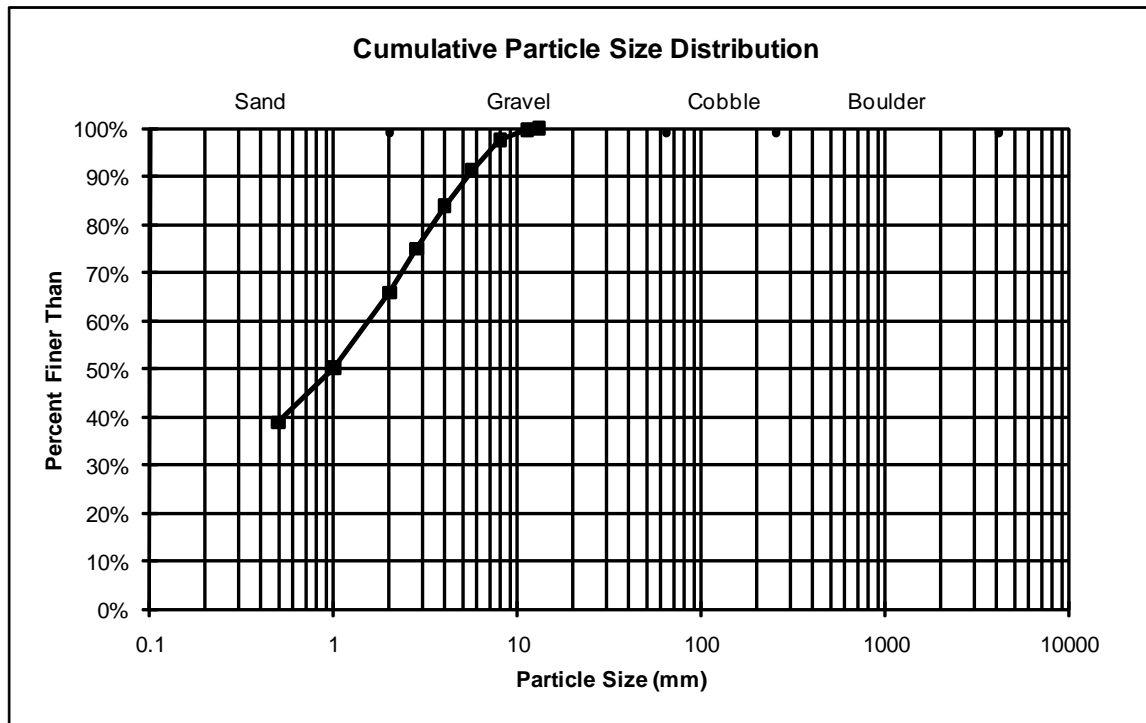
Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	356.90	38.8%	
0.5	105.80	11.5%	38.8%
1.0	143.10	15.5%	50.3%
2.0	84.00	9.1%	65.8%
2.8	82.10	8.9%	74.9%
4.0	68.80	7.5%	83.9%
5.6	57.20	6.2%	91.3%
8.0	19.10	2.1%	97.6%
11.2	3.40	0.4%	99.6%
13.0	*		100.0%
22.4			-
32.0			
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	920.40		

\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

**SITE NAME:** Pike's Peak Highway - Cut Slope  
**ID NUMBER:** 141CS Upper Fence  
**DATE:** 9/13/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.025	0.312	0.984	4.024	6.909	13.0



**Sieve Analysis Worksheet**

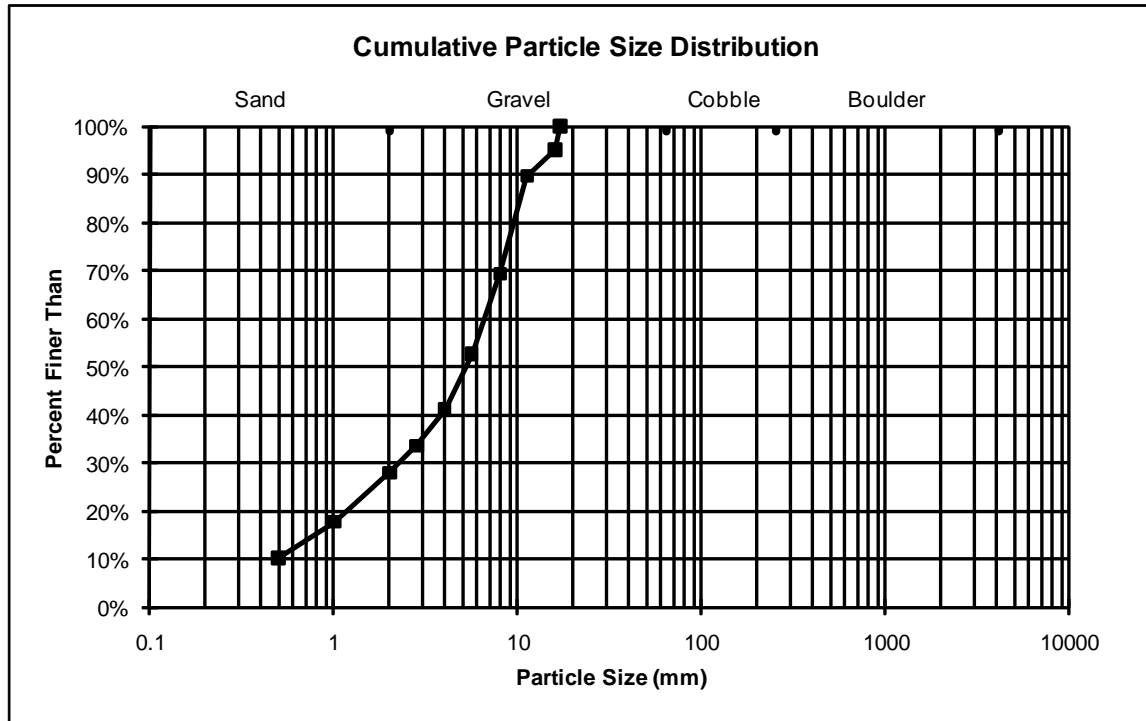
Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	114.80	10.2%	
0.5	84.50	7.5%	10.2%
1.0	114.80	10.2%	17.7%
2.0	63.50	5.6%	27.9%
2.8	84.70	7.5%	33.6%
4.0	130.30	11.6%	41.1%
5.6	187.20	16.6%	52.7%
8.0	229.00	20.3%	69.3%
11.2	62.00	5.5%	89.6%
16.0	54.60	4.9%	95.1%
17.0	*		100.0%
32.0			-
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1125.40		

\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

**SITE NAME:** Pike's Peak Highway - Cut Slope  
**ID NUMBER:** 185CS Lower Fence  
**DATE:** 7/27/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.779	2.999	5.184	10.203	15.847	17.0





**Sieve Analysis Worksheet**

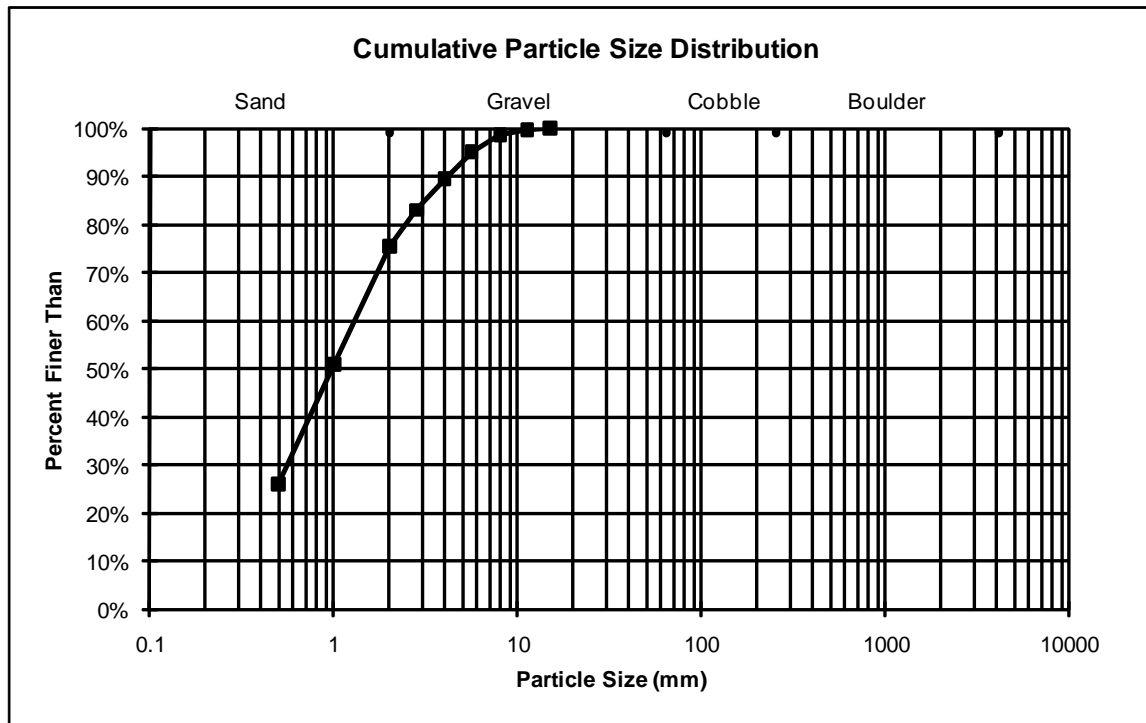
Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	221.20	26.1%	
0.5	210.10	24.8%	26.1%
1.0	208.30	24.5%	50.8%
2.0	64.70	7.6%	75.4%
2.8	54.00	6.4%	83.0%
4.0	48.20	5.7%	89.4%
5.6	29.70	3.5%	95.1%
8.0	9.50	1.1%	98.6%
11.2	2.80	0.3%	99.7%
15.0	*		100.0%
22.4			-
32.0			
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	848.50		

\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

**SITE NAME:** Pike's Peak Highway - Cut Slope  
**ID NUMBER:** 185CS Upper Fence  
**DATE:** 7/27/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.064	0.642	0.977	2.961	5.583	15.0



**Sieve Analysis Worksheet**

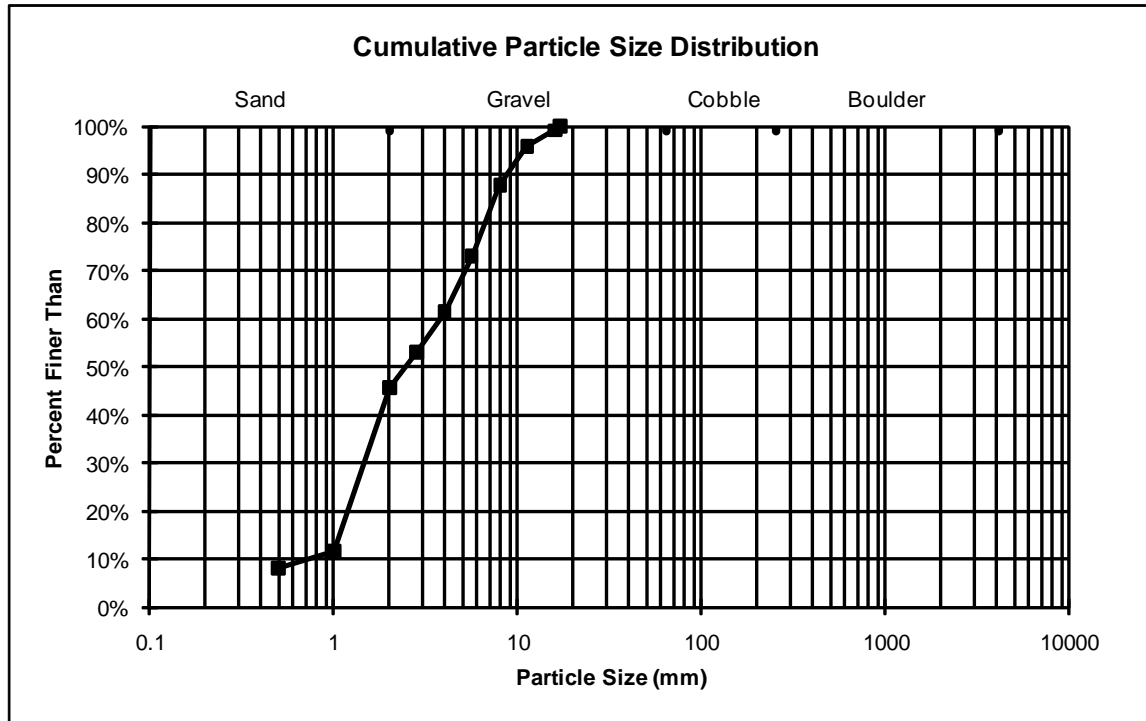
Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	65.50	8.1%	
0.5	27.20	3.4%	8.1%
1.0	275.60	34.2%	11.5%
2.0	59.20	7.3%	45.7%
2.8	67.10	8.3%	53.1%
4.0	93.00	11.5%	61.4%
5.6	119.40	14.8%	72.9%
8.0	65.10	8.1%	87.8%
11.2	26.60	3.3%	95.8%
16.0	6.90	0.9%	99.1%
17.0	*		100.0%
32.0			-
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	805.60		

\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

**SITE NAME:** Pike's Peak Highway - Cut Slope  
**ID NUMBER:** 192CS Lower Fence  
**DATE:** 8/12/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	1.073	1.610	2.433	7.308	10.814	17.0



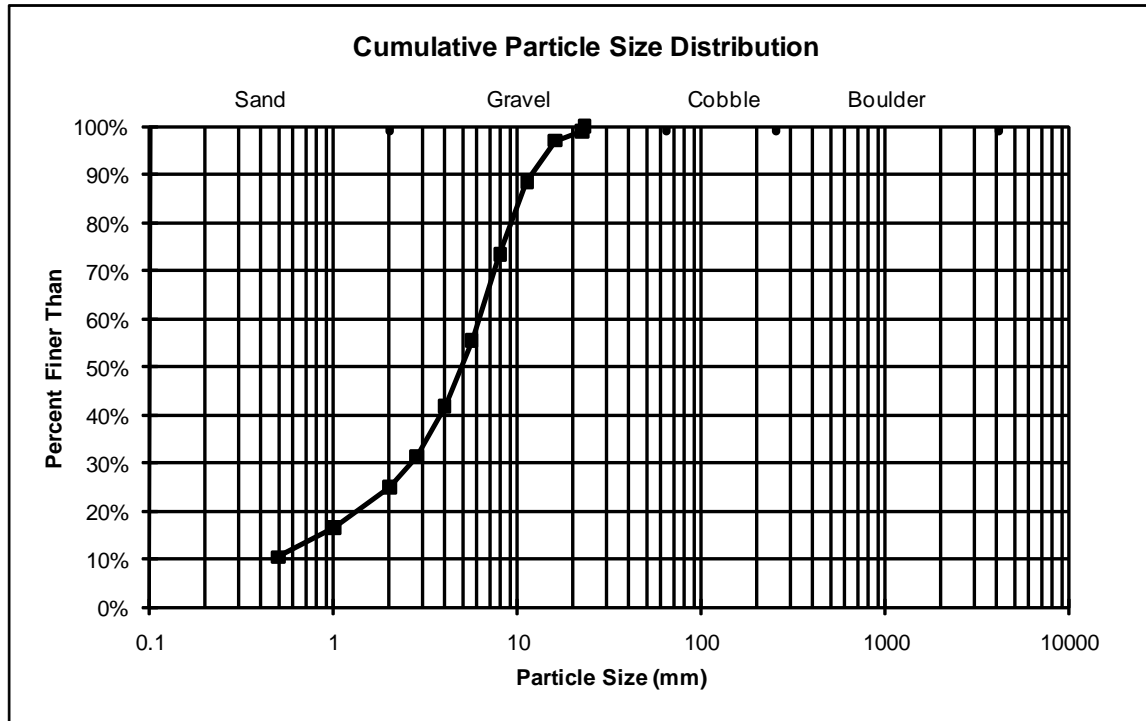
**Sieve Analysis Worksheet**

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	118.80	10.4%	
0.5	68.60	6.0%	10.4%
1.0	99.00	8.7%	16.4%
2.0	72.80	6.4%	25.0%
2.8	118.90	10.4%	31.4%
4.0	156.50	13.7%	41.8%
5.6	204.80	17.9%	55.5%
8.0	173.00	15.1%	73.3%
11.2	97.30	8.5%	88.5%
16.0	23.50	2.1%	97.0%
22.4	11.20	1.0%	99.0%
23.0	*		100.0%
45.0			-
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1144.40		

**SITE NAME:** Pike's Peak Highway - Cut Slope  
**ID NUMBER:** 192CS Upper Fence  
**DATE:** 8/12/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.853	3.170	4.897	10.140	14.732	23.0



\*Measured value of the largest particle in the sample and not a sieve weight

**Sieve Analysis Worksheet**

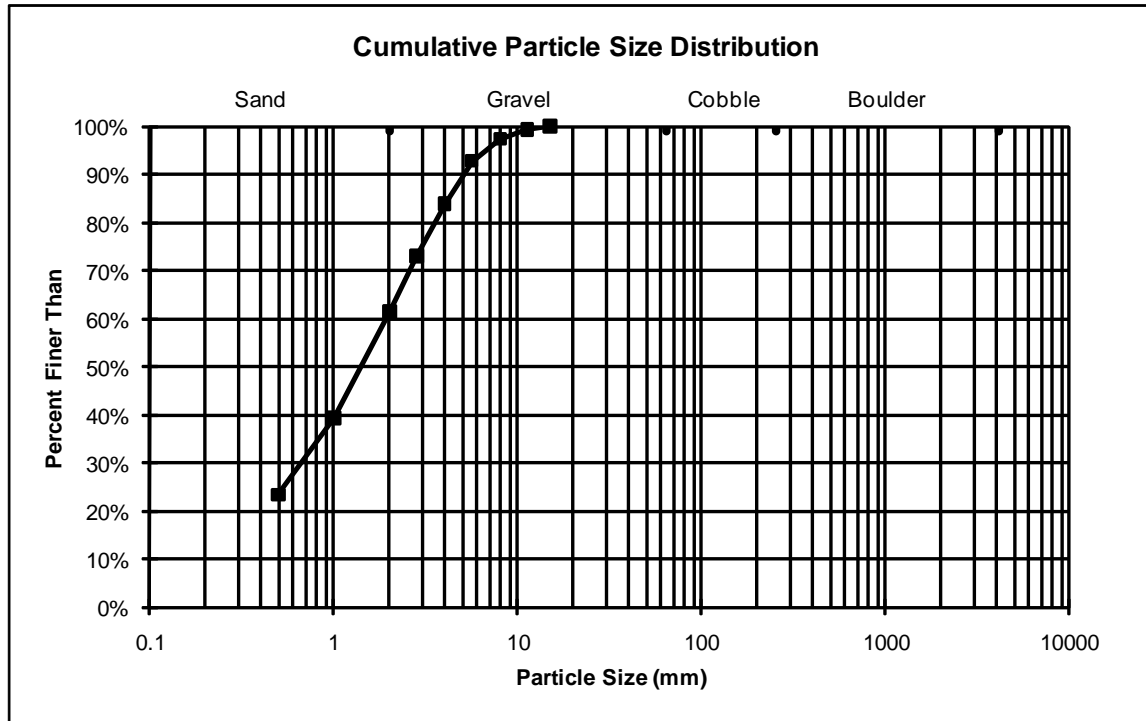
Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	224.00	23.4%	
0.5	152.80	15.9%	23.4%
1.0	212.10	22.1%	39.3%
2.0	111.10	11.6%	61.4%
2.8	105.50	11.0%	73.0%
4.0	84.20	8.8%	84.0%
5.6	43.70	4.6%	92.8%
8.0	19.50	2.0%	97.3%
11.2	6.30	0.7%	99.3%
15.0	*		100.0%
22.4			-
32.0			
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	959.20		

\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

**SITE NAME:** Pike's Peak Highway - Fill Slope  
**ID NUMBER:** 001FS Upper Fence  
**DATE:** 7/27/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.088	0.830	1.399	4.004	6.676	15.0



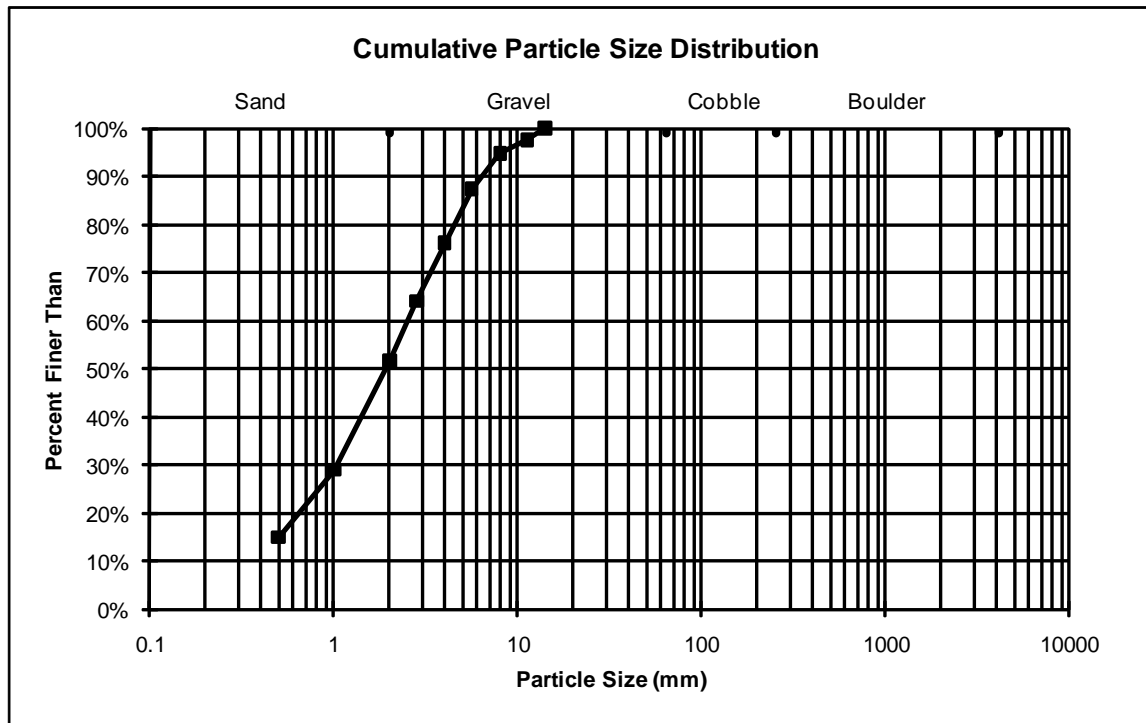
**Sieve Analysis Worksheet**

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	140.30	14.9%	
0.5	133.00	14.1%	14.9%
1.0	214.70	22.7%	28.9%
2.0	117.00	12.4%	51.7%
2.8	113.30	12.0%	64.1%
4.0	107.00	11.3%	76.1%
5.6	68.80	7.3%	87.4%
8.0	27.00	2.9%	94.7%
11.2	23.30	2.5%	97.5%
14.0	*		100.0%
22.4			-
32.0			
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	944.40		

**SITE NAME:** Pike's Peak Highway - Fill Slope  
**ID NUMBER:** 039FS Upper Fence  
**DATE:** 8/12/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.504	1.203	1.901	5.064	8.313	14.0



\*Measured value of the largest particle in the sample and not a sieve weight

**Sieve Analysis Worksheet**

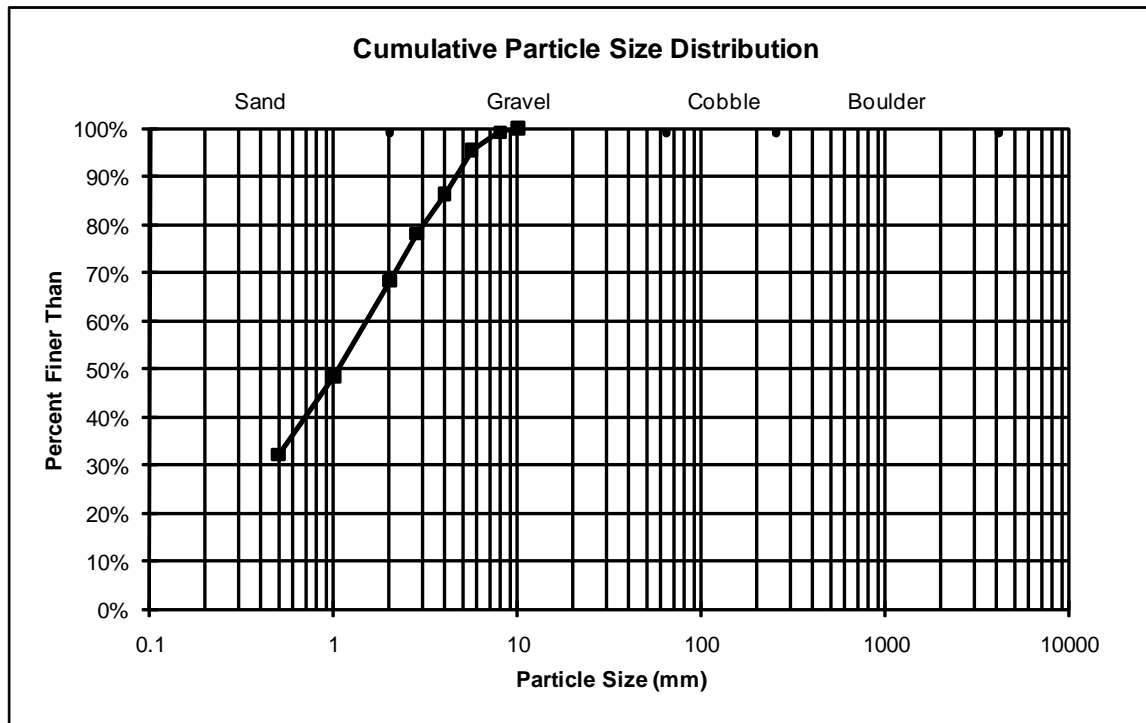
Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	388.50	32.1%	
0.5	196.80	16.3%	32.1%
1.0	240.20	19.8%	48.4%
2.0	119.50	9.9%	68.2%
2.8	100.10	8.3%	78.1%
4.0	109.90	9.1%	86.3%
5.6	44.90	3.7%	95.4%
8.0	10.60	0.9%	99.1%
10.0	*		100.0%
16.0			-
22.4			
32.0			
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1210.50		

\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

**SITE NAME:** Pike's Peak Highway - Fill Slope  
**ID NUMBER:** 048FS Lower Fence  
**DATE:** 8/9/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.038	0.566	1.059	3.617	5.515	10.0



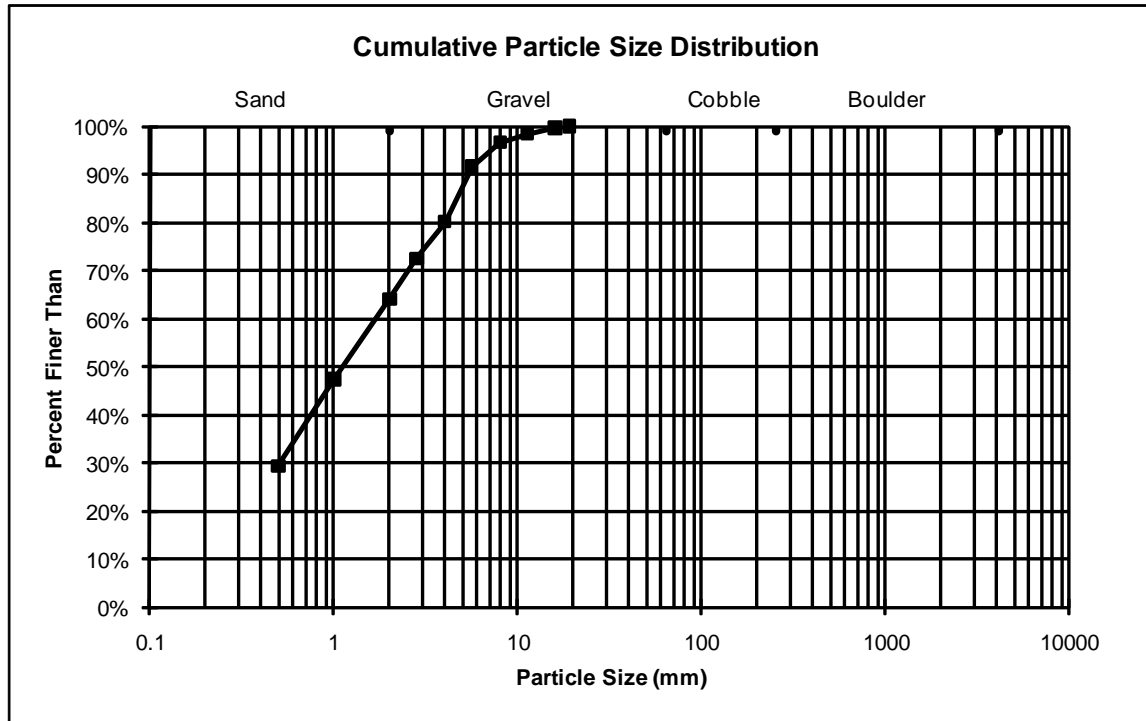
**Sieve Analysis Worksheet**

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	346.60	29.3%	
0.5	214.20	18.1%	29.3%
1.0	195.90	16.6%	47.5%
2.0	99.90	8.5%	64.0%
2.8	90.20	7.6%	72.5%
4.0	135.50	11.5%	80.1%
5.6	59.70	5.1%	91.6%
8.0	20.40	1.7%	96.7%
11.2	13.80	1.2%	98.4%
16.0	5.30	0.4%	99.6%
19.0	*		100.0%
32.0			-
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1181.50		

**SITE NAME:** Pike's Peak Highway - Fill Slope  
**ID NUMBER:** 048FS Upper Fence  
**DATE:** 8/9/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.047	0.621	1.112	4.480	7.117	19.0



\*Measured value of the largest particle in the sample and not a sieve weight

**Sieve Analysis Worksheet**

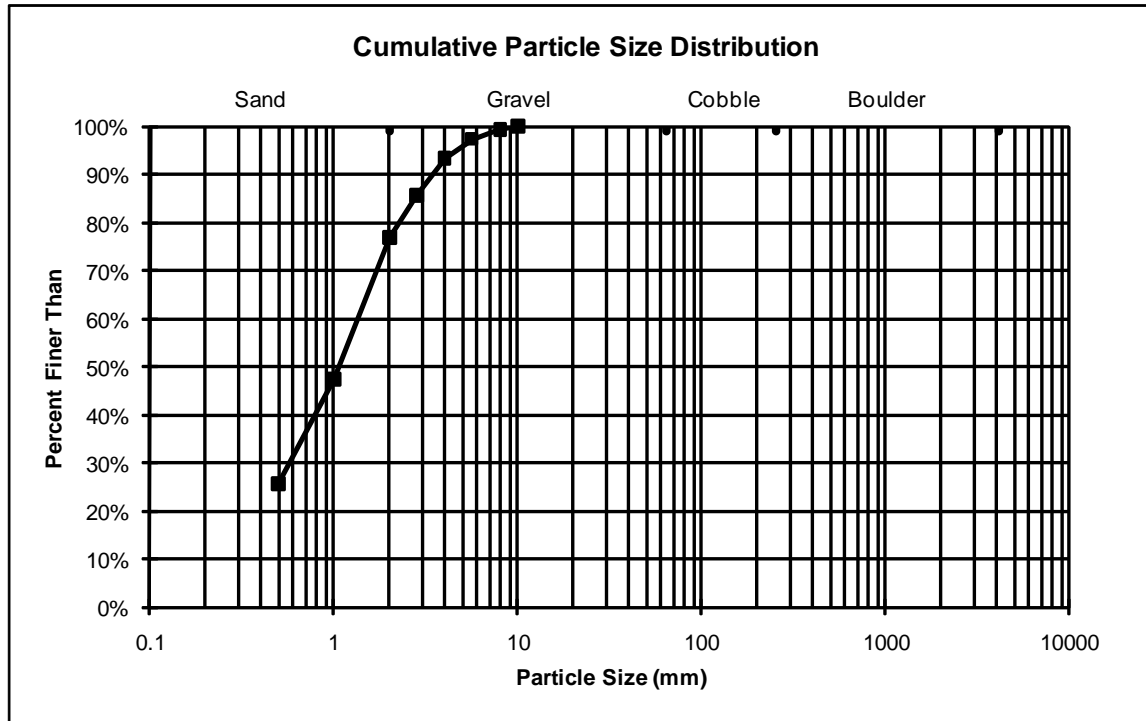
Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	296.70	25.7%	
0.5	249.90	21.6%	25.7%
1.0	341.60	29.5%	47.3%
2.0	100.80	8.7%	76.8%
2.8	90.30	7.8%	85.5%
4.0	46.50	4.0%	93.3%
5.6	22.70	2.0%	97.4%
8.0	7.80	0.7%	99.3%
10.0	*		100.0%
16.0			-
22.4			
32.0			
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1156.30		

\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

**SITE NAME:** Pike's Peak Highway - Fill Slope  
**ID NUMBER:** 052FS Lower Fence  
**DATE:** 5/18/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.067	0.675	1.066	2.639	4.596	10.0





**Sieve Analysis Worksheet**

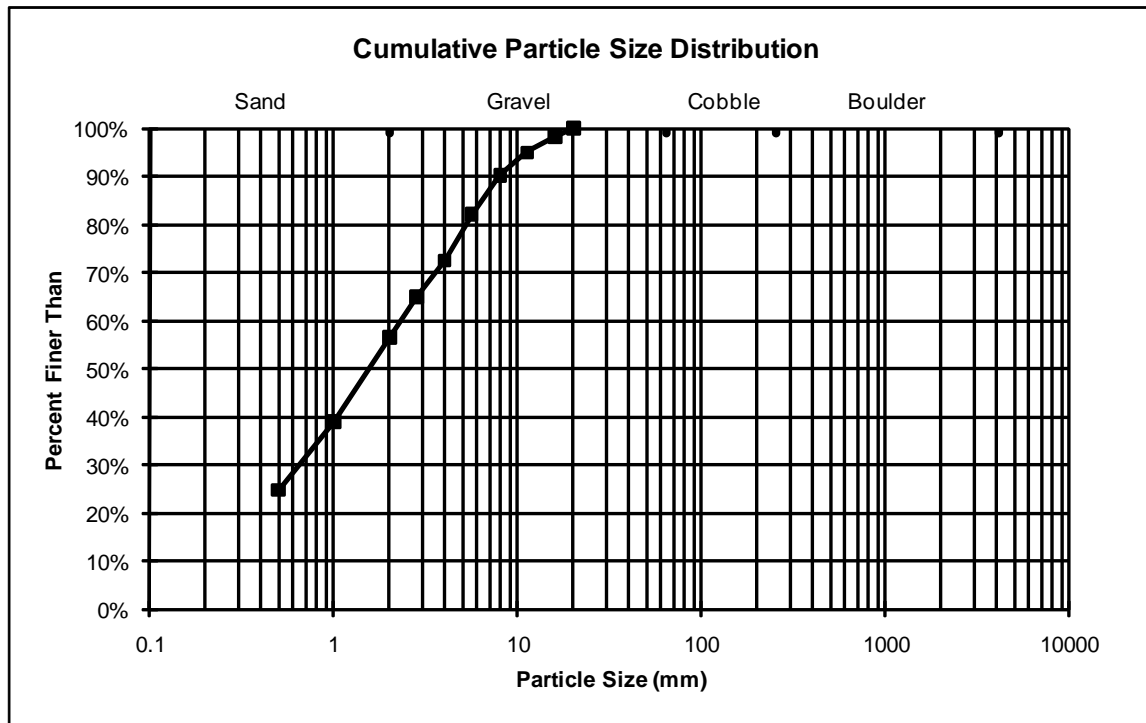
Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	276.00	24.7%	
0.5	159.10	14.2%	24.7%
1.0	194.80	17.4%	38.9%
2.0	95.00	8.5%	56.4%
2.8	85.20	7.6%	64.9%
4.0	107.10	9.6%	72.5%
5.6	89.10	8.0%	82.1%
8.0	54.20	4.9%	90.1%
11.2	36.10	3.2%	94.9%
16.0	20.70	1.9%	98.1%
20.0	*		100.0%
32.0			-
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1117.30		

\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

**SITE NAME:** Pike's Peak Highway - Fill Slope  
**ID NUMBER:** 052FS Upper Fence  
**DATE:** 5/18/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.074	0.825	1.552	6.099	11.304	20.0



**Sieve Analysis Worksheet**

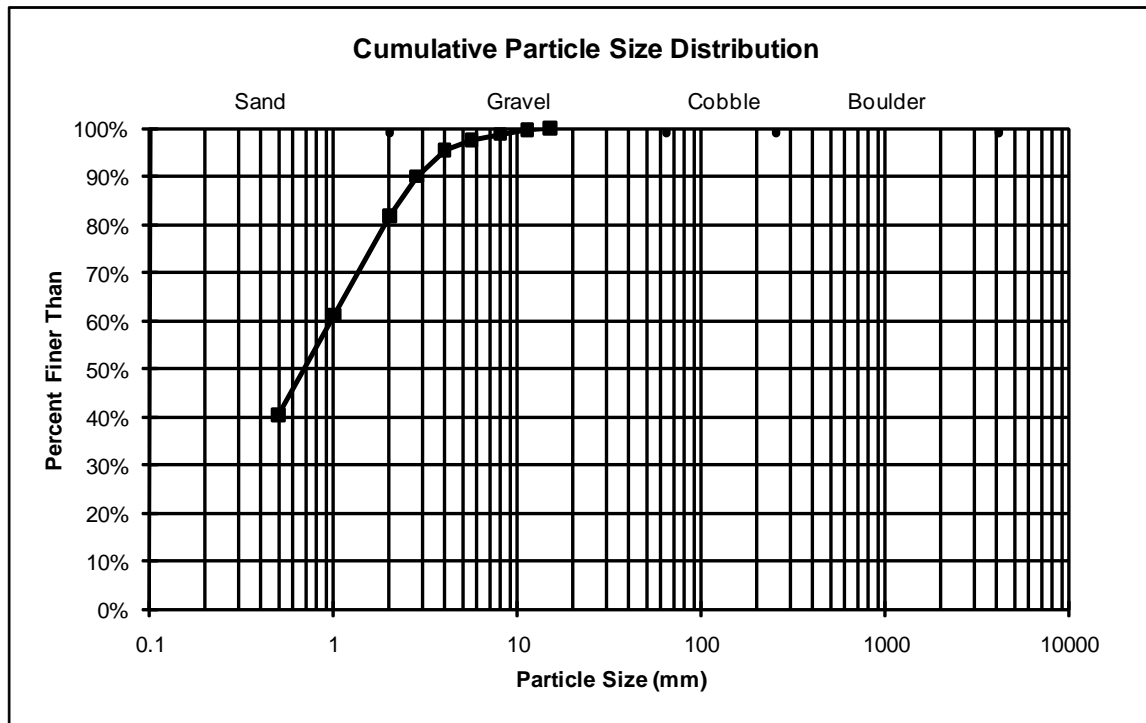
Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	315.50	40.3%	
0.5	163.80	20.9%	40.3%
1.0	161.70	20.6%	61.2%
2.0	63.50	8.1%	81.9%
2.8	43.00	5.5%	90.0%
4.0	17.00	2.2%	95.5%
5.6	8.90	1.1%	97.6%
8.0	6.90	0.9%	98.8%
11.2	2.80	0.4%	99.6%
15.0	*		100.0%
22.4			-
32.0			
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	783.10		

\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

**SITE NAME:** Pike's Peak Highway - Fill Slope  
**ID NUMBER:** 074FS Lower Fence  
**DATE:** 7/26/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.024	0.264	0.690	2.186	3.884	15.0



**Sieve Analysis Worksheet**

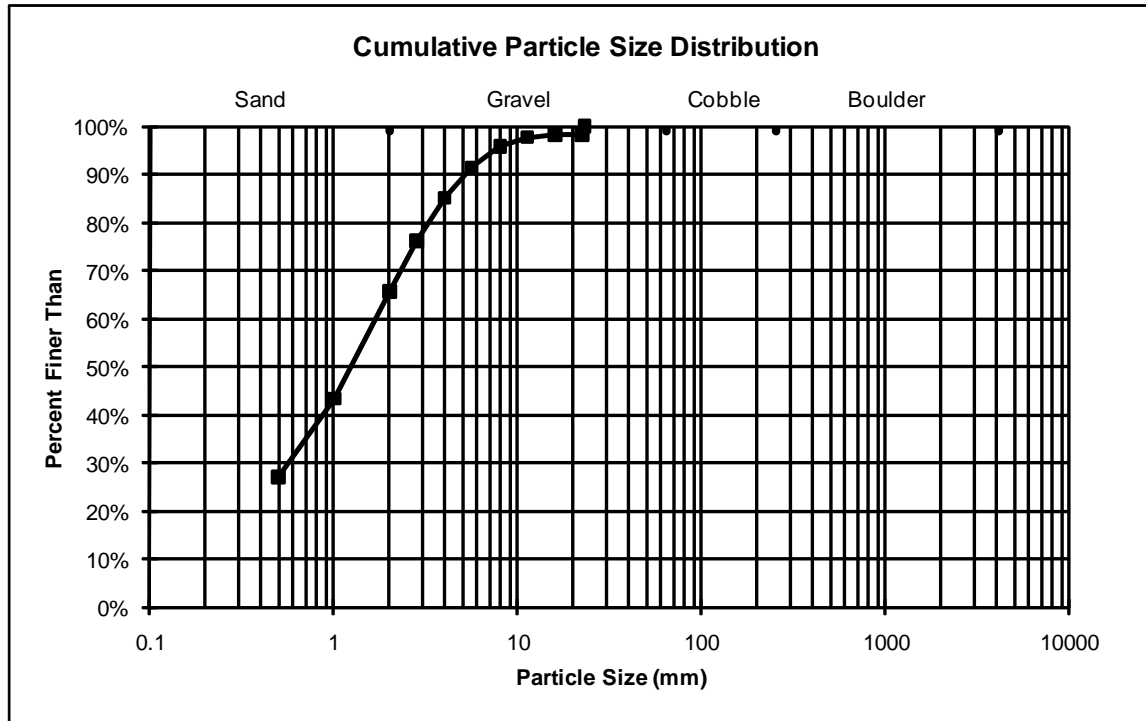
Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	369.20	27.0%	
0.5	222.20	16.3%	27.0%
1.0	306.30	22.4%	43.3%
2.0	143.80	10.5%	65.7%
2.8	121.40	8.9%	76.2%
4.0	86.40	6.3%	85.1%
5.6	58.70	4.3%	91.4%
8.0	26.60	1.9%	95.7%
11.2	8.80	0.6%	97.7%
16.0	0.00	0.0%	98.3%
22.4	22.90	1.7%	98.3%
23.0	*		100.0%
45.0			-
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1366.30		

\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

**SITE NAME:** Pike's Peak Highway - Fill Slope  
**ID NUMBER:** 074FS Upper Fence  
**DATE:** 7/26/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.058	0.703	1.231	3.825	7.528	23.0



**Sieve Analysis Worksheet**

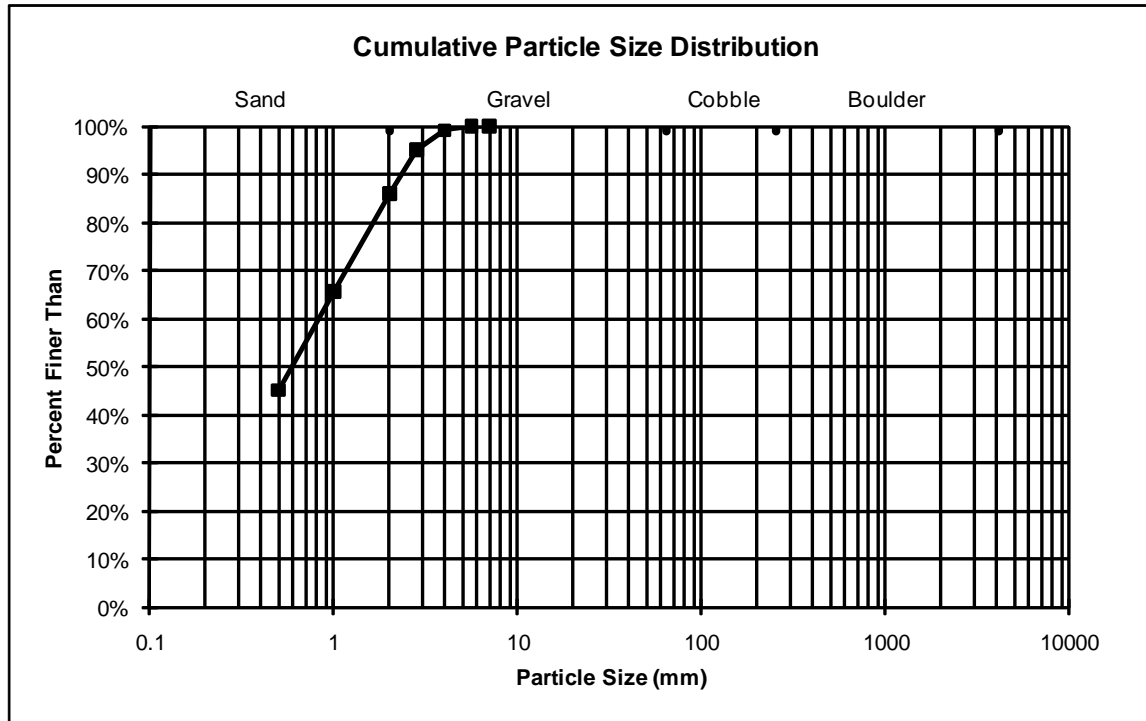
Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	295.90	45.0%	
0.5	135.90	20.7%	45.0%
1.0	133.50	20.3%	65.7%
2.0	59.40	9.0%	86.0%
2.8	26.80	4.1%	95.1%
4.0	5.10	0.8%	99.1%
5.6	0.50	0.1%	99.9%
7.0	*		100.0%
11.2			-
16.0			
22.4			
32.0			
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	657.10		

\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

**SITE NAME:** Pike's Peak Highway - Fill Slope  
**ID NUMBER:** 074FS Lower Fence  
**DATE:** 8/12/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.020	0.170	0.591	1.866	2.793	7.0



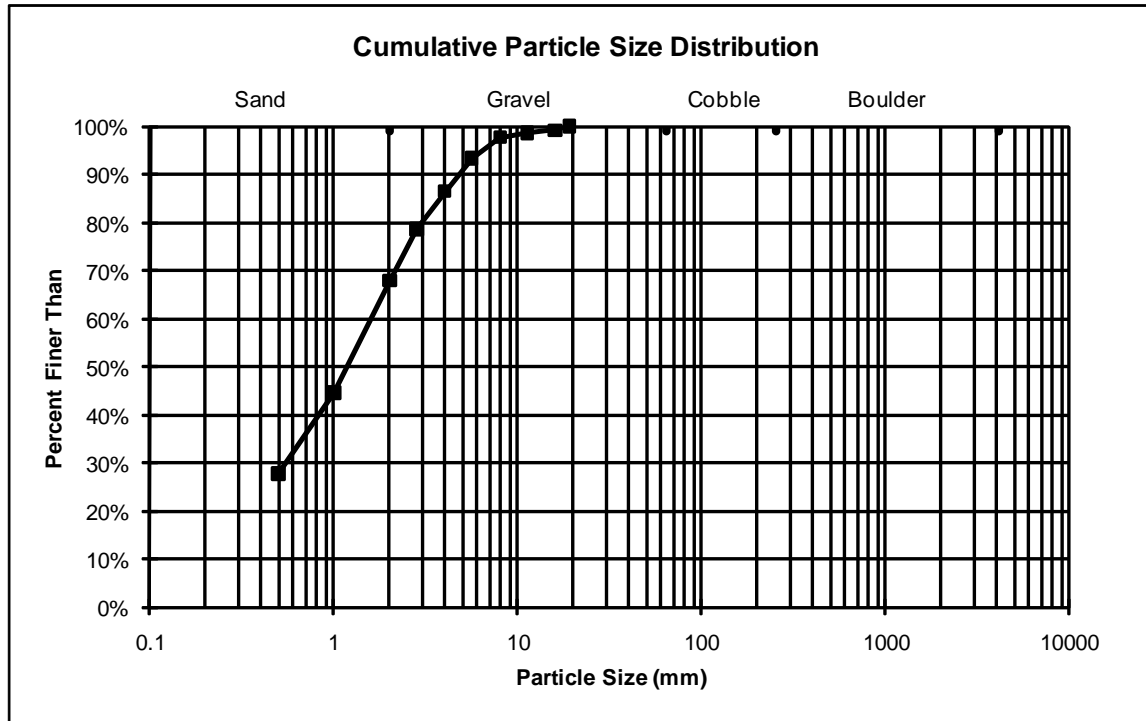
**Sieve Analysis Worksheet**

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	272.00	27.7%	
0.5	164.10	16.7%	27.7%
1.0	229.60	23.4%	44.5%
2.0	105.70	10.8%	67.9%
2.8	77.10	7.9%	78.6%
4.0	66.10	6.7%	86.5%
5.6	43.70	4.5%	93.2%
8.0	9.10	0.9%	97.7%
11.2	5.10	0.5%	98.6%
16.0	8.60	0.9%	99.1%
19.0	*		100.0%
32.0			-
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	981.10		

**SITE NAME:** Pike's Peak Highway - Fill Slope  
**ID NUMBER:** 083FS Lower Fence  
**DATE:** 6/7/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.054	0.676	1.179	3.573	6.457	19.0



\*Measured value of the largest particle in the sample and not a sieve weight

**Sieve Analysis Worksheet**

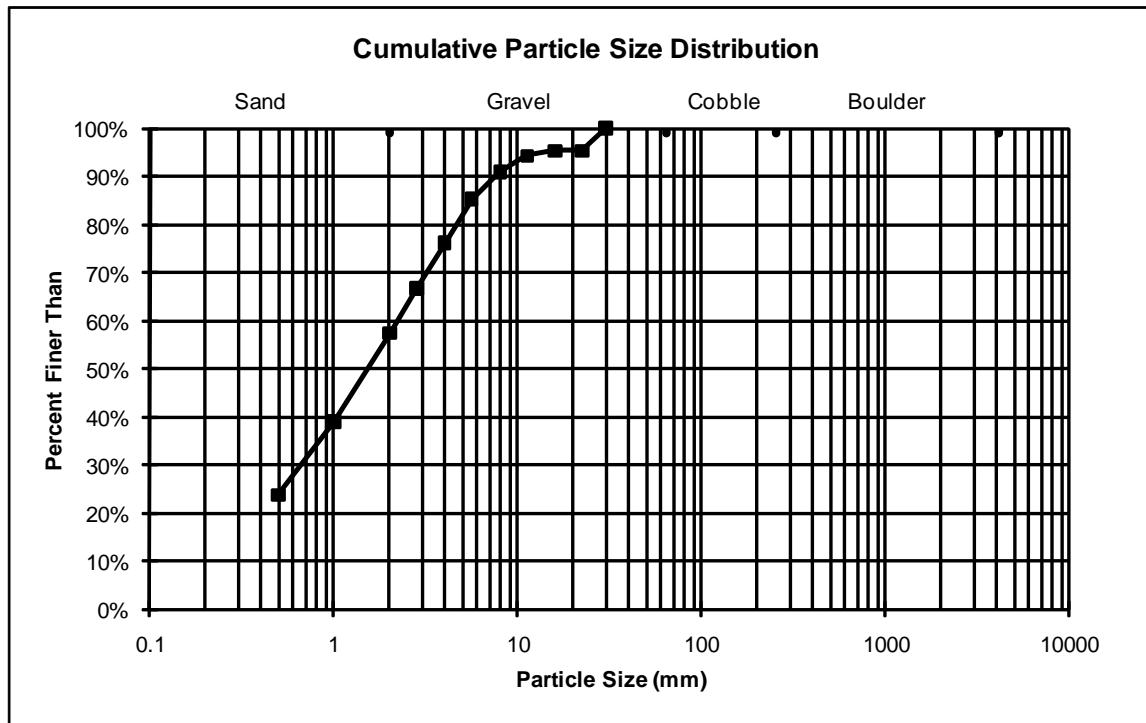
Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	265.60	23.7%	
0.5	171.50	15.3%	23.7%
1.0	204.80	18.3%	39.0%
2.0	103.40	9.2%	57.3%
2.8	108.30	9.7%	66.6%
4.0	100.40	9.0%	76.2%
5.6	62.50	5.6%	85.2%
8.0	38.60	3.4%	90.8%
11.2	12.10	1.1%	94.2%
16.0	0.00	0.0%	95.3%
22.4	52.70	4.7%	95.3%
30.0	*		100.0%
45.0			-
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1119.90		

\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

**SITE NAME:** Pike's Peak Highway - Fill Slope  
**ID NUMBER:** 083FS Upper Fence  
**DATE:** 6/7/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.084	0.833	1.516	5.356	14.519	30.0



**Sieve Analysis Worksheet**

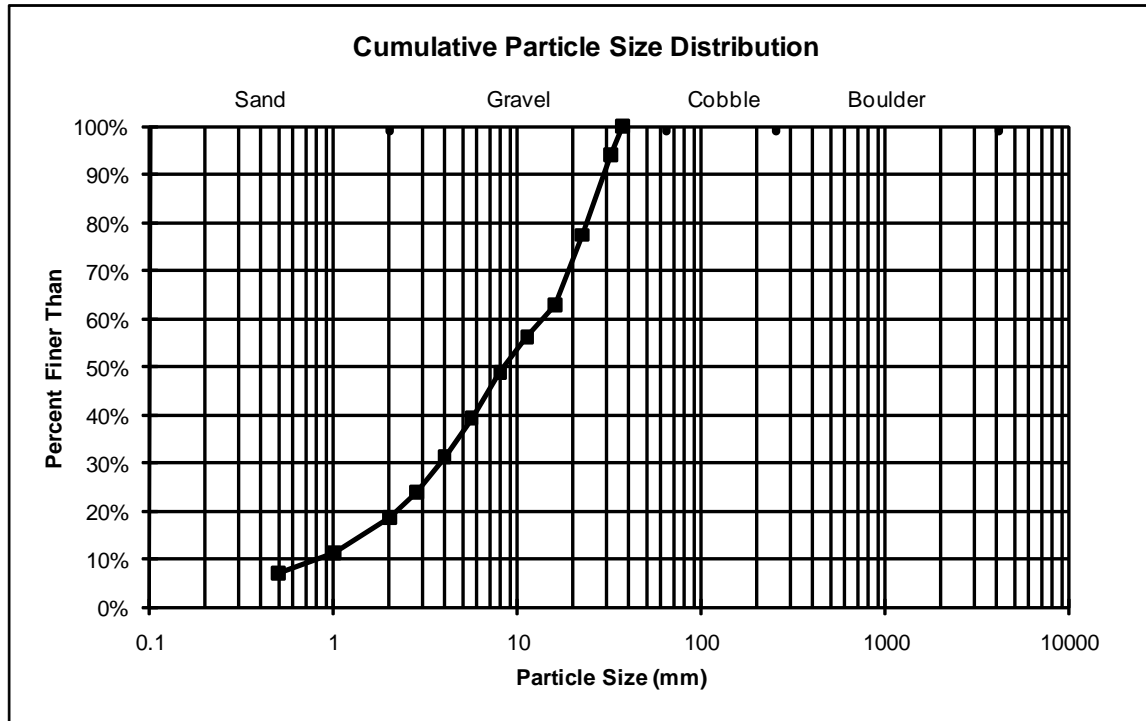
Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	75.70	6.9%	
0.5	46.20	4.2%	6.9%
1.0	81.90	7.5%	11.2%
2.0	57.30	5.2%	18.7%
2.8	80.10	7.3%	23.9%
4.0	88.40	8.1%	31.2%
5.6	104.30	9.5%	39.3%
8.0	80.60	7.4%	48.9%
11.2	70.70	6.5%	56.2%
16.0	159.90	14.6%	62.7%
22.4	182.50	16.7%	77.4%
32.0	64.90	5.9%	94.1%
37.0	*		100.0%
64.0			-
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1092.50		

\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

**SITE NAME:** Pike's Peak Highway - Fill Slope  
**ID NUMBER:** 093FS Upper Fence  
**DATE:** 7/6/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	1.427	4.679	8.423	25.815	32.744	37.0



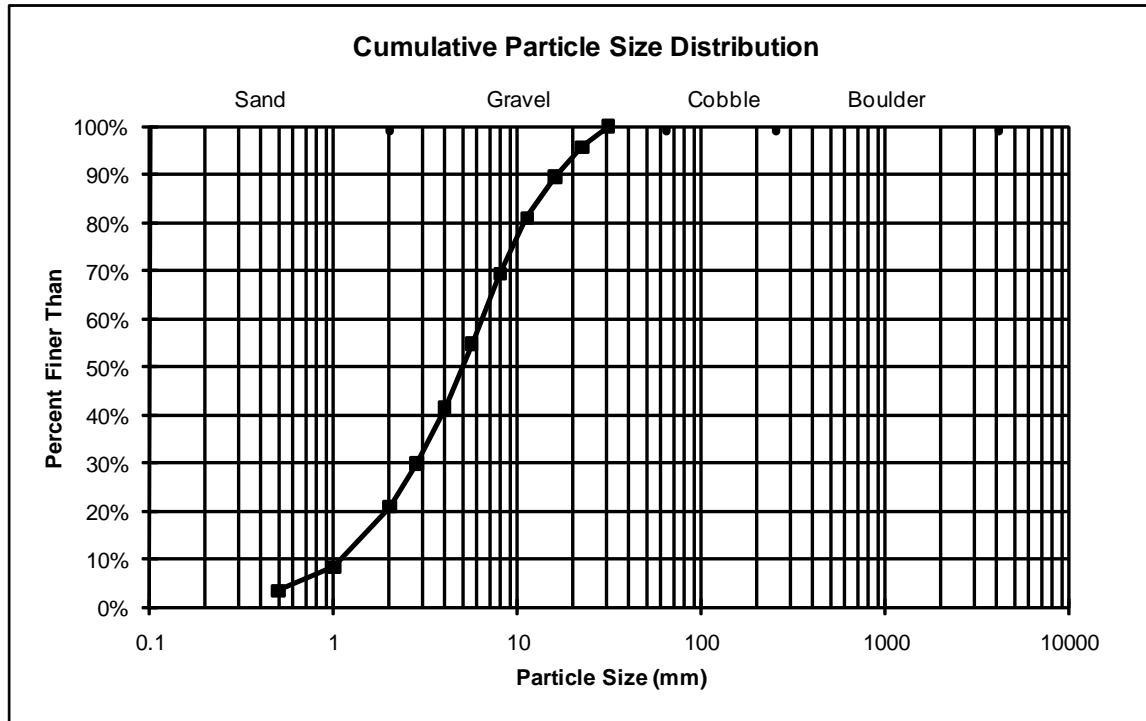
**Sieve Analysis Worksheet**

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	49.70	3.4%	
0.5	72.30	4.9%	3.4%
1.0	185.30	12.6%	8.3%
2.0	131.10	8.9%	20.8%
2.8	173.90	11.8%	29.7%
4.0	196.90	13.3%	41.5%
5.6	213.10	14.4%	54.8%
8.0	171.70	11.6%	69.3%
11.2	124.80	8.5%	80.9%
16.0	92.20	6.2%	89.4%
22.4	64.60	4.4%	95.6%
31.0	*		100.0%
45.0			-
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1475.60		

**SITE NAME:** Pike's Peak Highway - Fill Slope  
**ID NUMBER:** 098FS Upper Fence  
**DATE:** 8/9/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	1.450	3.286	4.957	12.756	21.662	31.0



\*Measured value of the largest particle in the sample and not a sieve weight



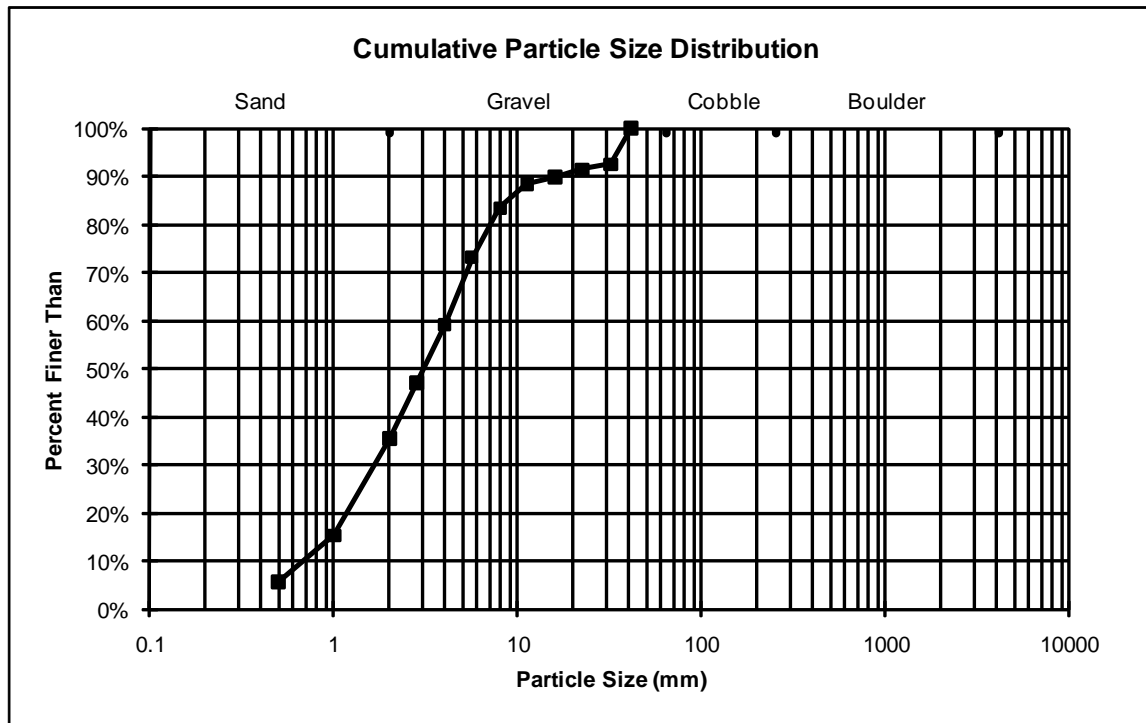
**Sieve Analysis Worksheet**

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	60.60	5.7%	
0.5	102.70	9.6%	5.7%
1.0	214.30	20.1%	15.3%
2.0	125.60	11.8%	35.3%
2.8	129.00	12.1%	47.1%
4.0	149.10	14.0%	59.2%
5.6	109.40	10.2%	73.1%
8.0	54.10	5.1%	83.3%
11.2	15.00	1.4%	88.4%
16.0	17.10	1.6%	89.8%
22.4	11.30	1.1%	91.4%
32.0	80.50	7.5%	92.5%
41.0	*		100.0%
64.0			-
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1068.70		

**SITE NAME:** Pike's Peak Highway - Fill Slope  
**ID NUMBER:** 101FS Lower Fence  
**DATE:** 6/21/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.980	1.977	3.052	8.356	34.781	41.0



\*Measured value of the largest particle in the sample and not a sieve weight

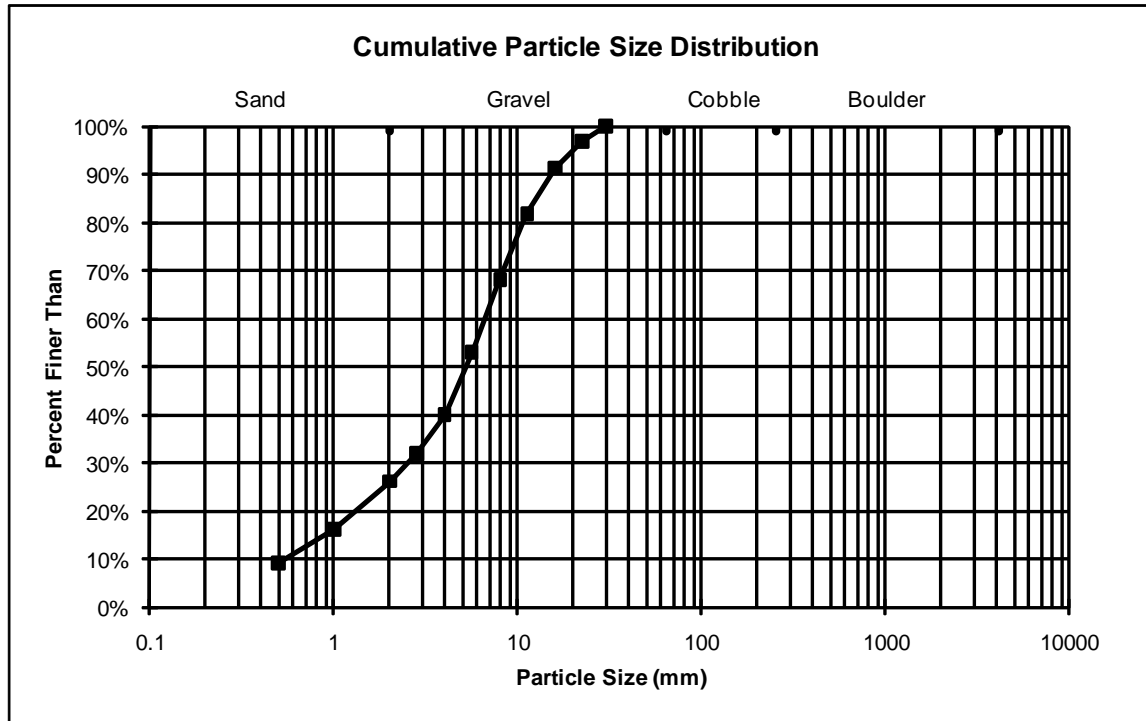
**Sieve Analysis Worksheet**

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	115.20	9.0%	
0.5	90.80	7.1%	9.0%
1.0	127.50	10.0%	16.1%
2.0	74.60	5.8%	26.1%
2.8	101.30	7.9%	32.0%
4.0	166.30	13.0%	39.9%
5.6	191.80	15.0%	52.9%
8.0	175.80	13.8%	68.0%
11.2	123.40	9.7%	81.7%
16.0	68.00	5.3%	91.4%
22.4	41.80	3.3%	96.7%
30.0	*		100.0%
45.0			-
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1276.50		

**SITE NAME:** Pike's Peak Highway - Fill Slope  
**ID NUMBER:** 101FS Upper Fence  
**DATE:** 6/21/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.895	3.208	5.191	12.178	20.087	30.0



\*Measured value of the largest particle in the sample and not a sieve weight

**Sieve Analysis Worksheet**

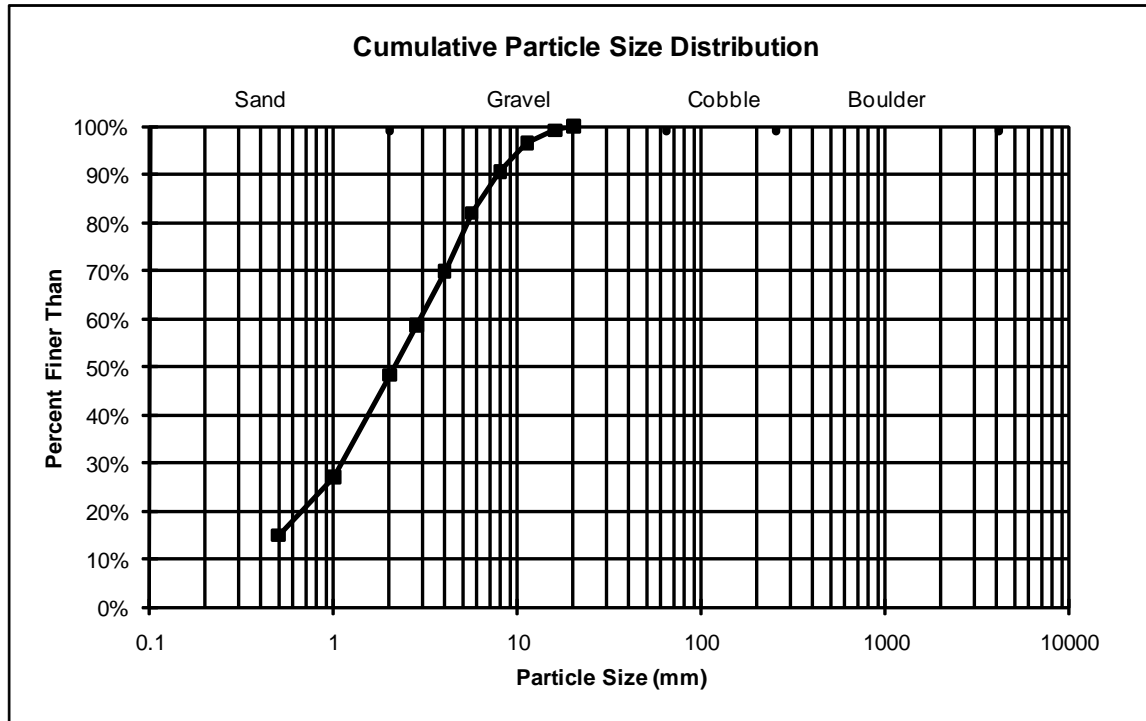
Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	192.00	14.9%	
0.5	158.00	12.2%	14.9%
1.0	272.50	21.1%	27.1%
2.0	134.40	10.4%	48.2%
2.8	144.00	11.1%	58.6%
4.0	157.80	12.2%	69.7%
5.6	110.80	8.6%	82.0%
8.0	77.10	6.0%	90.5%
11.2	34.00	2.6%	96.5%
16.0	11.10	0.9%	99.1%
20.0	*		100.0%
32.0			-
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1291.70		

\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

**SITE NAME:** Pike's Peak Highway - Fill Slope  
**ID NUMBER:** 124FS Lower Fence  
**DATE:** 6/21/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.504	1.297	2.120	6.095	10.287	20.0



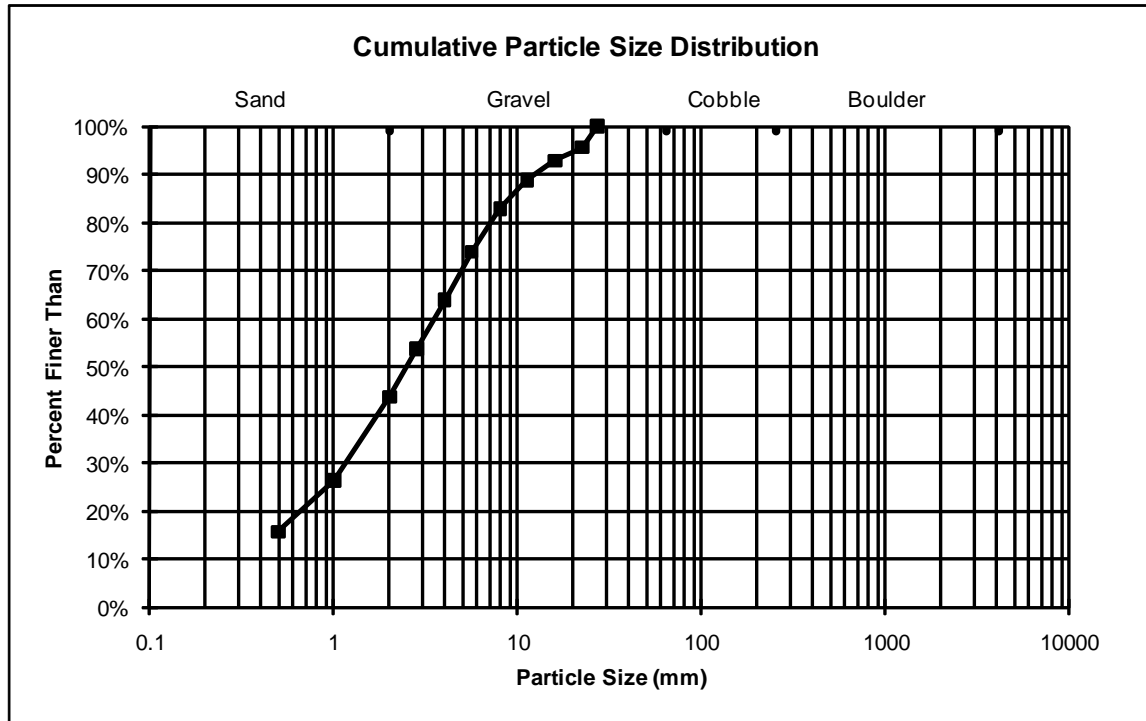
**Sieve Analysis Worksheet**

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	197.20	15.7%	
0.5	134.40	10.7%	15.7%
1.0	218.90	17.4%	26.3%
2.0	124.50	9.9%	43.7%
2.8	128.00	10.2%	53.6%
4.0	127.50	10.1%	63.7%
5.6	113.90	9.0%	73.9%
8.0	72.70	5.8%	82.9%
11.2	52.70	4.2%	88.7%
16.0	34.10	2.7%	92.9%
22.4	55.80	4.4%	95.6%
27.0	*		100.0%
45.0			-
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1259.70		

**SITE NAME:** Pike's Peak Highway - Fill Slope  
**ID NUMBER:** 124FS Upper Fence  
**DATE:** 6/21/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.408	1.414	2.478	8.526	20.867	27.0



\*Measured value of the largest particle in the sample and not a sieve weight

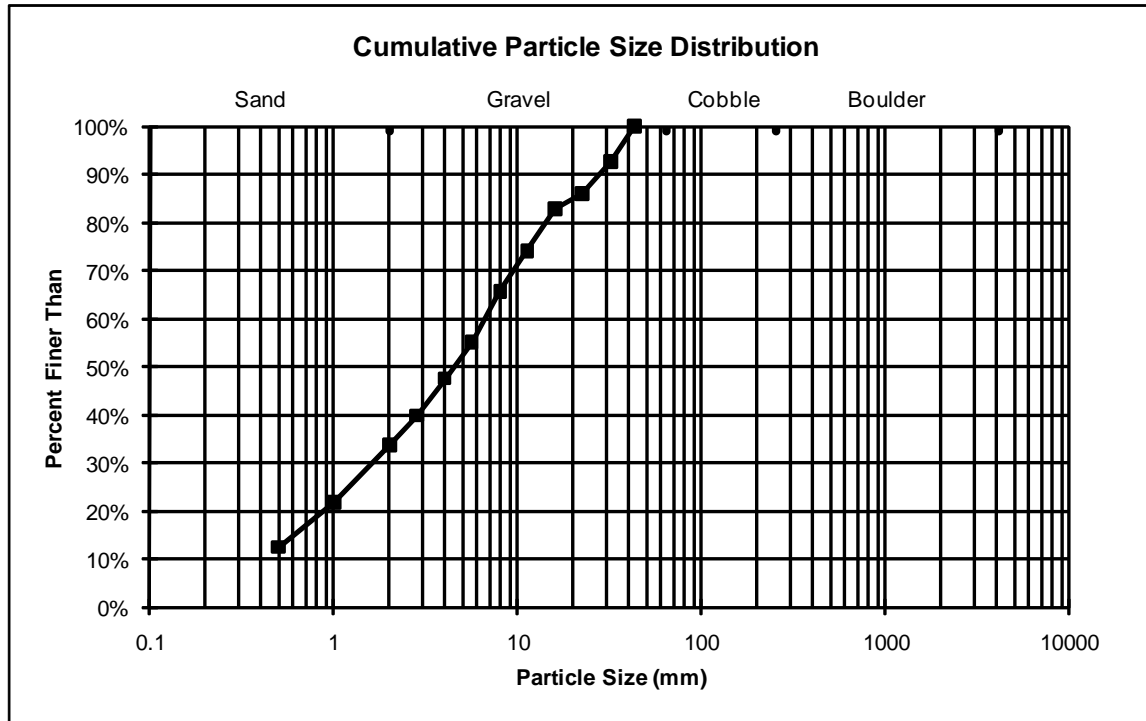
**Sieve Analysis Worksheet**

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	146.40	12.4%	
0.5	110.80	9.4%	12.4%
1.0	139.10	11.8%	21.8%
2.0	73.10	6.2%	33.6%
2.8	91.20	7.7%	39.8%
4.0	88.80	7.5%	47.5%
5.6	124.00	10.5%	55.0%
8.0	101.50	8.6%	65.5%
11.2	102.40	8.7%	74.1%
16.0	36.20	3.1%	82.8%
22.4	80.70	6.8%	85.9%
32.0	85.90	7.3%	92.7%
43.0	*		100.0%
64.0			-
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1180.10		

**SITE NAME:** Pike's Peak Highway - Fill Slope  
**ID NUMBER:** 177FS Upper Fence  
**DATE:** 5/7/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.606	2.160	4.472	18.221	35.102	43.0



\*Measured value of the largest particle in the sample and not a sieve weight

**Sieve Analysis Worksheet**

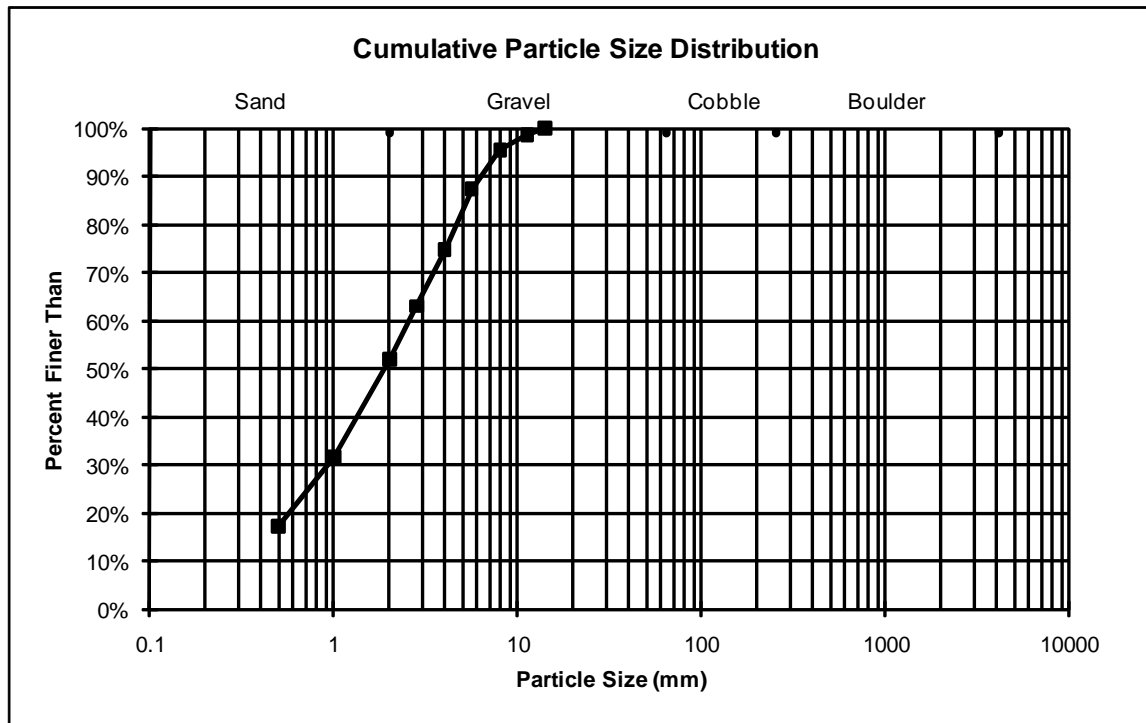
Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	174.60	17.1%	
0.5	147.60	14.5%	17.1%
1.0	207.70	20.4%	31.6%
2.0	111.80	11.0%	52.0%
2.8	119.30	11.7%	63.0%
4.0	127.70	12.5%	74.7%
5.6	83.00	8.2%	87.3%
8.0	31.90	3.1%	95.4%
11.2	14.70	1.4%	98.6%
14.0	*		100.0%
22.4			-
32.0			
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1018.30		

\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

**SITE NAME:** Pike's Peak Highway - Fill Slope  
**ID NUMBER:** 186FS Lower Fence  
**DATE:** 8/12/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.272	1.121	1.866	5.129	7.853	14.0



**Sieve Analysis Worksheet**

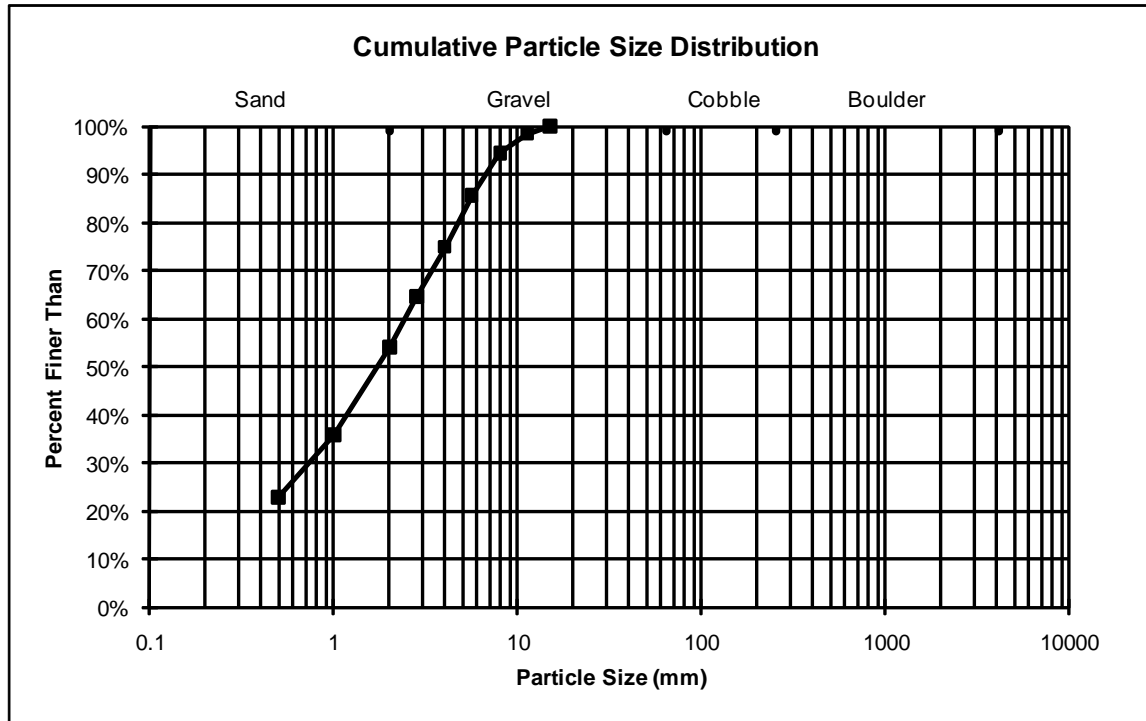
Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	215.90	22.8%	
0.5	122.90	13.0%	22.8%
1.0	174.10	18.4%	35.7%
2.0	100.20	10.6%	54.1%
2.8	96.70	10.2%	64.7%
4.0	102.40	10.8%	74.9%
5.6	83.00	8.8%	85.7%
8.0	37.70	4.0%	94.4%
11.2	15.20	1.6%	98.4%
15.0	*		100.0%
22.4			-
32.0			
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	948.10		

\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

**SITE NAME:** Pike's Peak Highway - Fill Slope  
**ID NUMBER:** 186FS Upper Fence  
**DATE:** 8/12/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.095	0.961	1.713	5.317	8.402	15.0



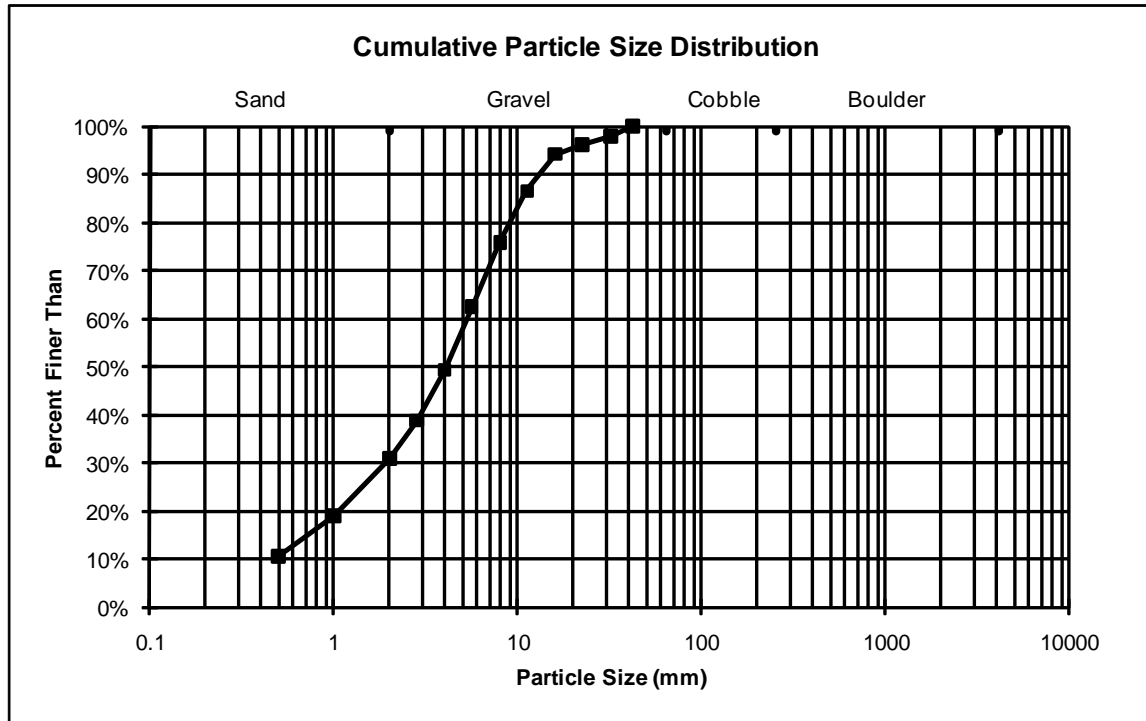
**Sieve Analysis Worksheet**

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	115.80	10.6%	
0.5	90.60	8.3%	10.6%
1.0	131.50	12.1%	18.9%
2.0	84.80	7.8%	31.0%
2.8	115.20	10.6%	38.8%
4.0	144.40	13.2%	49.3%
5.6	143.10	13.1%	62.6%
8.0	118.20	10.8%	75.7%
11.2	83.70	7.7%	86.5%
16.0	20.70	1.9%	94.2%
22.4	19.40	1.8%	96.1%
32.0	23.20	2.1%	97.9%
42.0	*		100.0%
64.0			-
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1090.60		

**SITE NAME:** Pike's Peak Highway - Fill Slope  
**ID NUMBER:** 193FS Upper Fence  
**DATE:** 7/26/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.721	2.380	4.070	10.357	18.451	42.0



\*Measured value of the largest particle in the sample and not a sieve weight



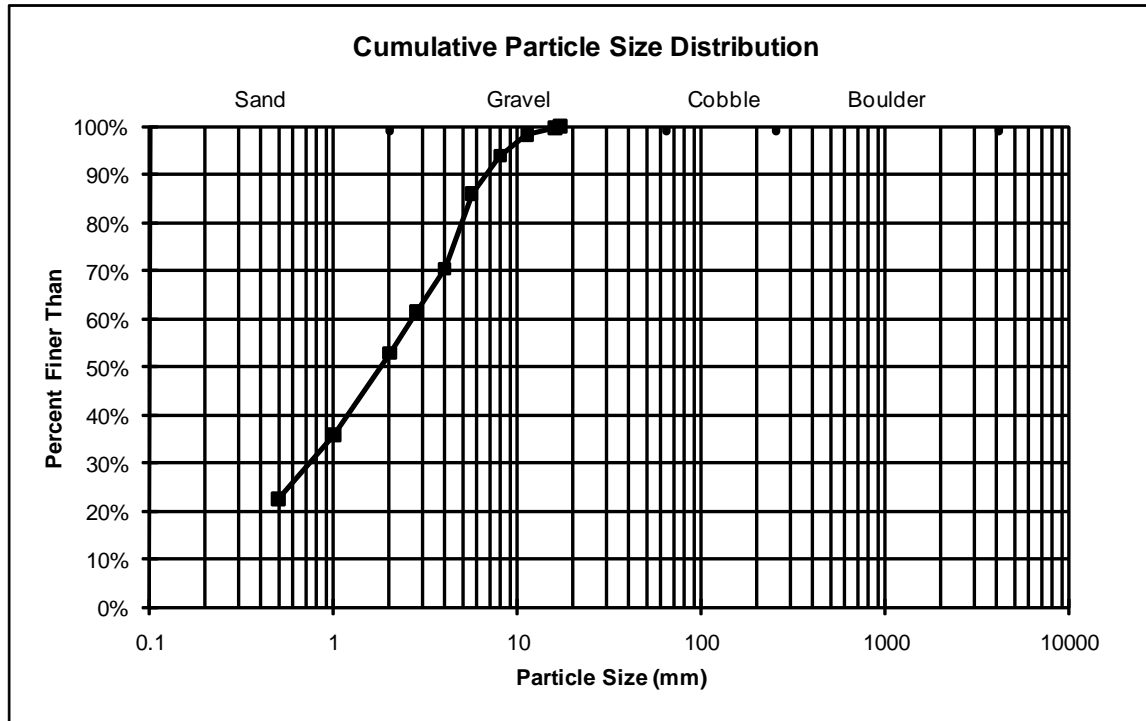
**Sieve Analysis Worksheet**

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	221.60	22.4%	
0.5	132.30	13.4%	22.4%
1.0	167.70	17.0%	35.8%
2.0	84.70	8.6%	52.8%
2.8	89.30	9.0%	61.3%
4.0	154.90	15.7%	70.4%
5.6	77.10	7.8%	86.0%
8.0	44.60	4.5%	93.8%
11.2	11.70	1.2%	98.4%
16.0	4.60	0.5%	99.5%
17.0	*		100.0%
32.0			-
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	988.50		

**SITE NAME:** Pike's Peak Highway - Fill Slope  
**ID NUMBER:** 204FS Lower Fence  
**DATE:** 5/7/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.100	0.959	1.786	5.360	8.723	17.0



\*Measured value of the largest particle in the sample and not a sieve weight

**Sieve Analysis Worksheet**

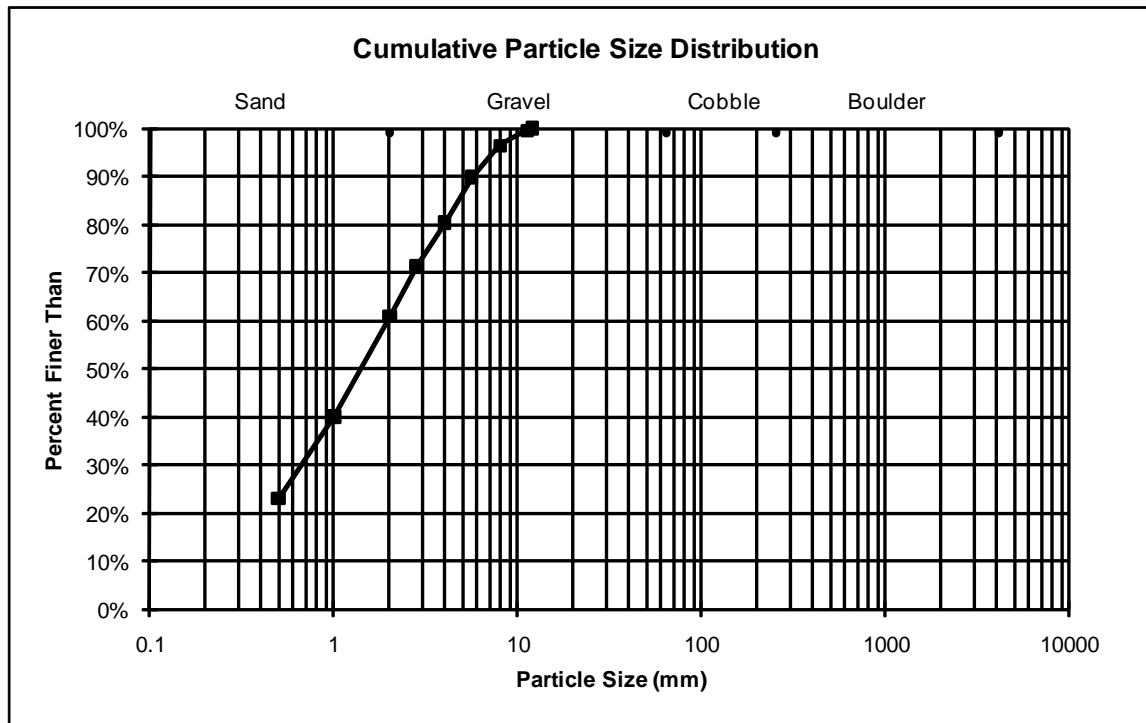
Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	324.70	22.9%	
0.5	240.50	17.0%	22.9%
1.0	296.30	20.9%	39.9%
2.0	147.60	10.4%	60.9%
2.8	127.50	9.0%	71.3%
4.0	134.20	9.5%	80.3%
5.6	92.90	6.6%	89.8%
8.0	44.70	3.2%	96.4%
11.2	6.90	0.5%	99.5%
12.0	*		100.0%
22.4			-
32.0			
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1415.30		

\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

**SITE NAME:** Pike's Peak Highway - Fill Slope  
**ID NUMBER:** 204FS Upper Fence  
**DATE:** 5/7/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.093	0.818	1.395	4.560	7.432	12.0

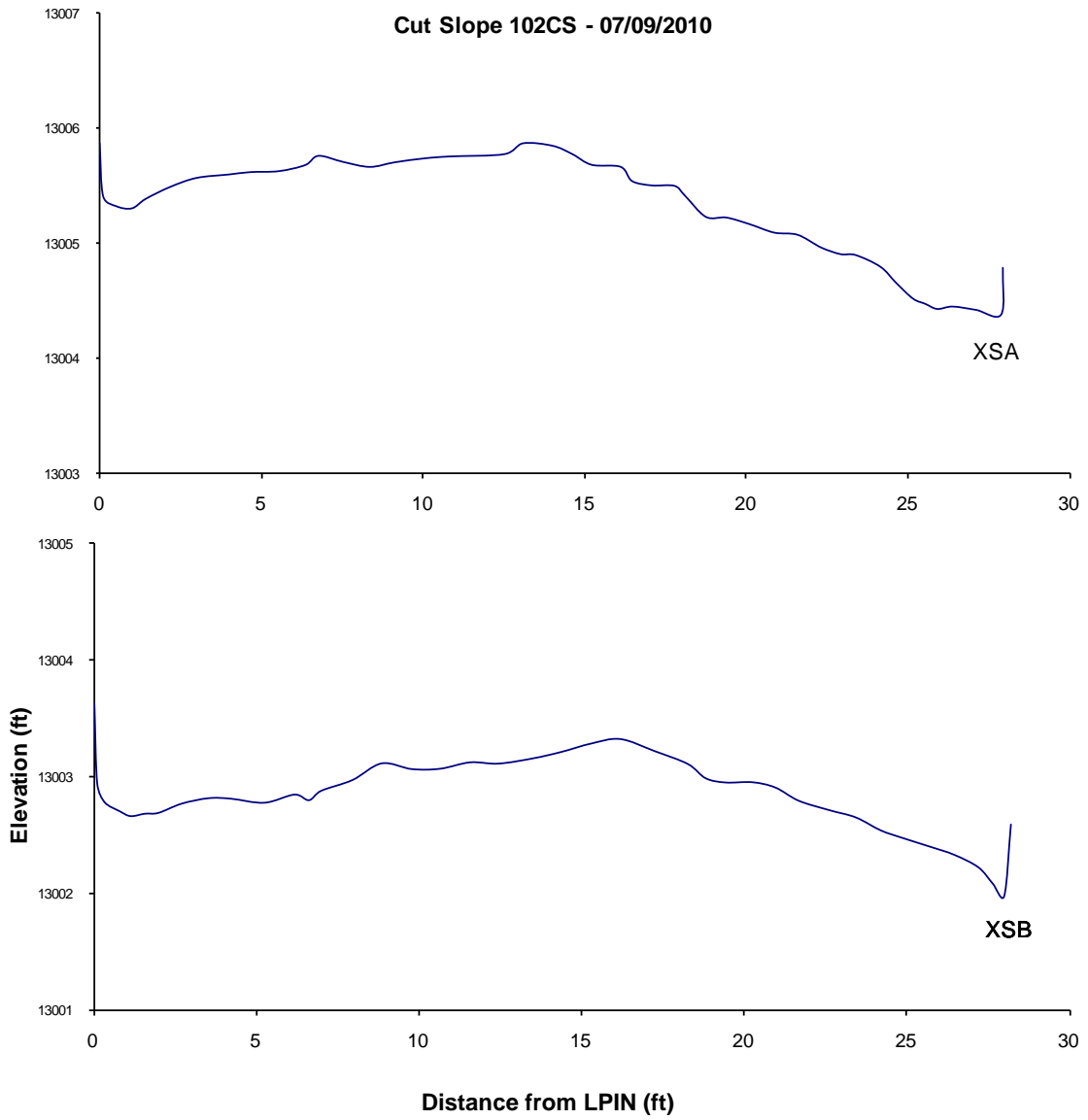


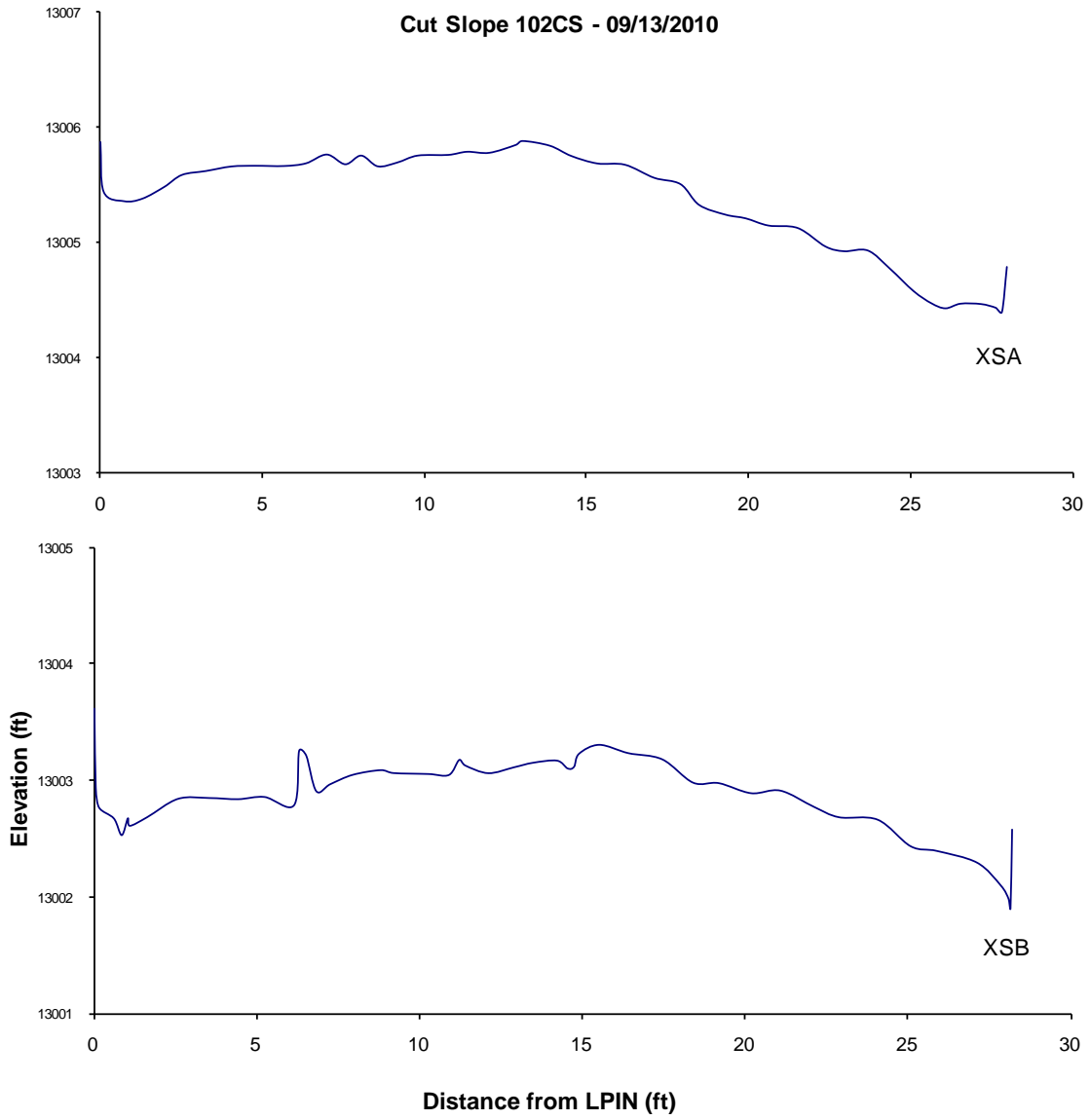
# Appendix H

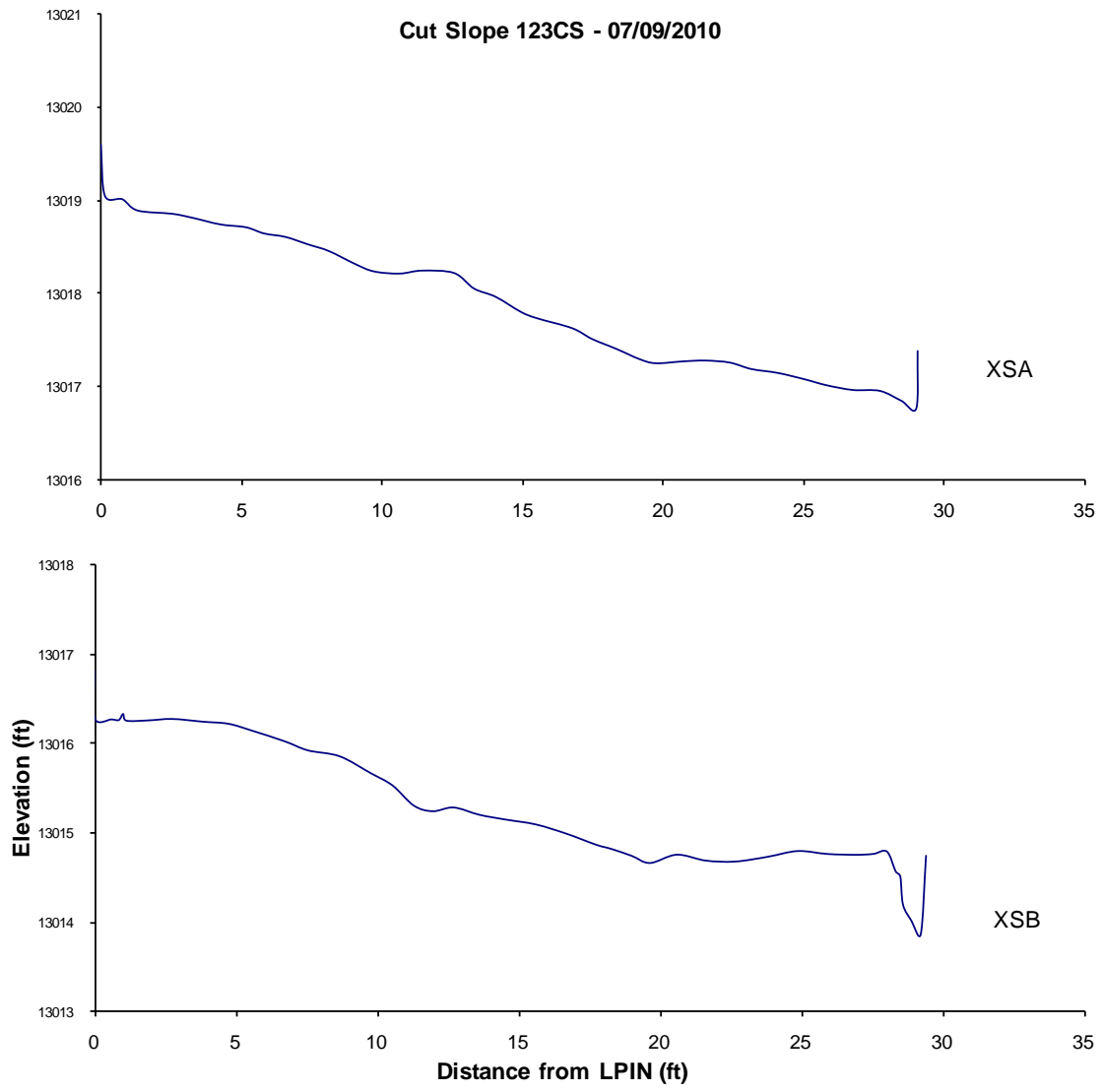
## Cut Slope

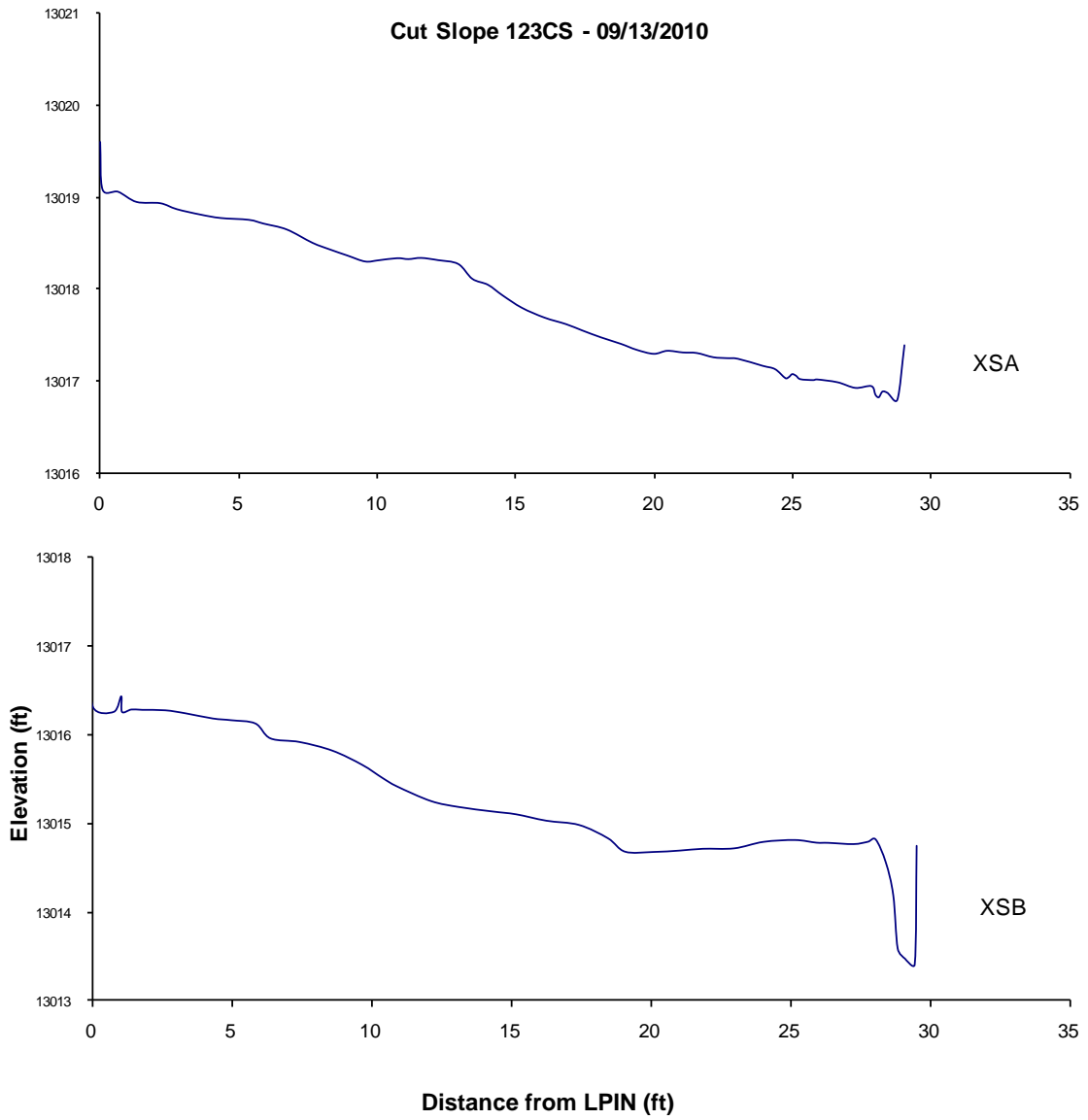
### Cross Section Graphs

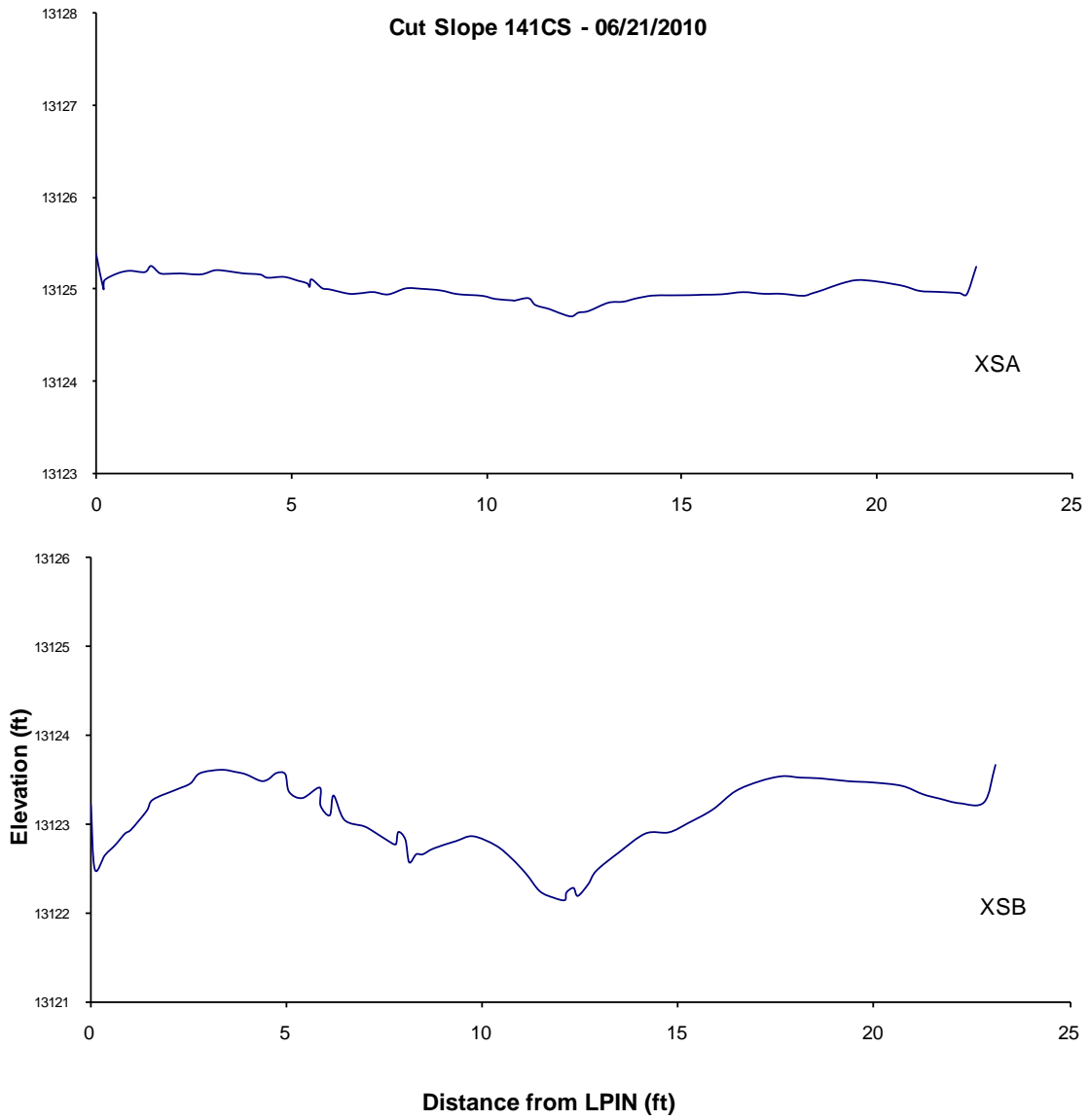
2010



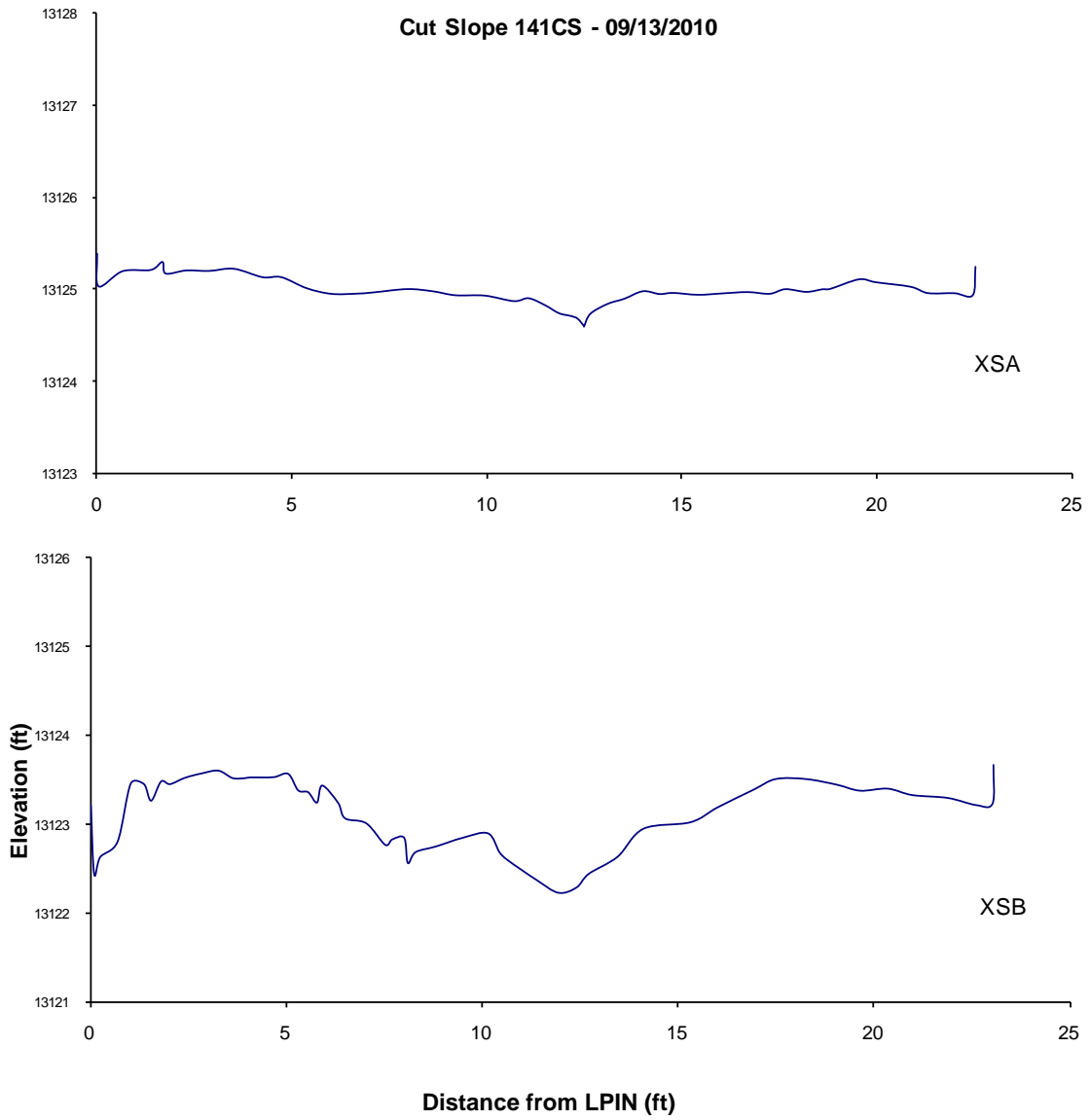












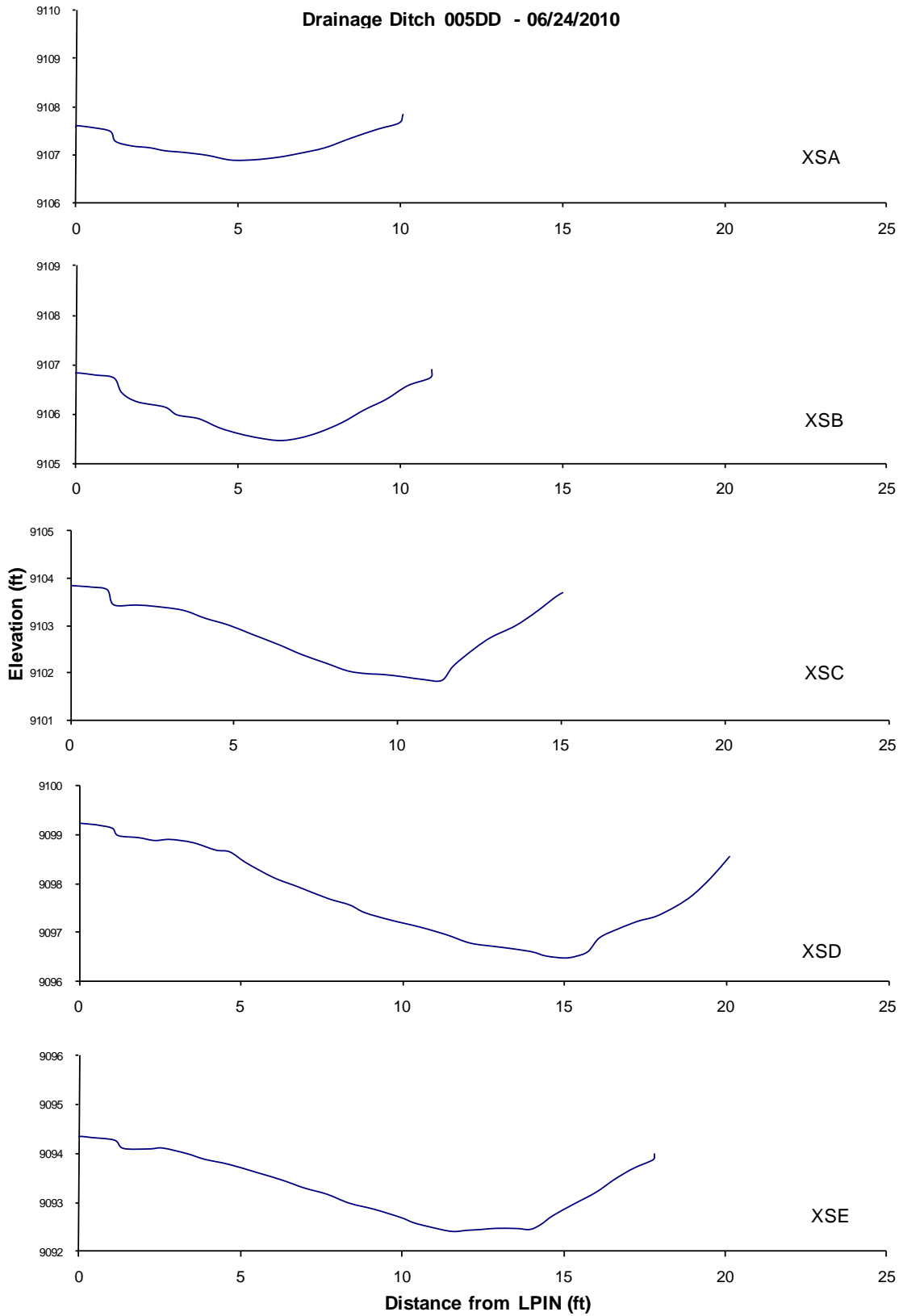


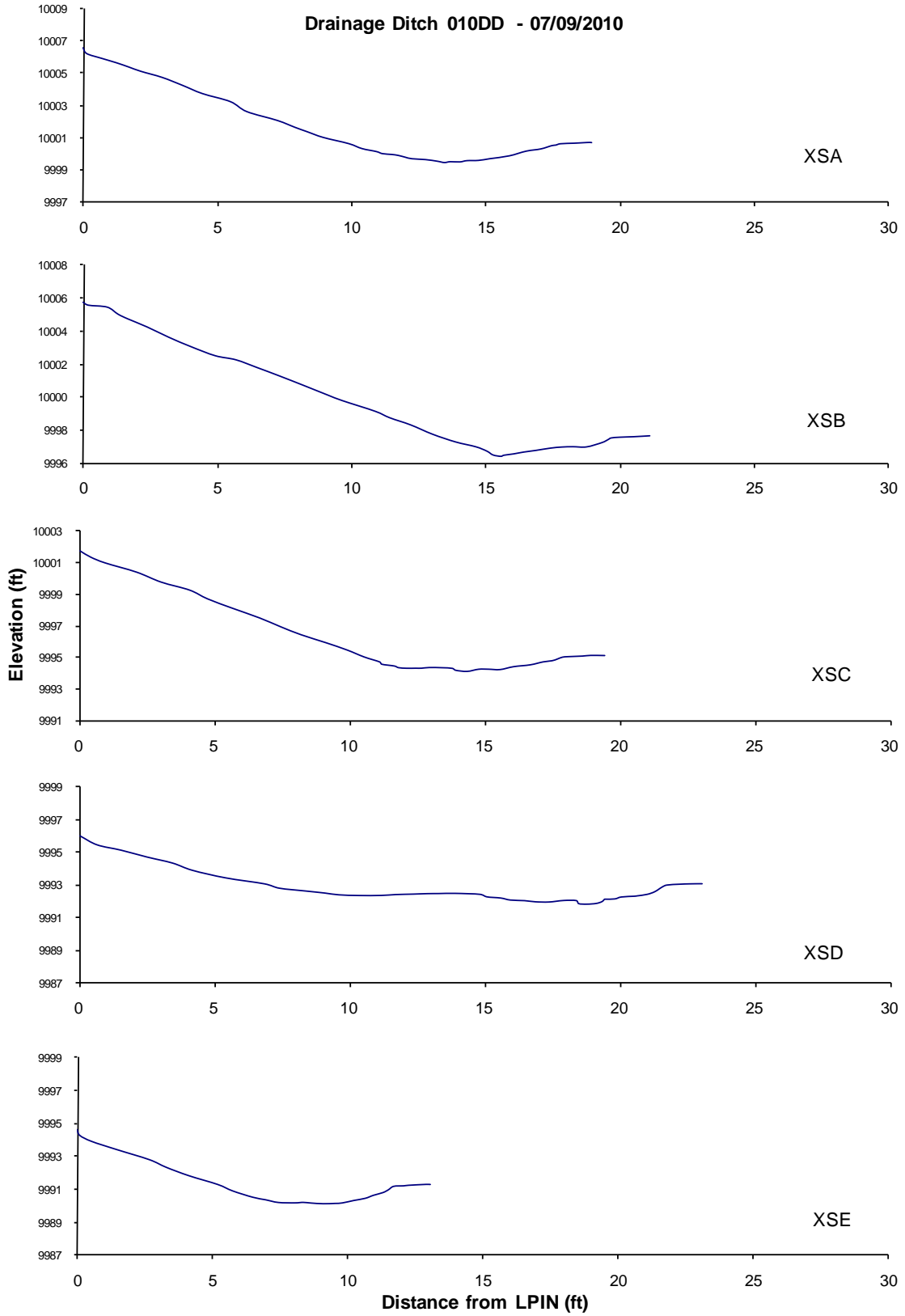
# Appendix I

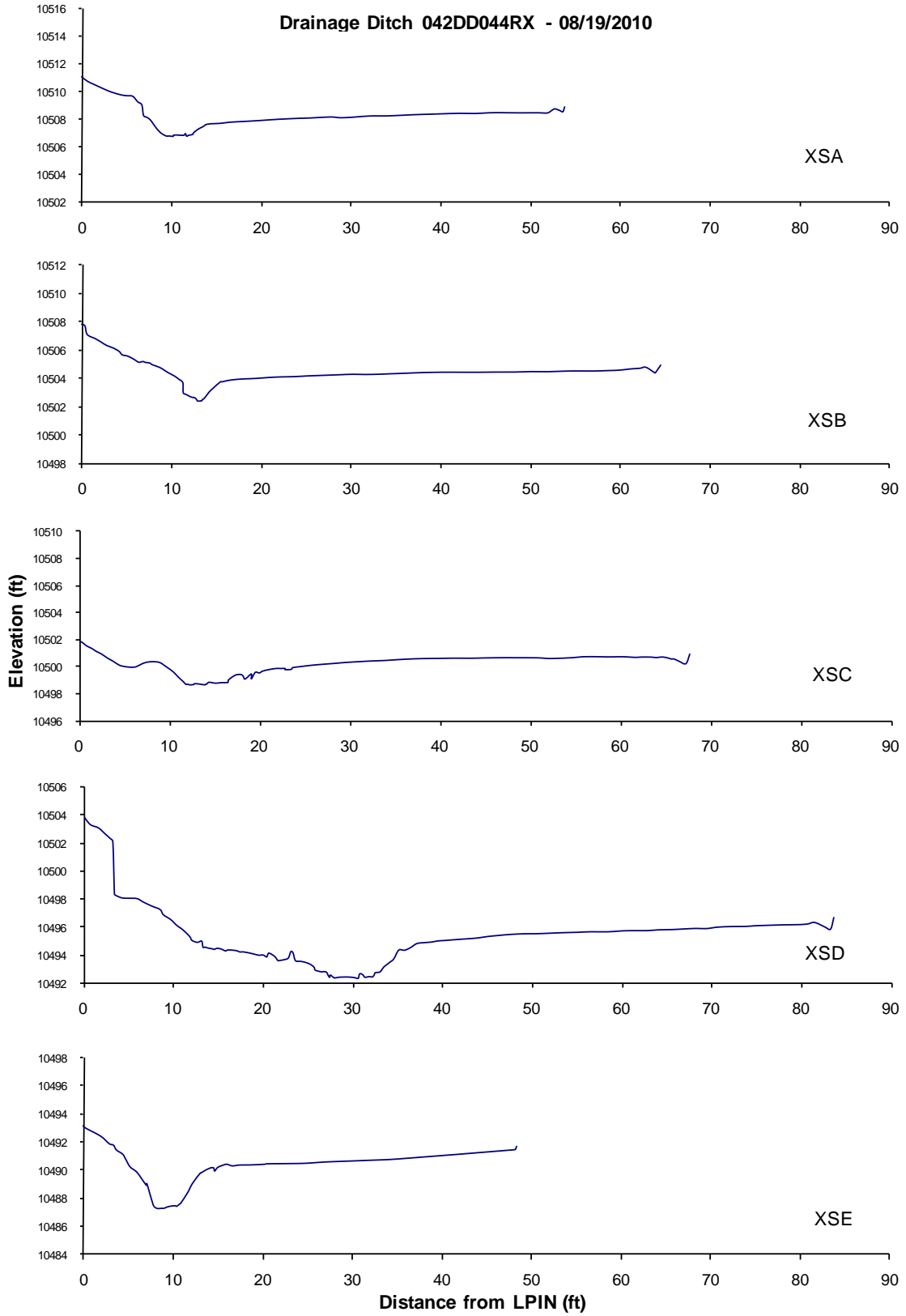
## Drainage Ditch

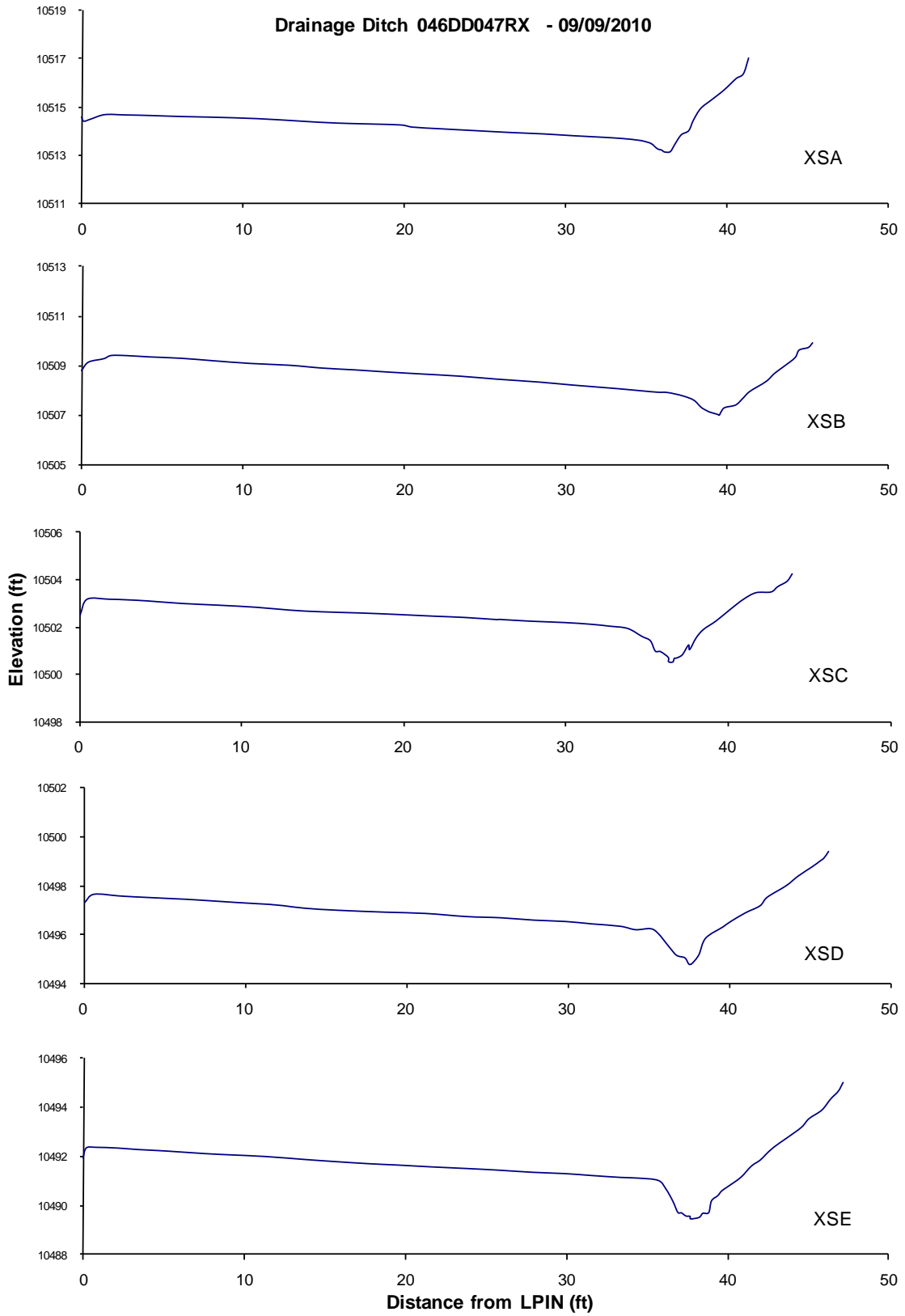
### Cross Section Graphs

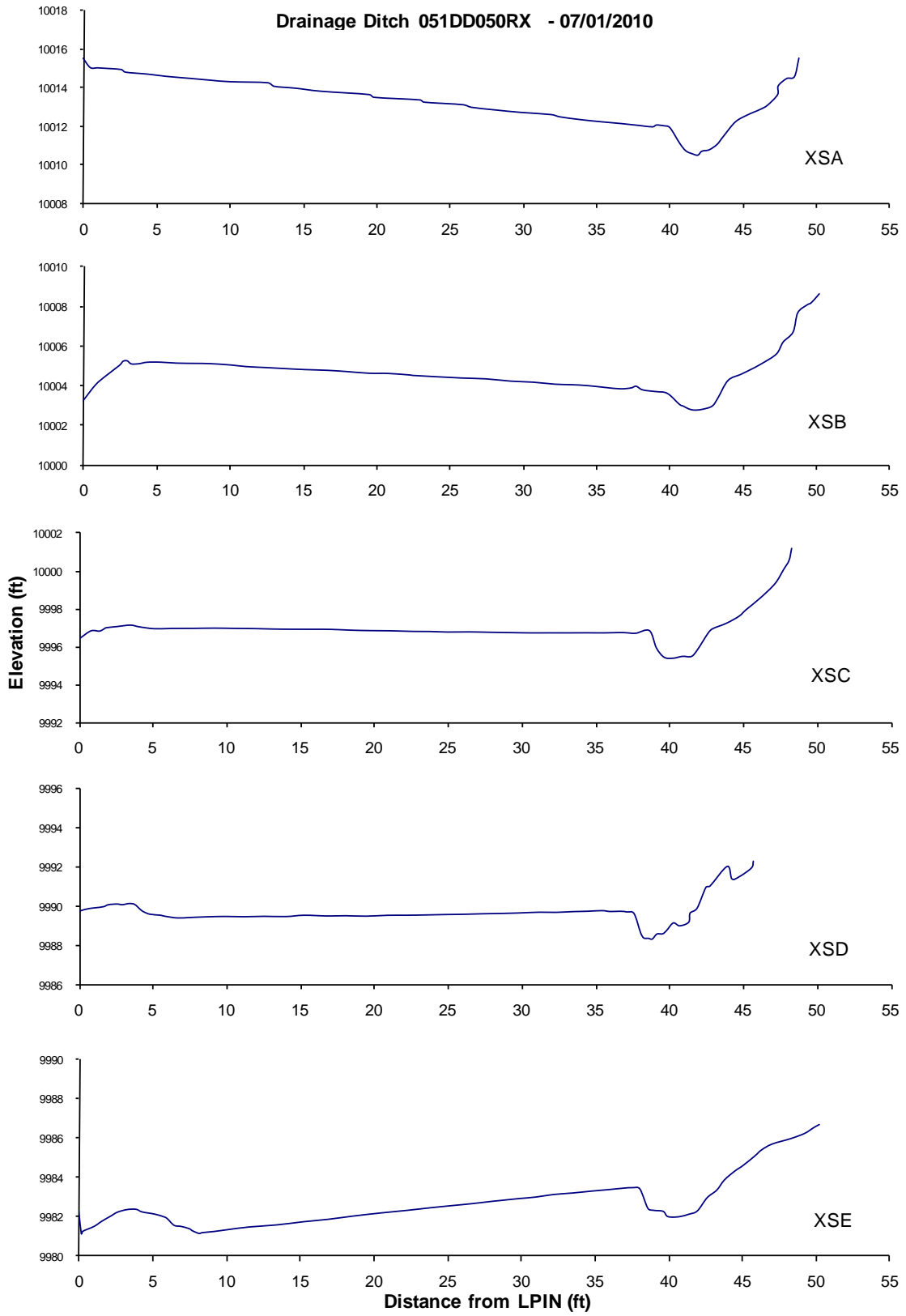
2010



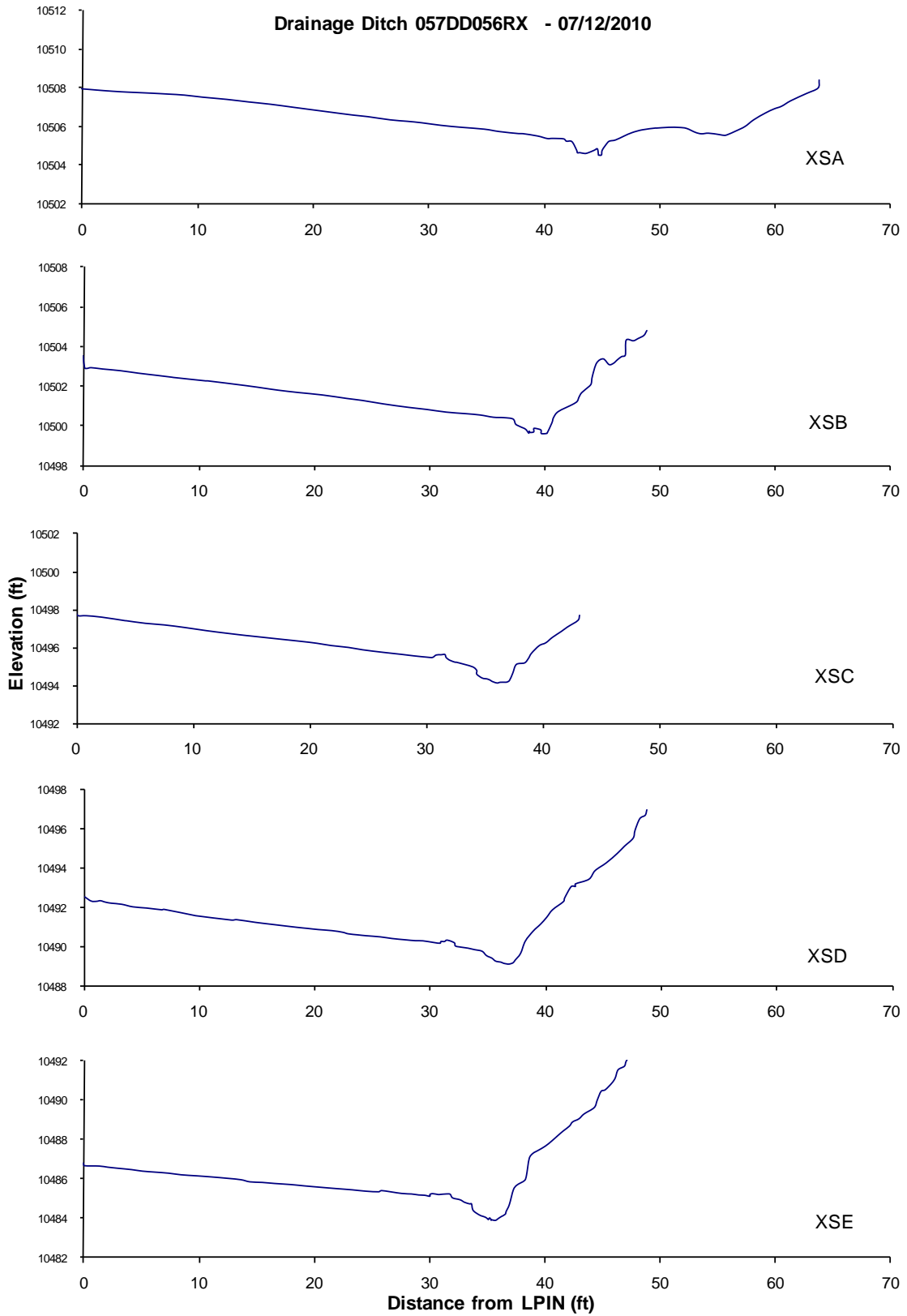




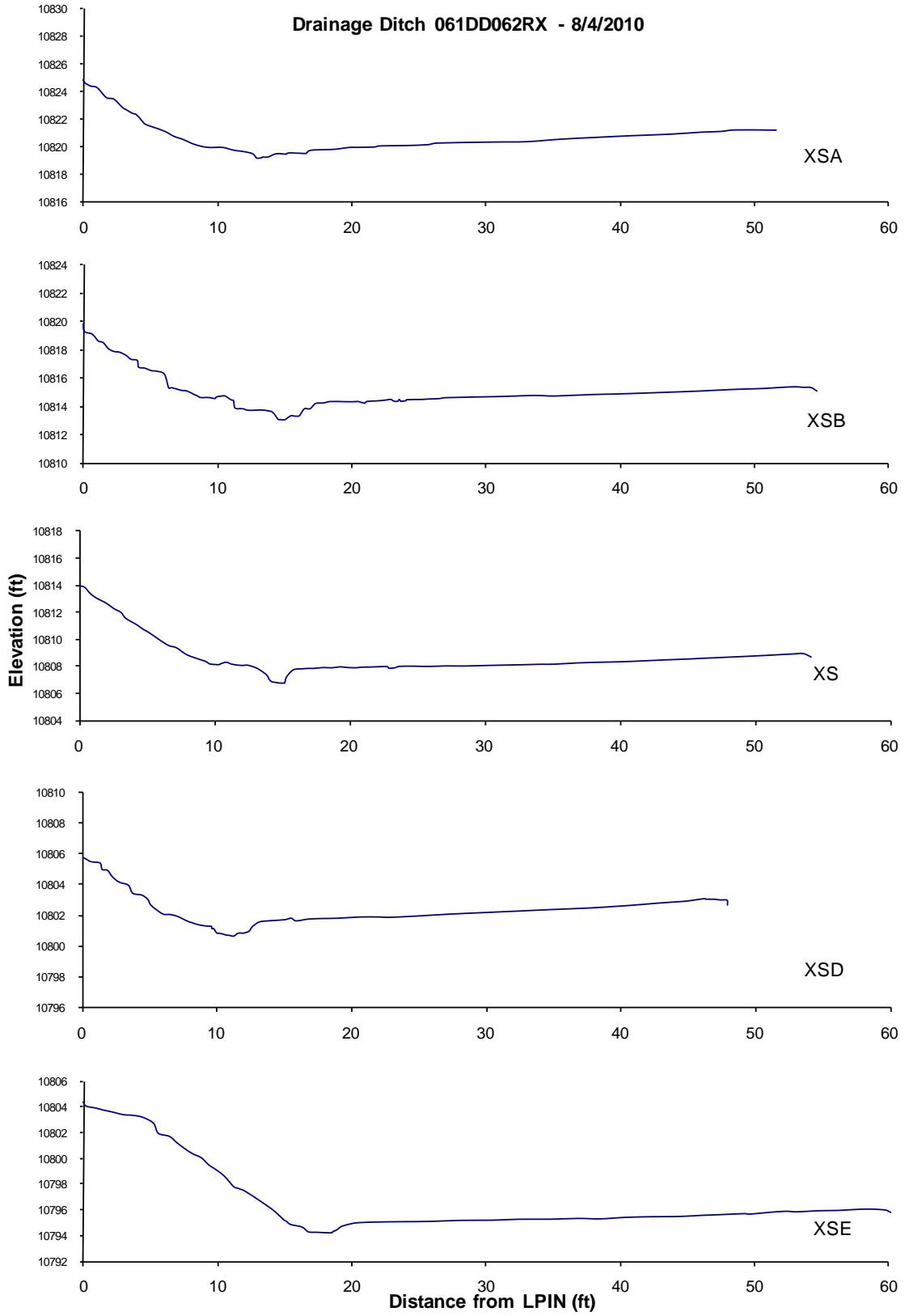


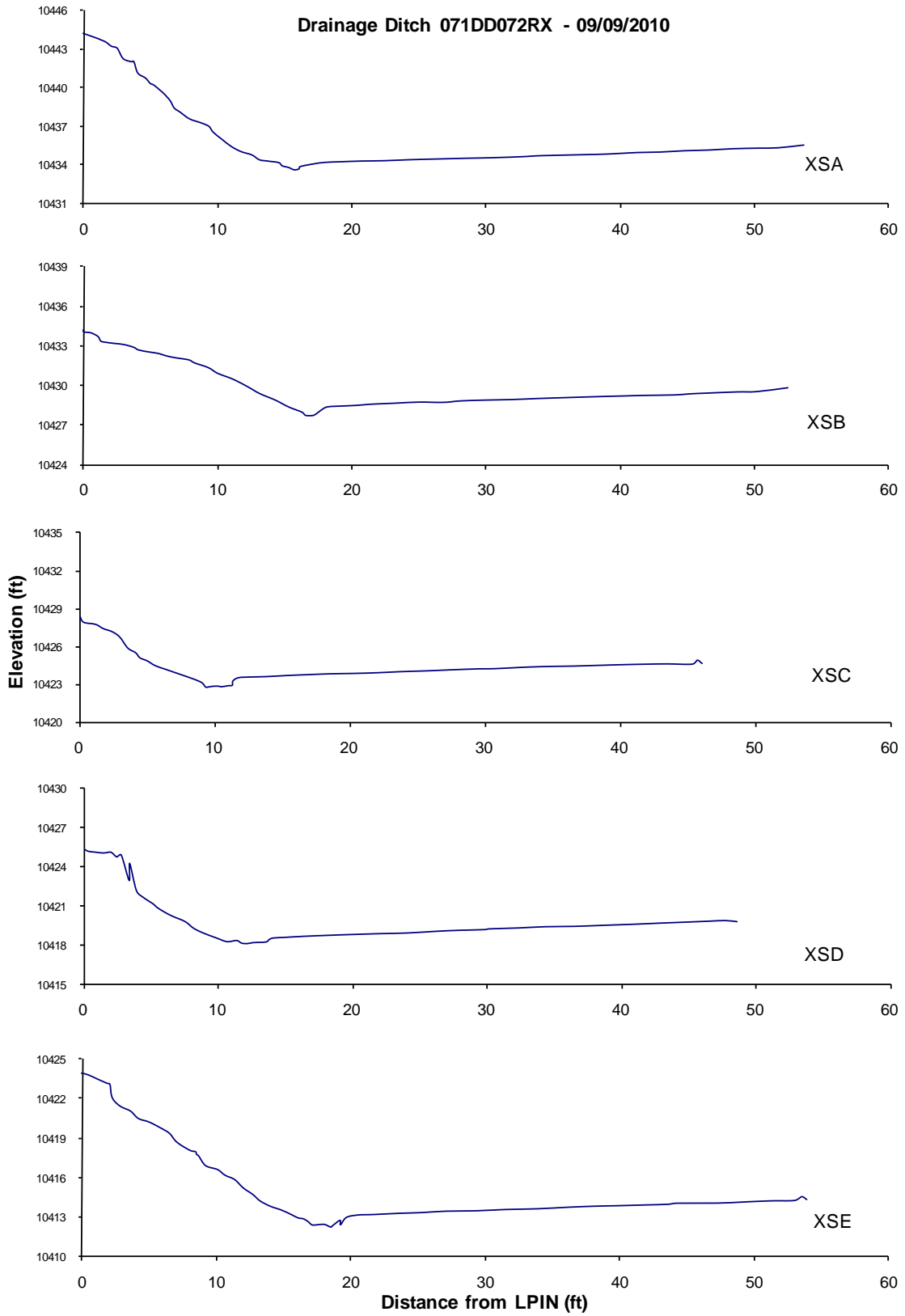


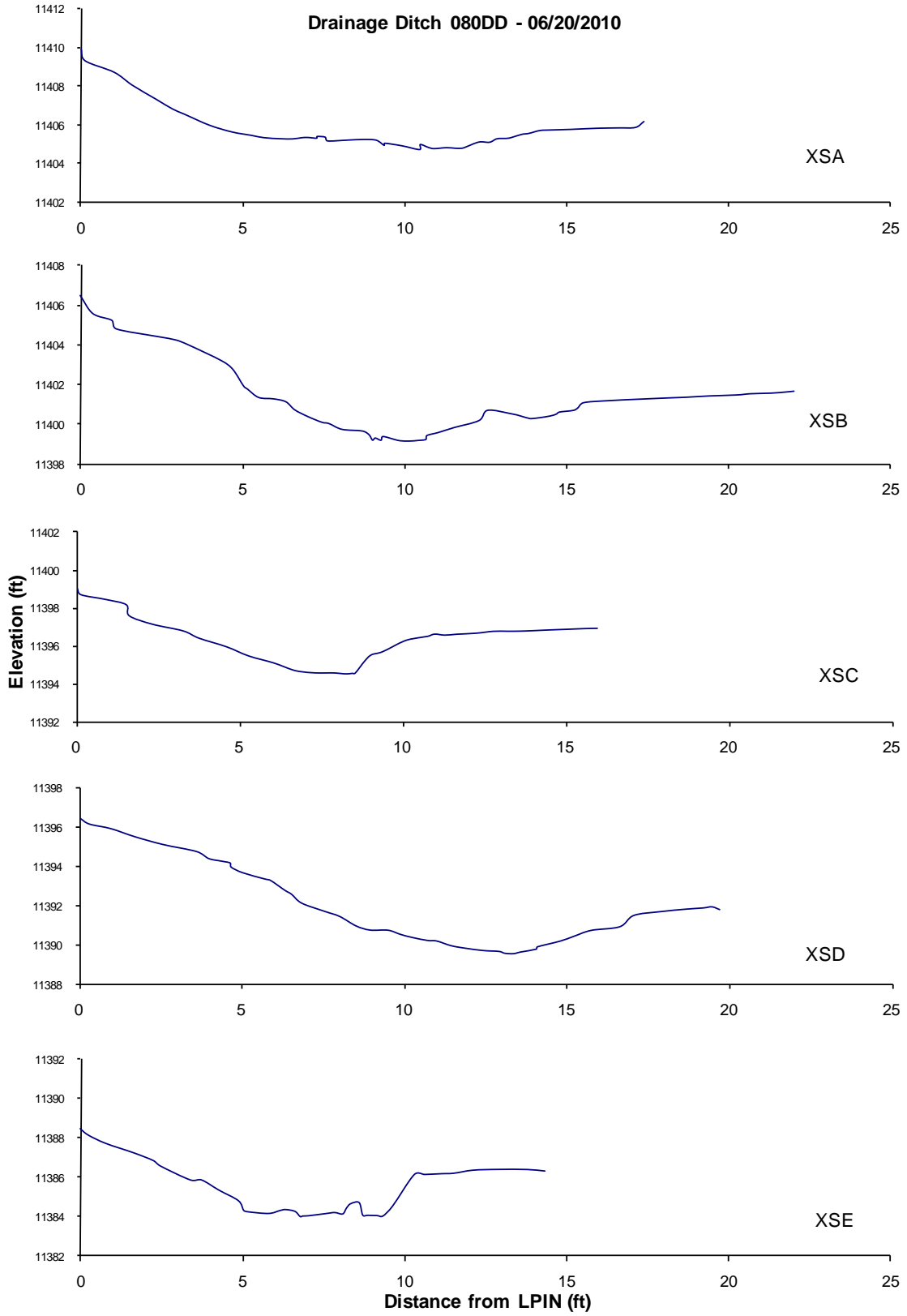


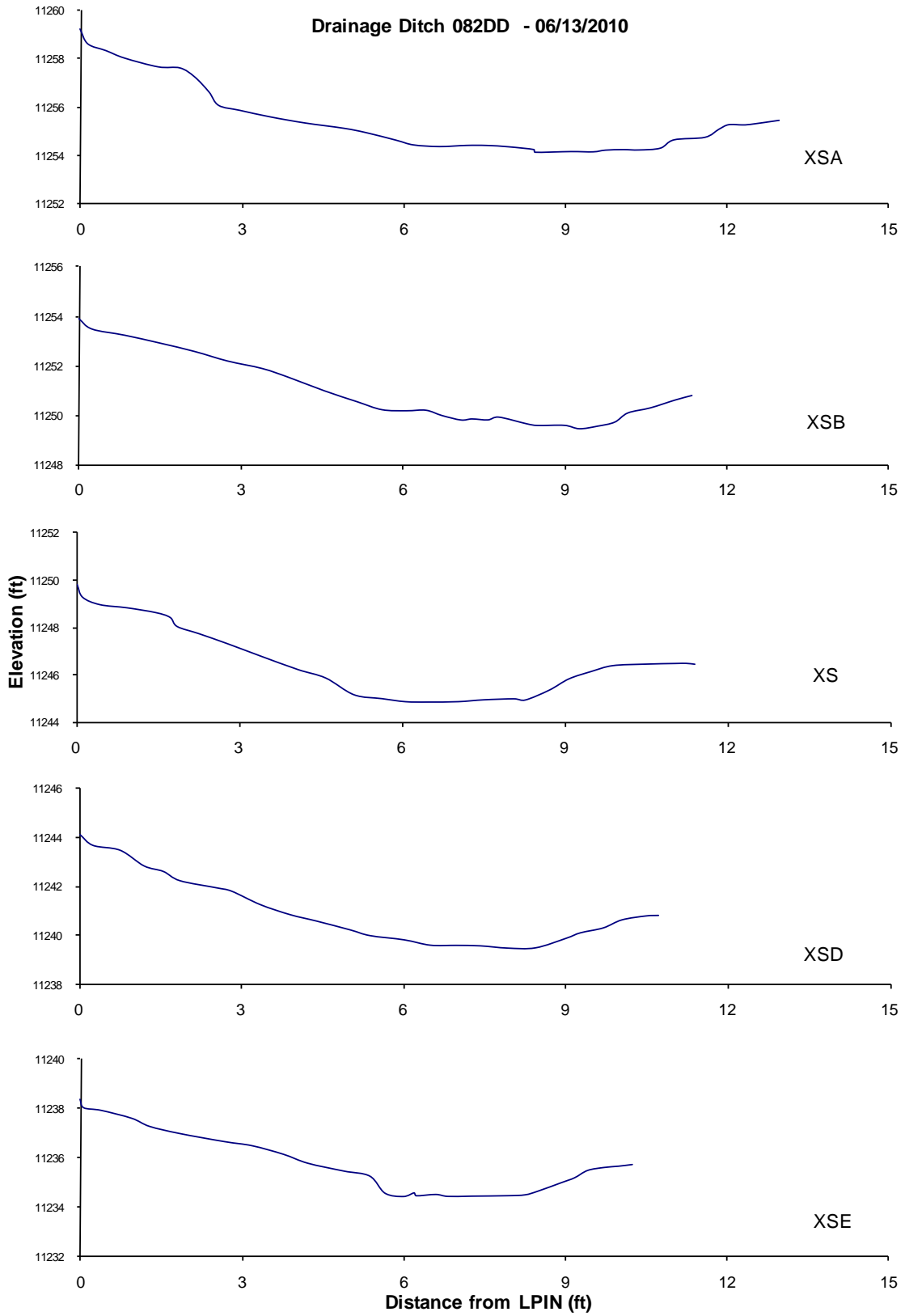


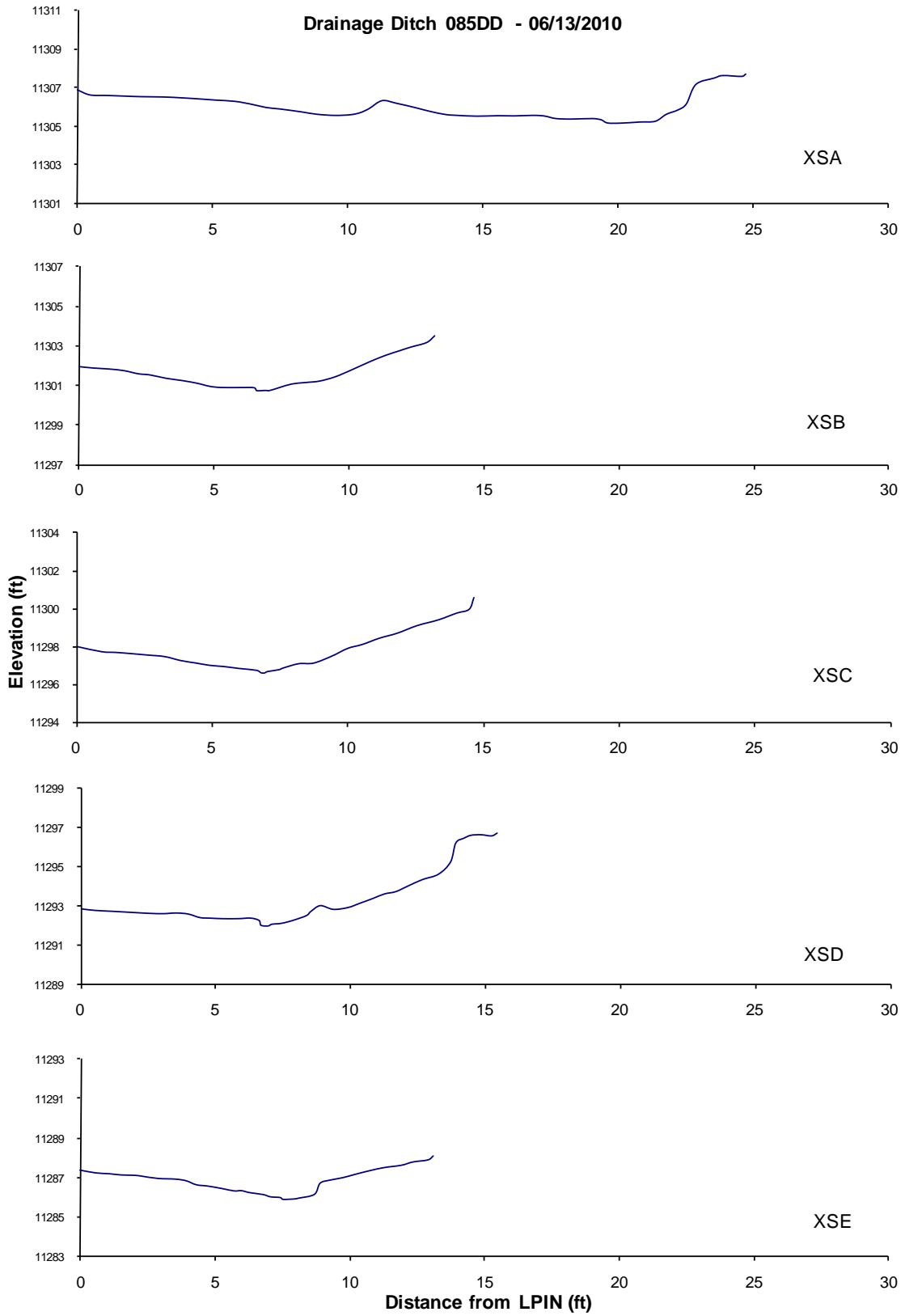
Drainage Ditch 061DD062RX - 8/4/2010

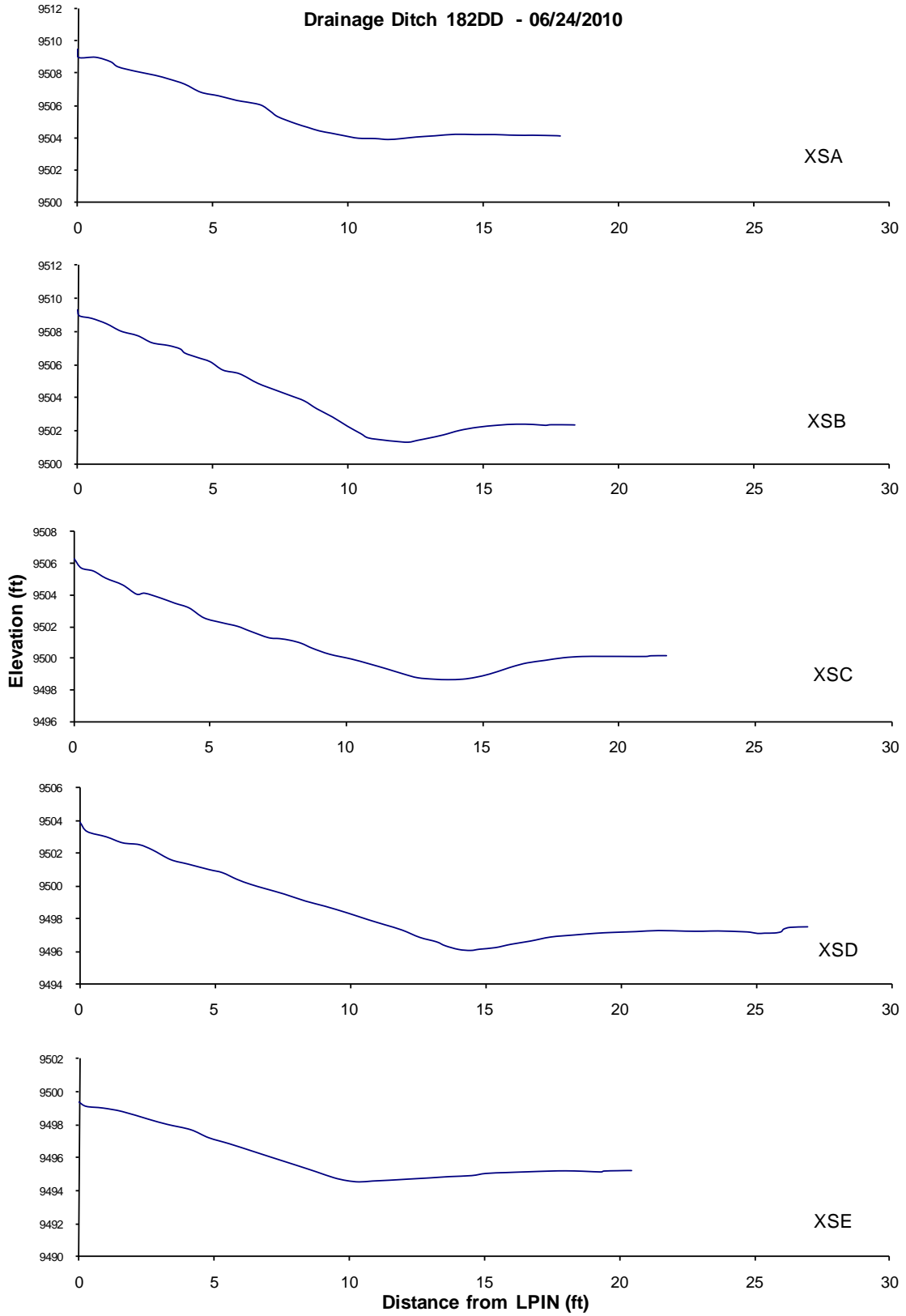


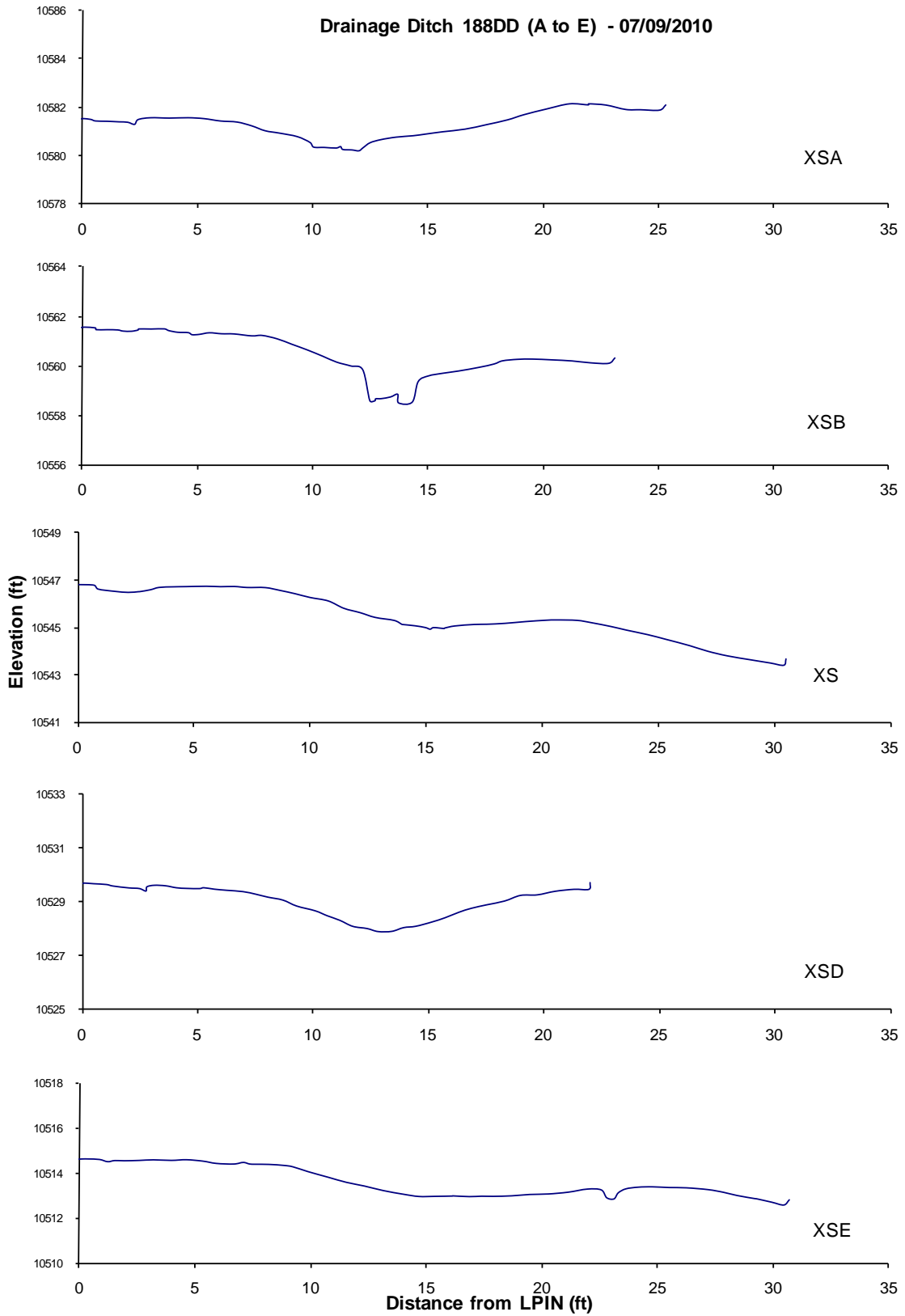




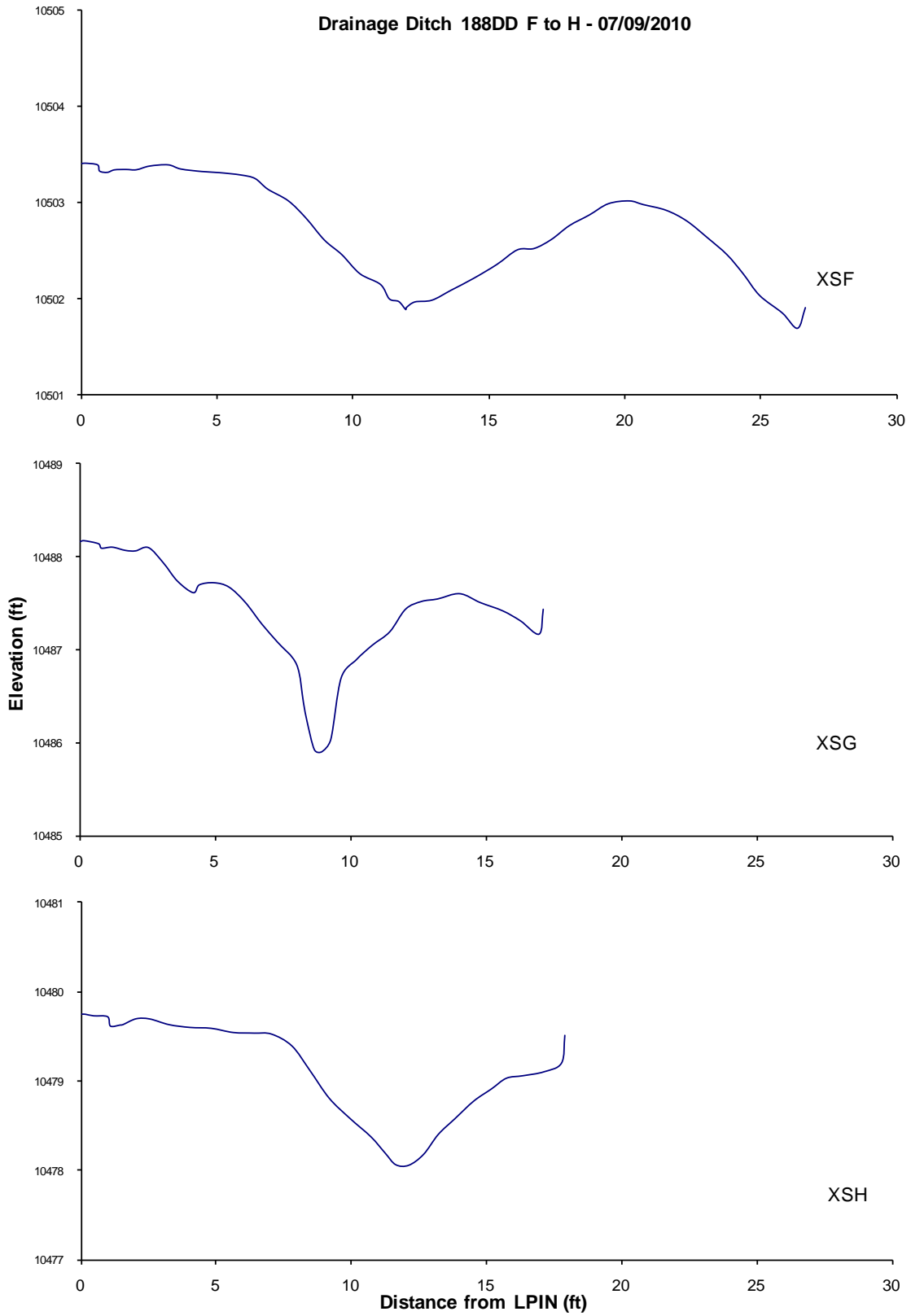


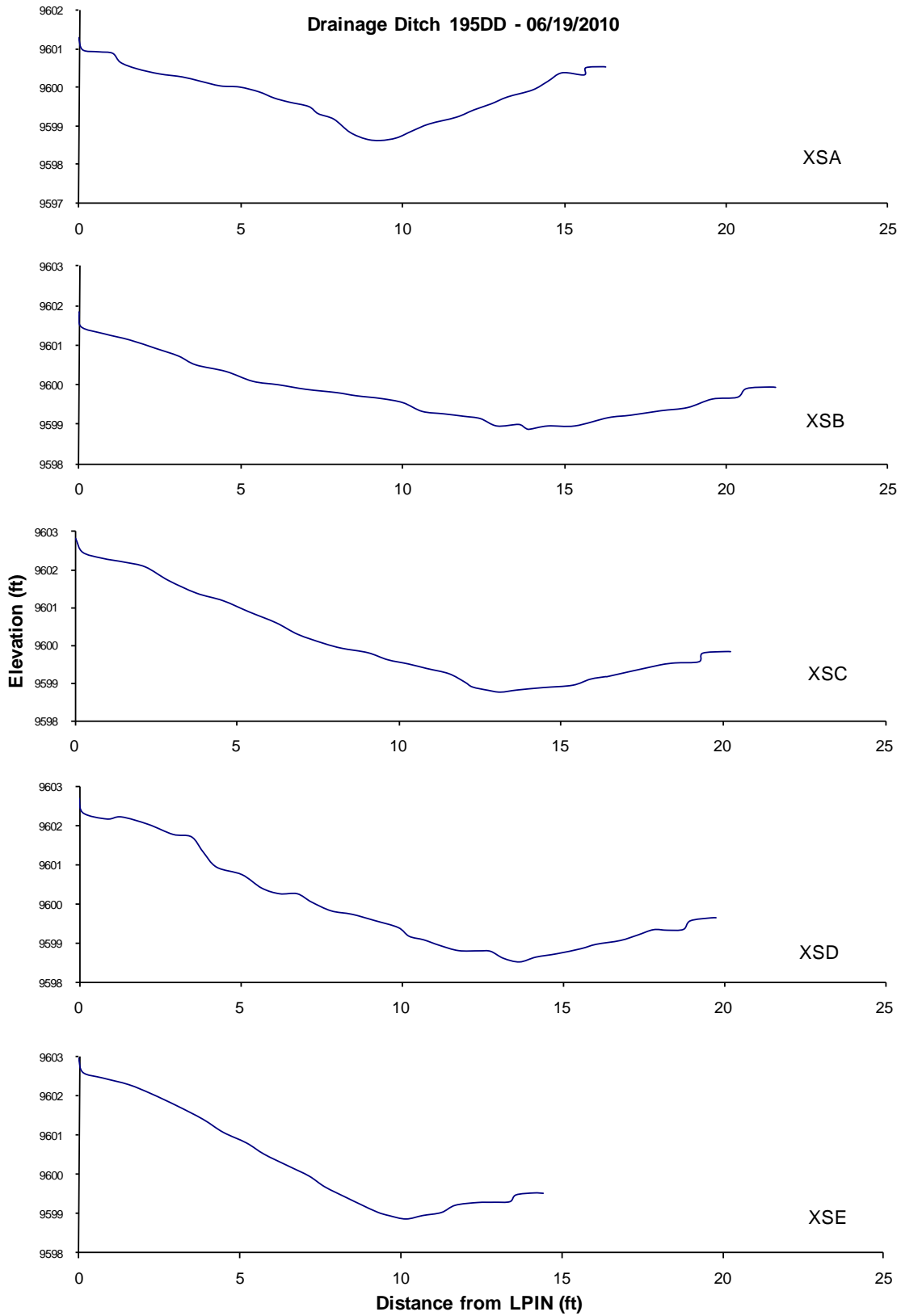


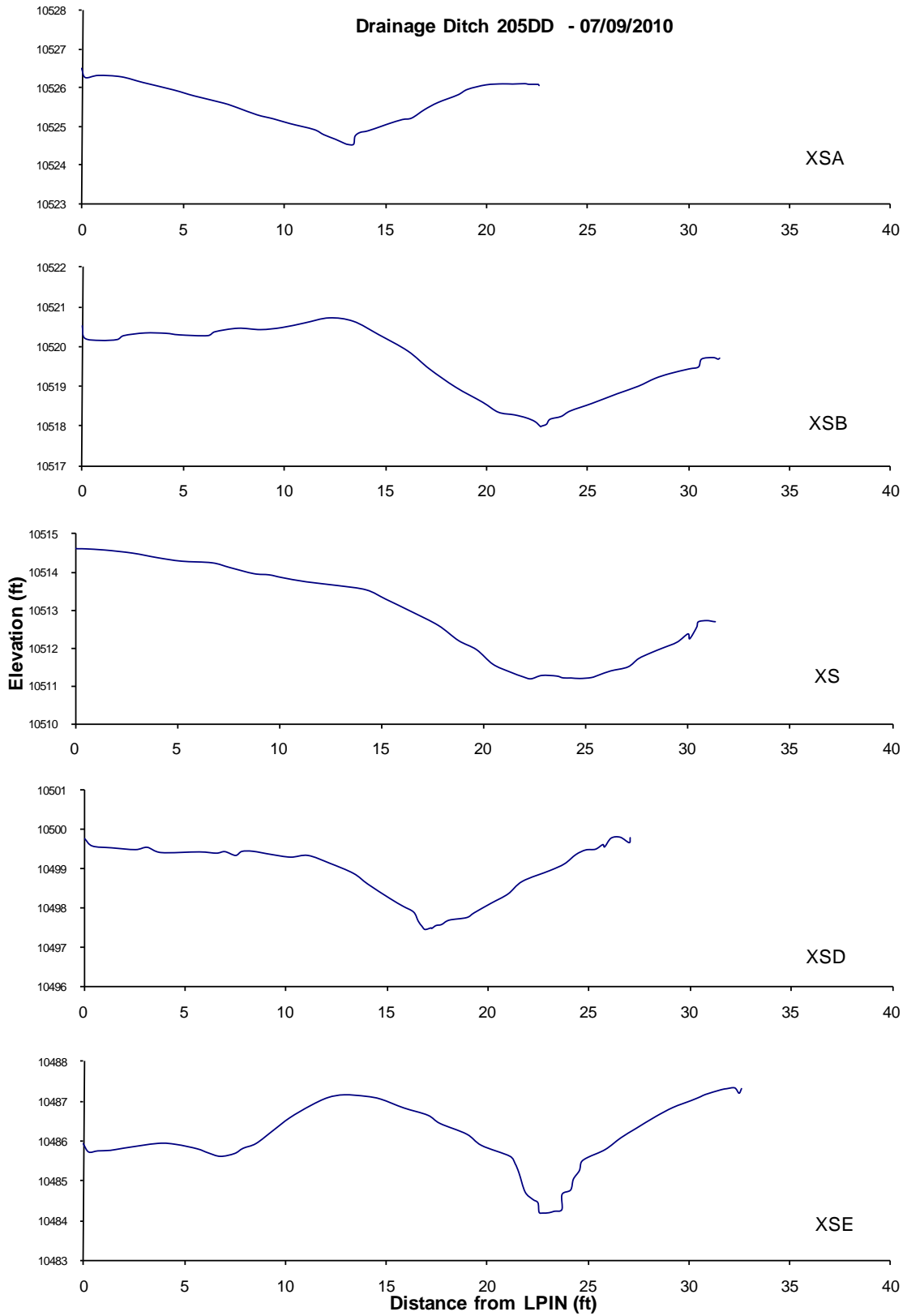












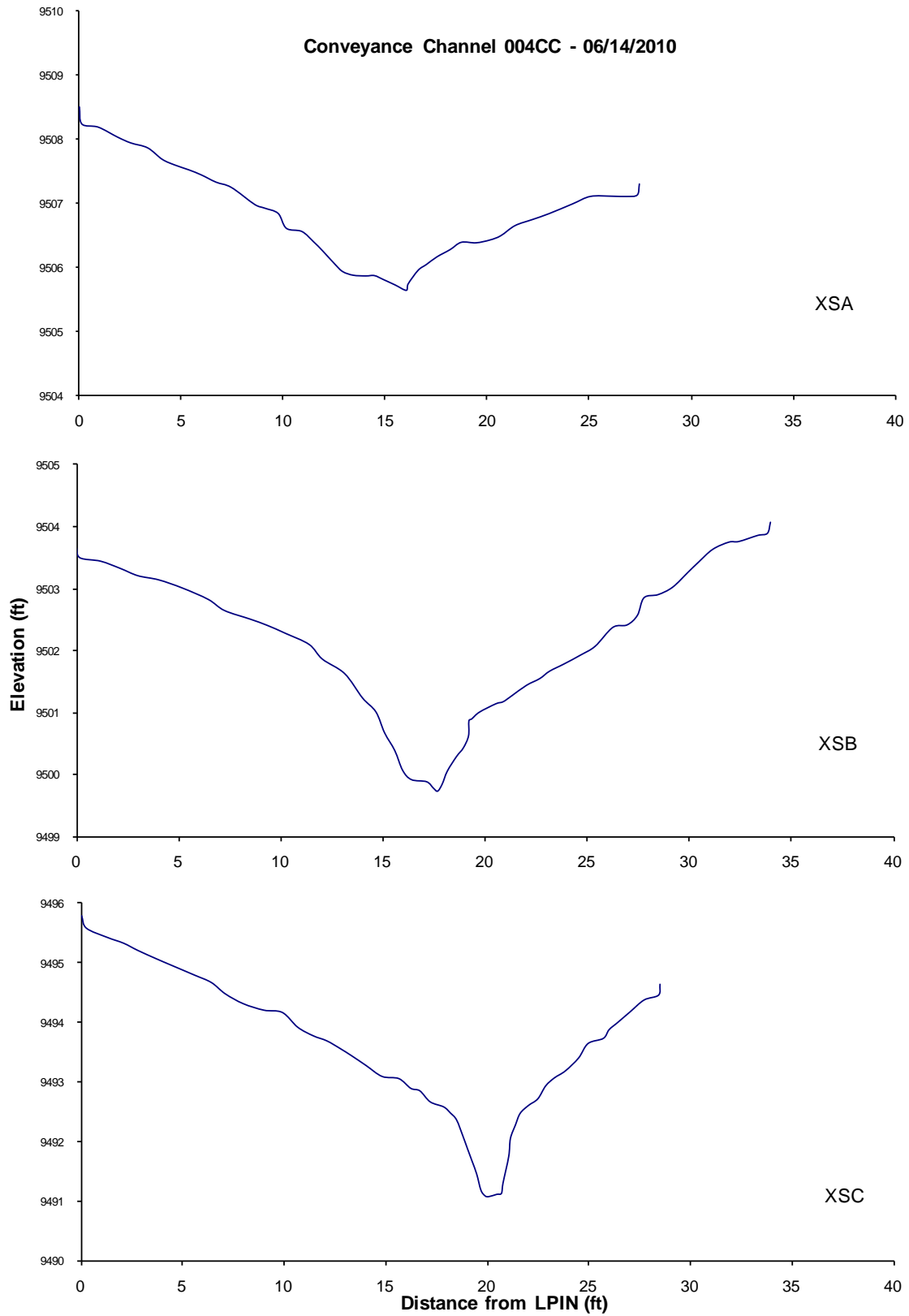


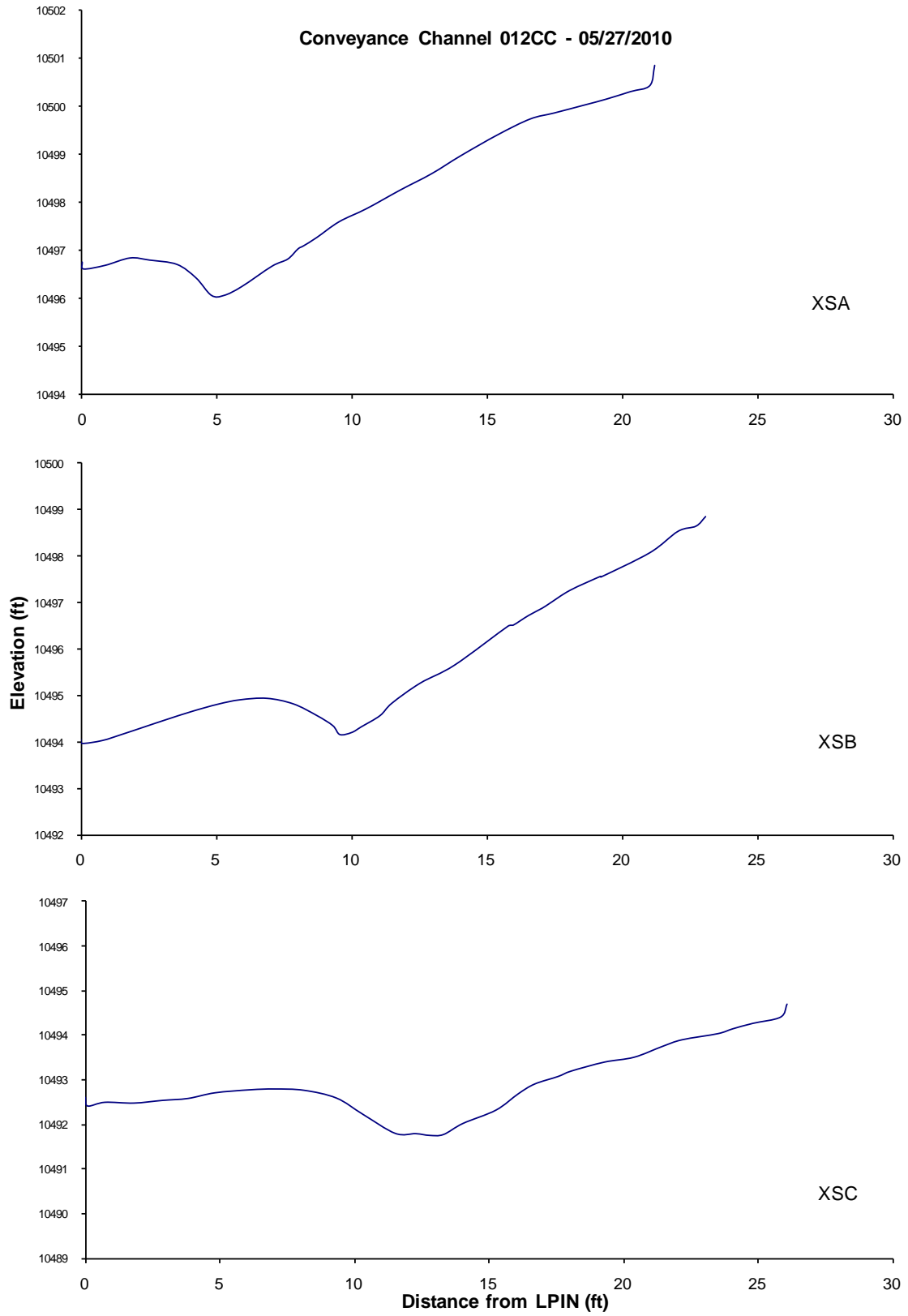
# Appendix J

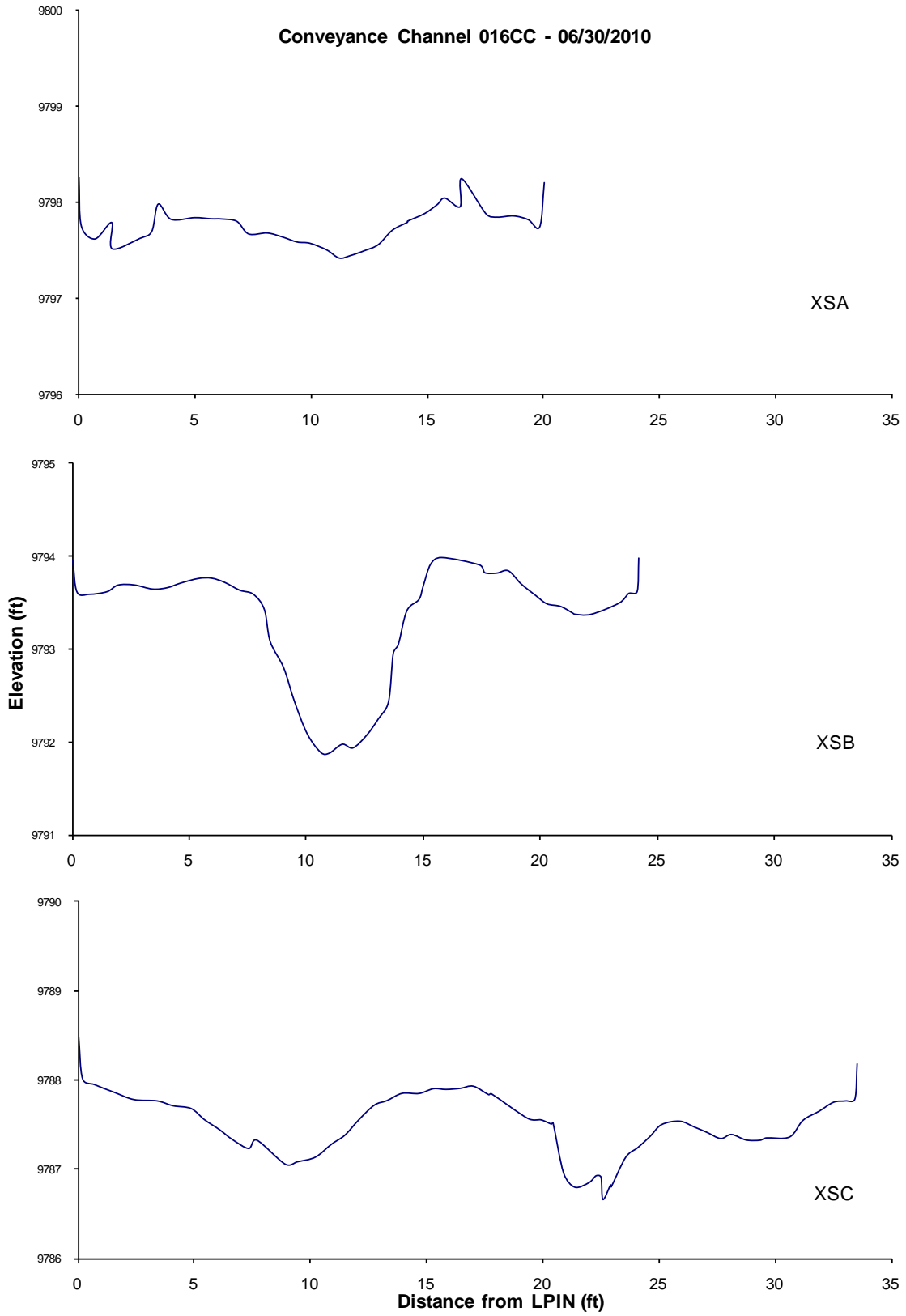
Conveyance Channel

Cross Section Graphs

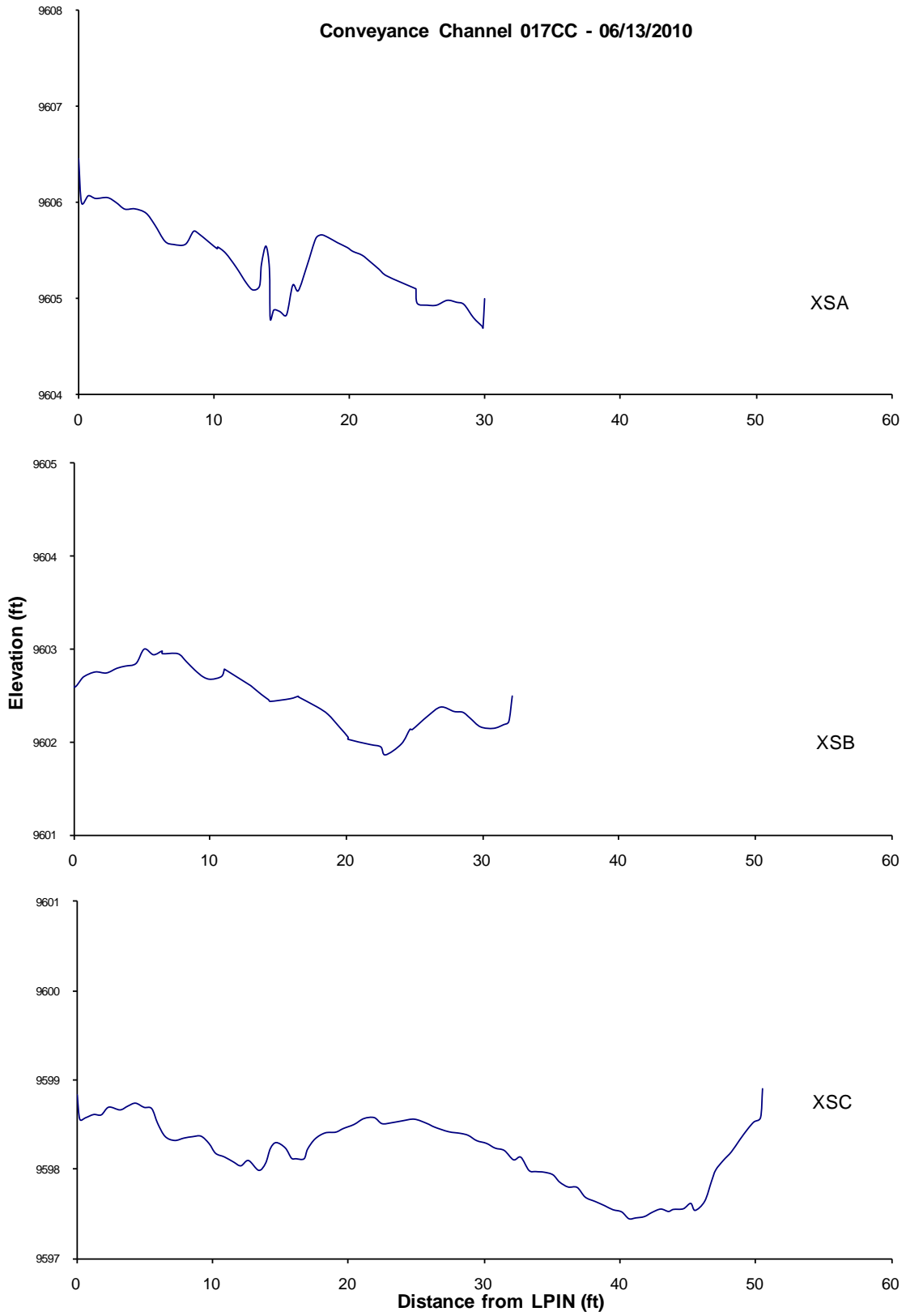
2010

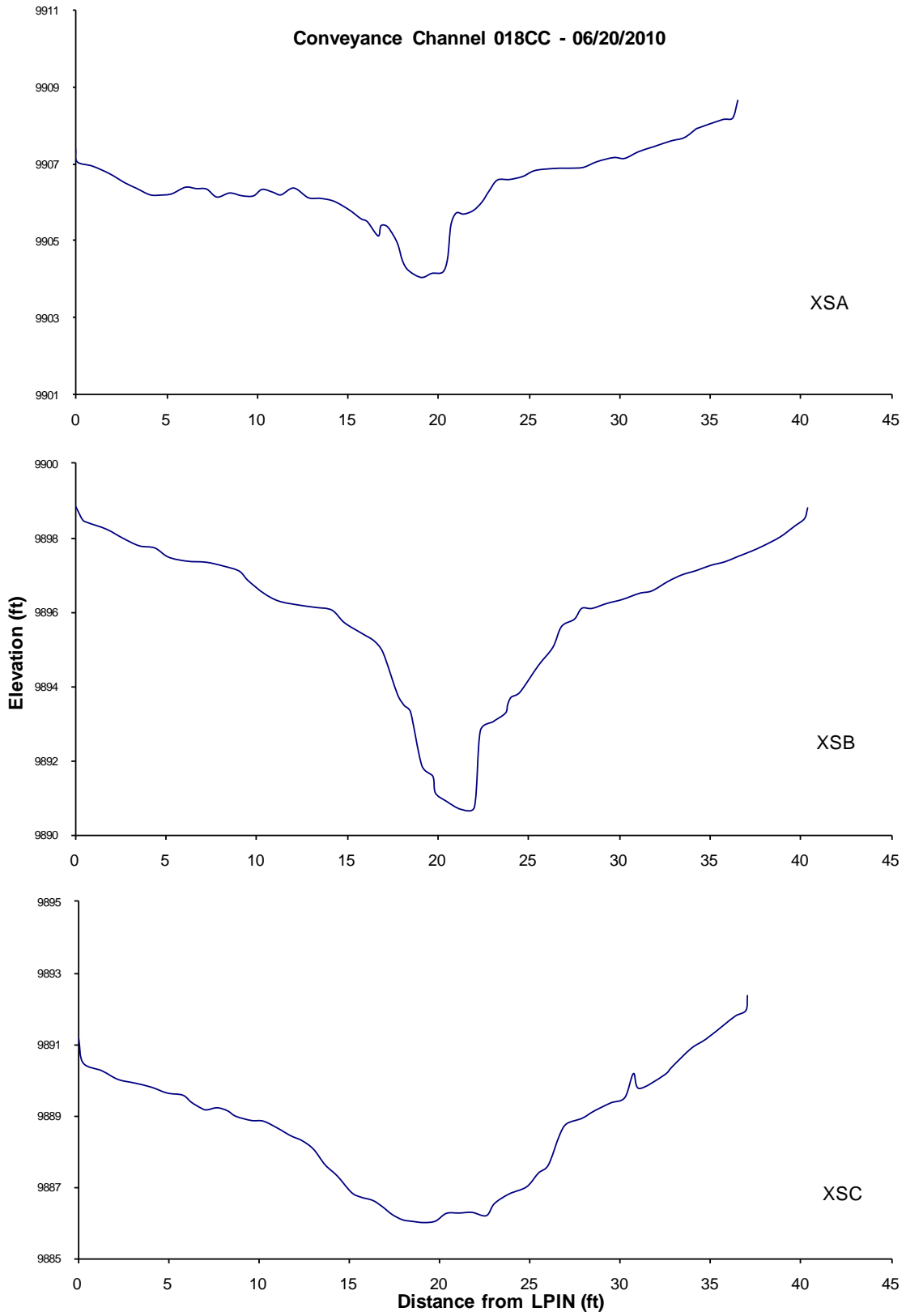




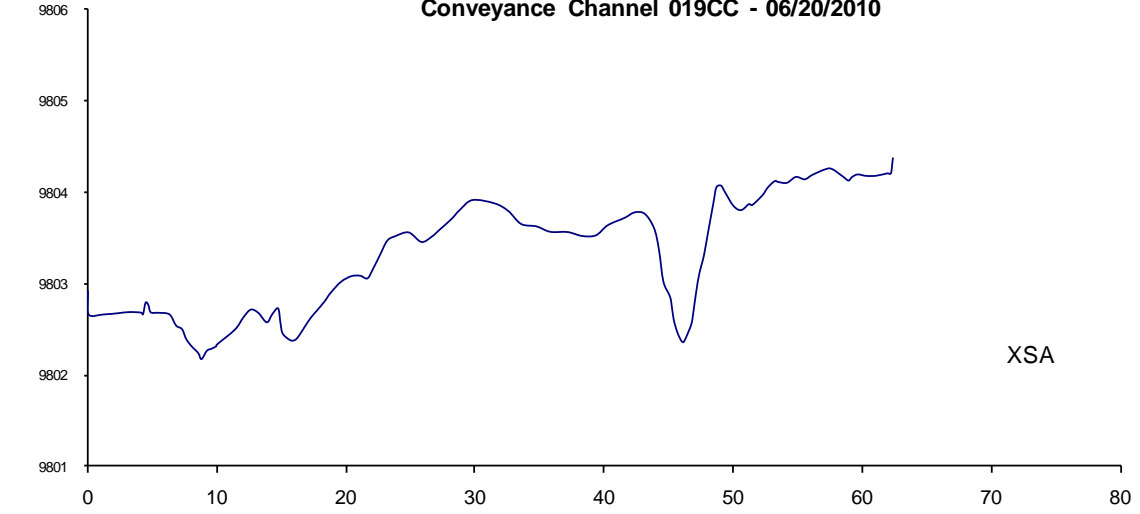




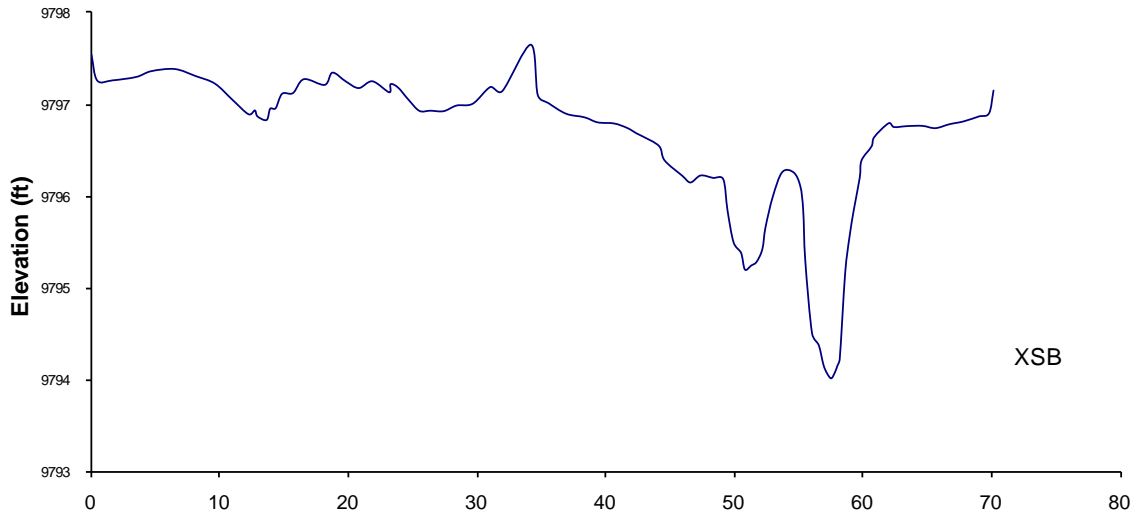




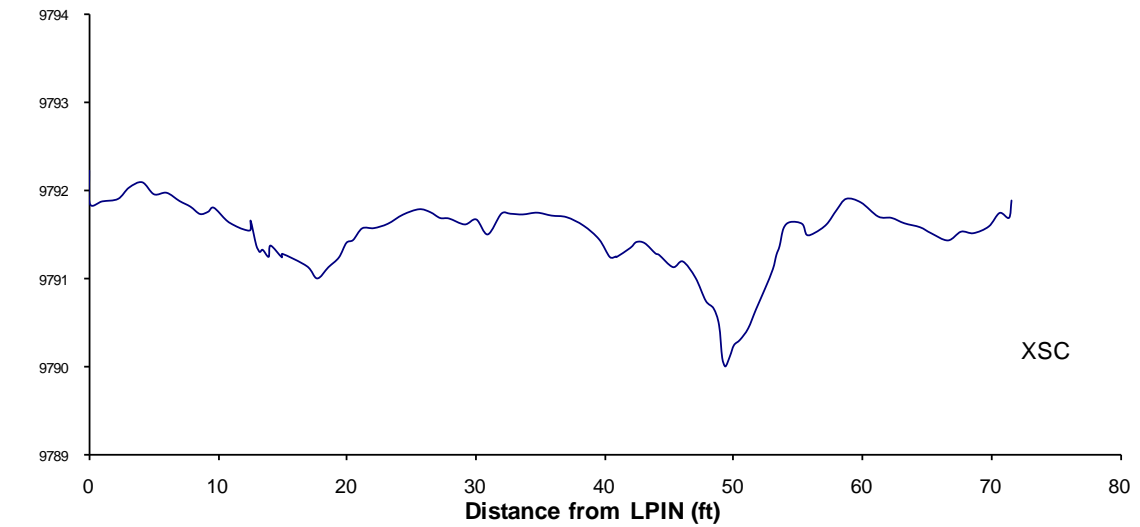
Conveyance Channel 019CC - 06/20/2010



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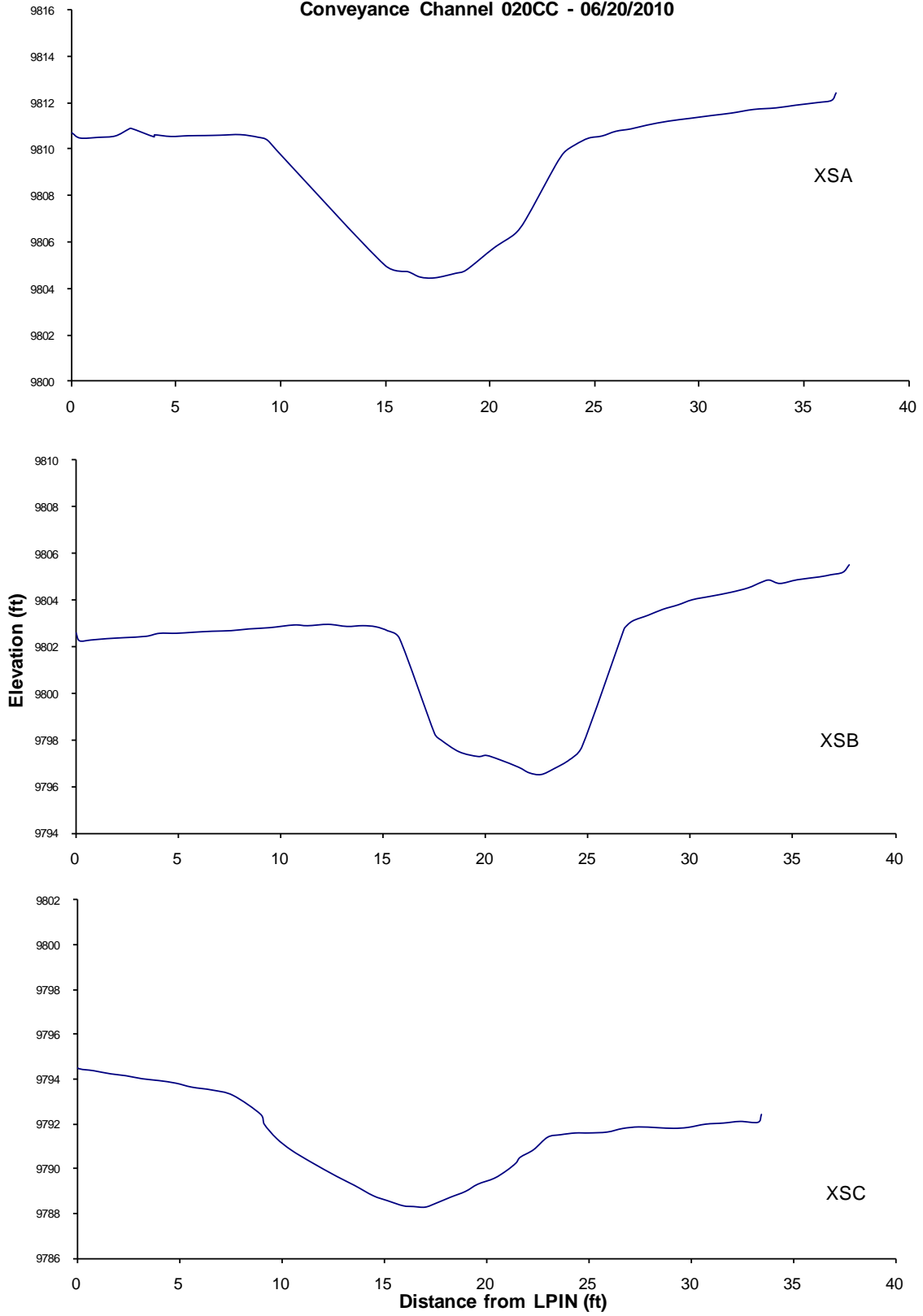


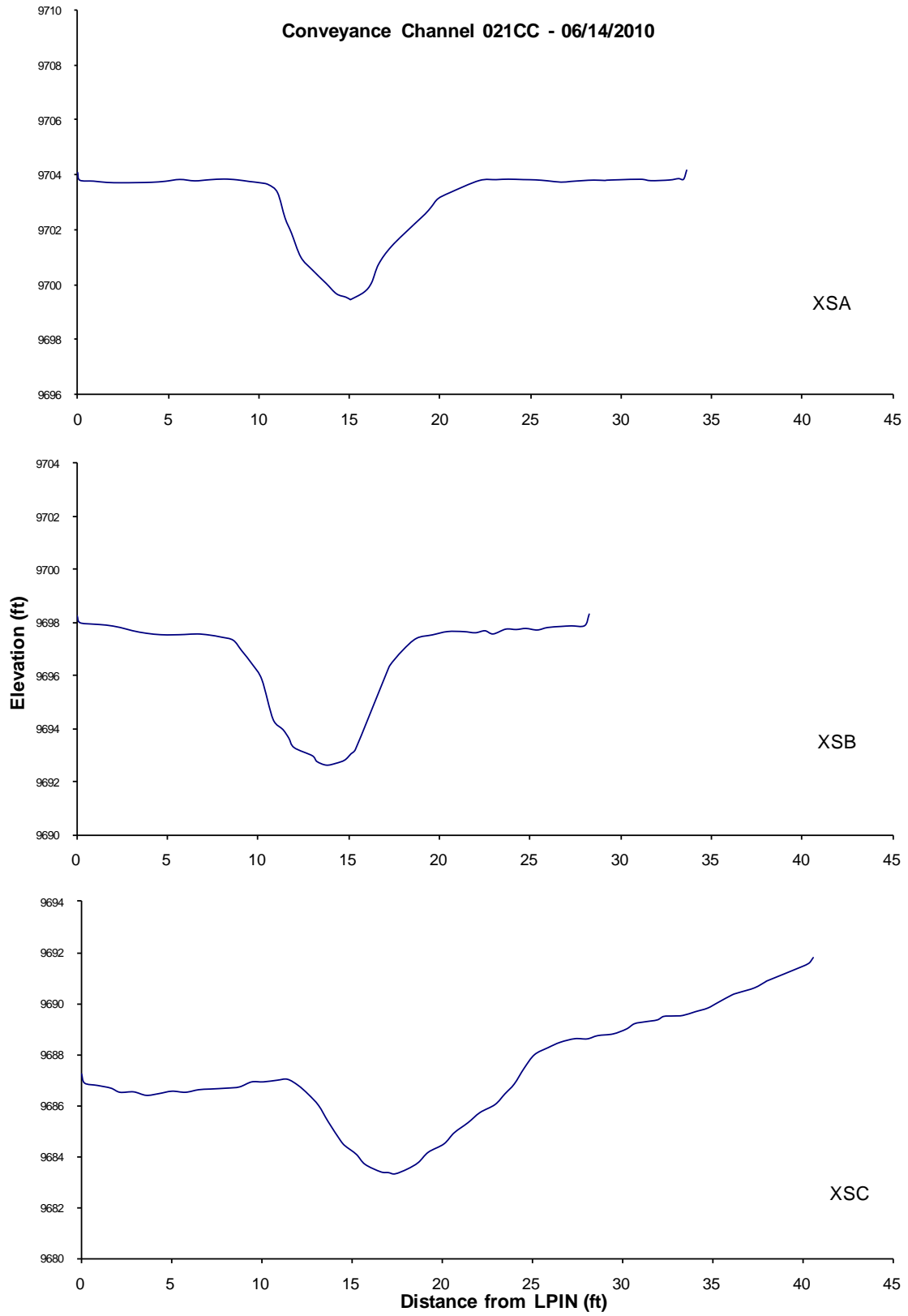
XSB

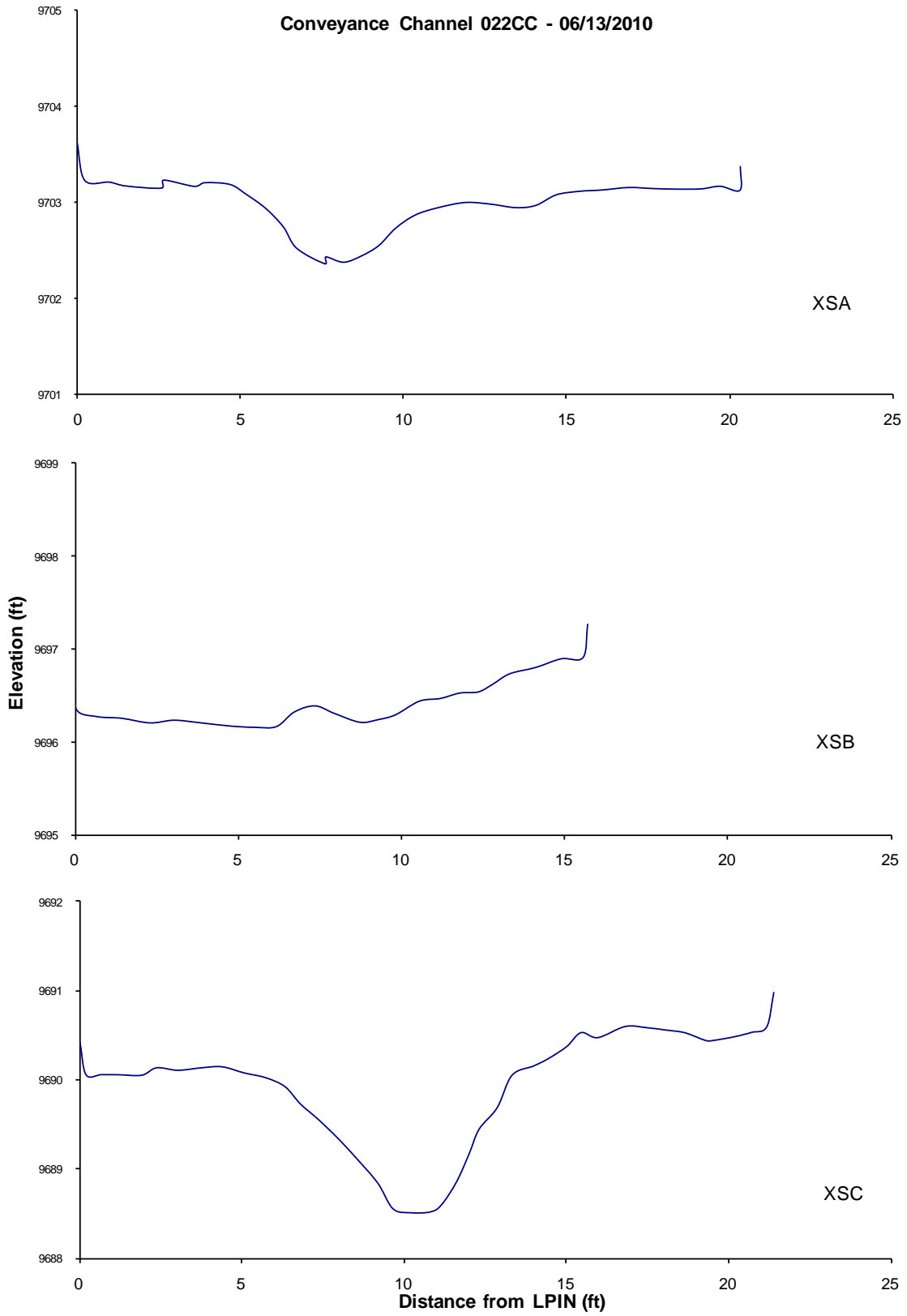


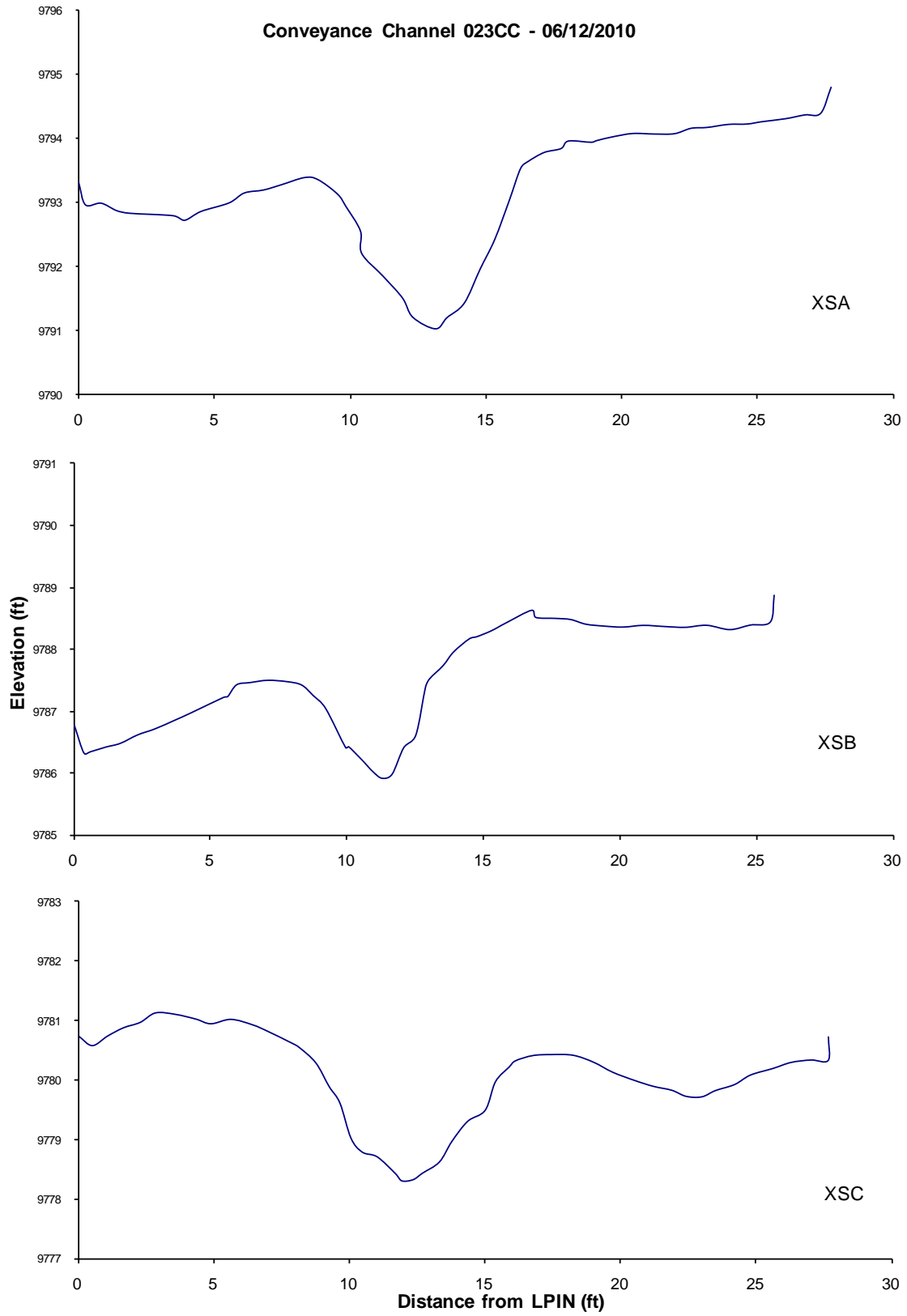
XSC

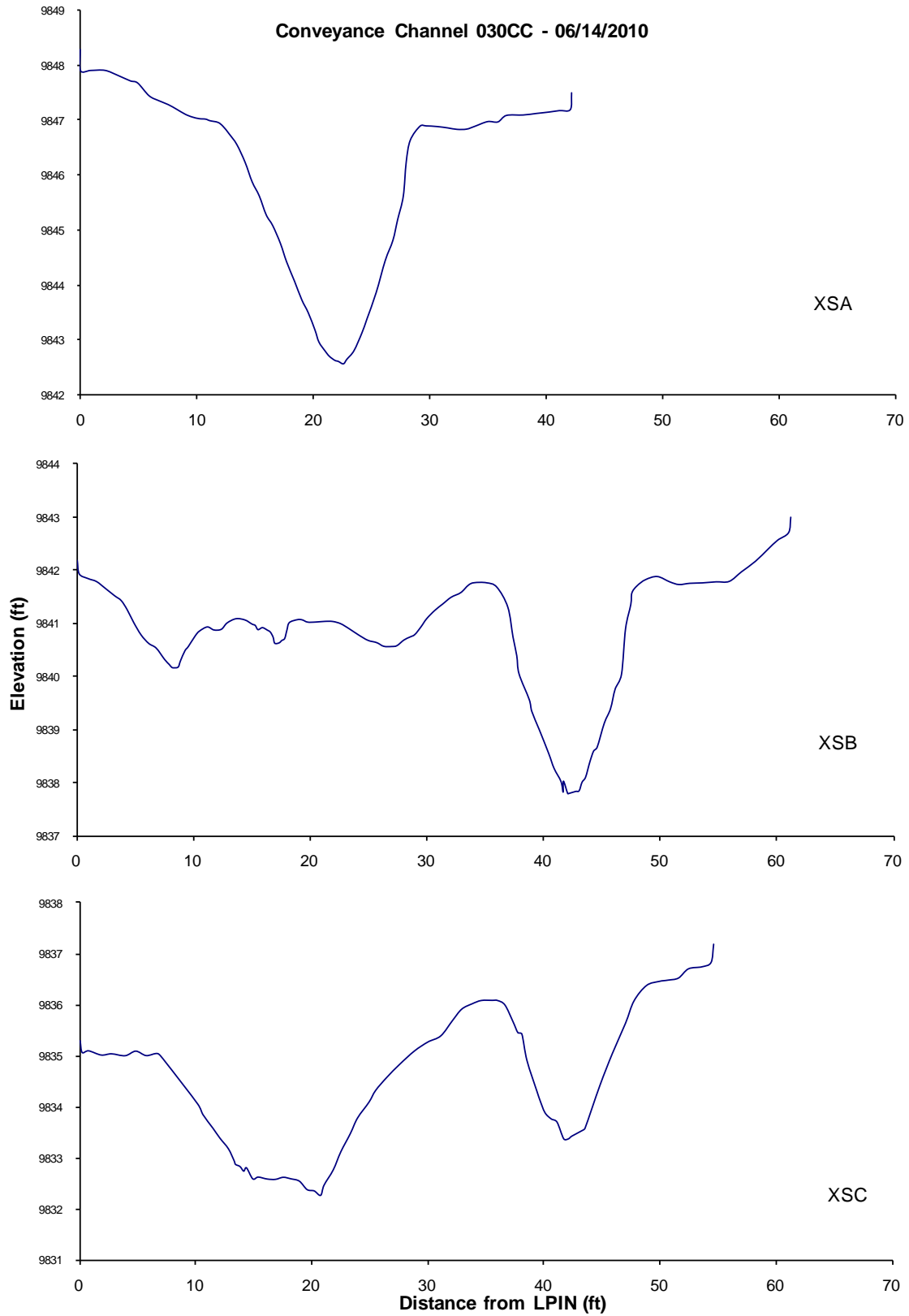
Conveyance Channel 020CC - 06/20/2010



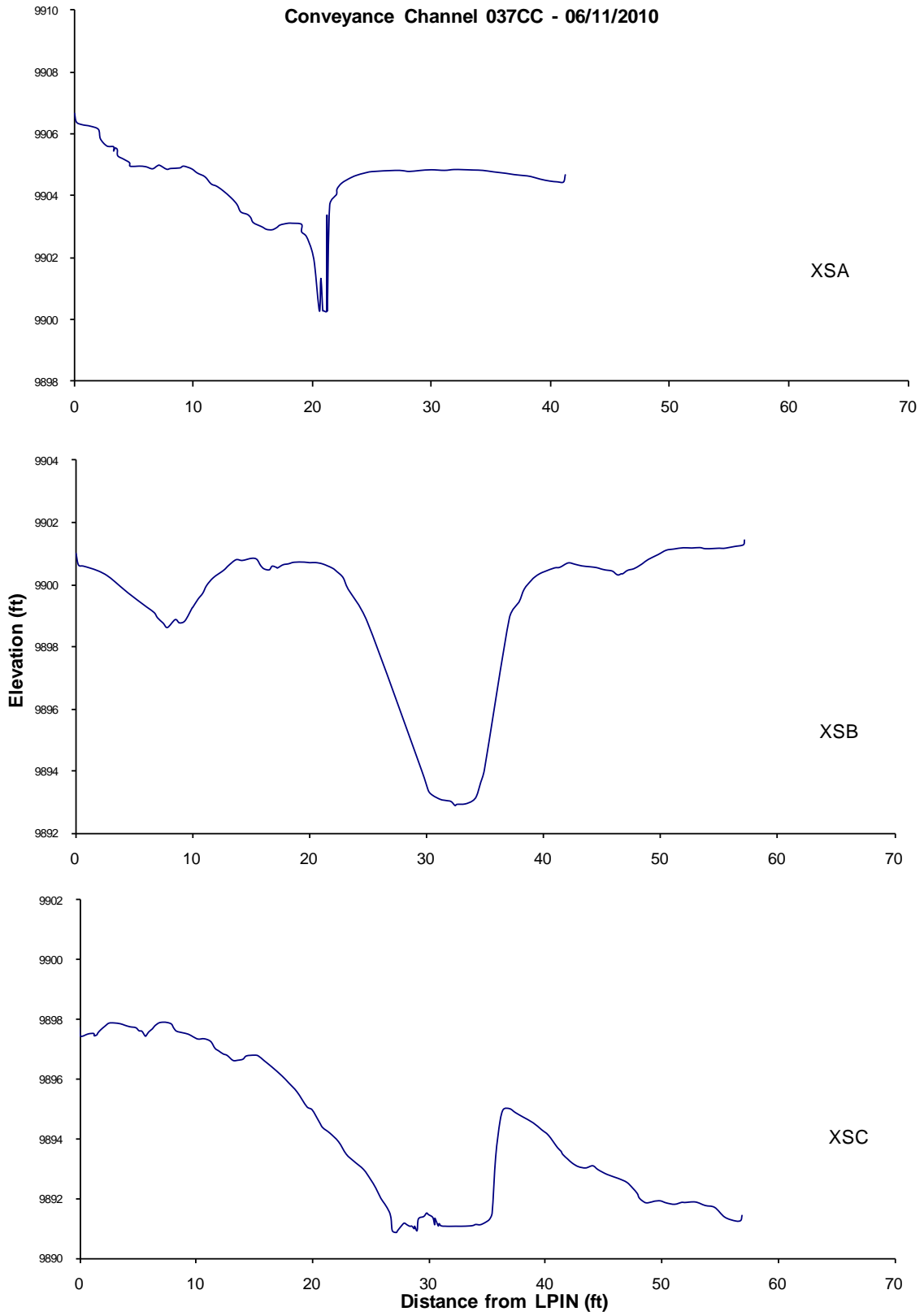


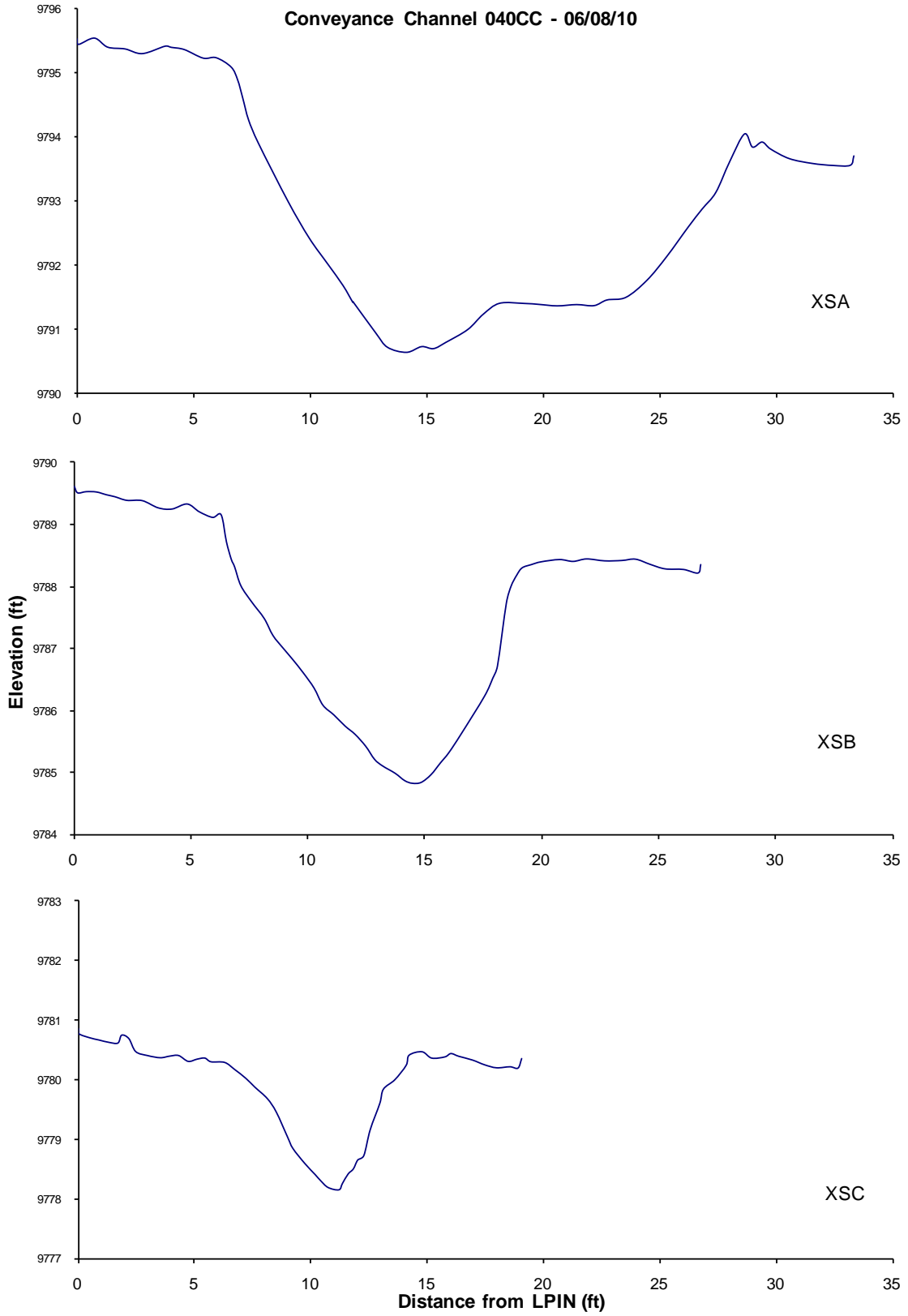


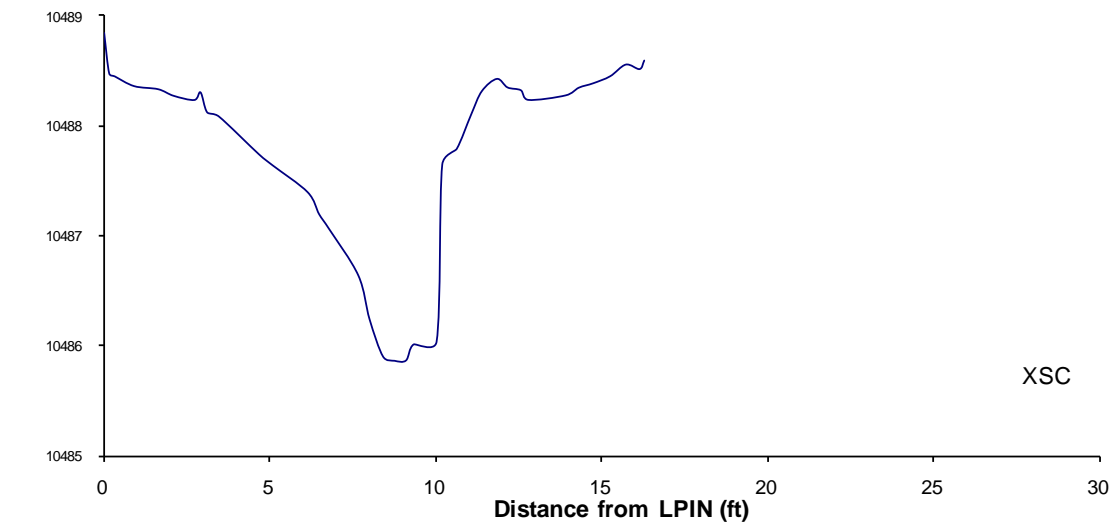
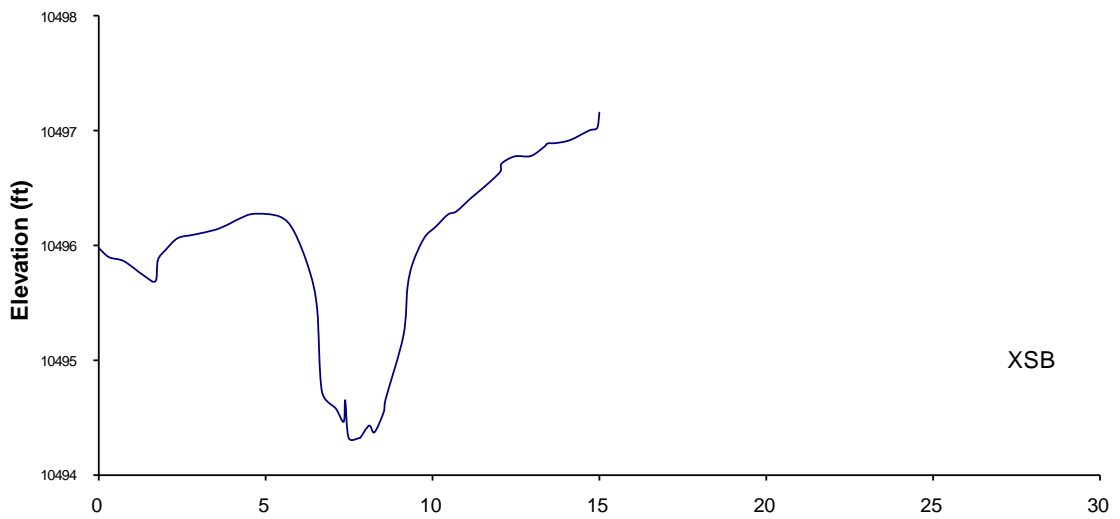
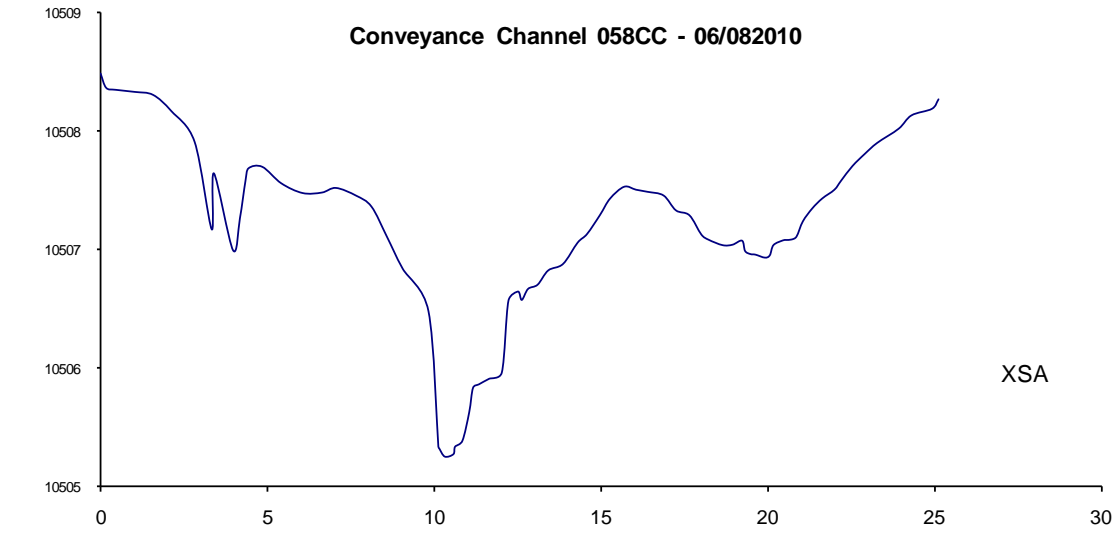


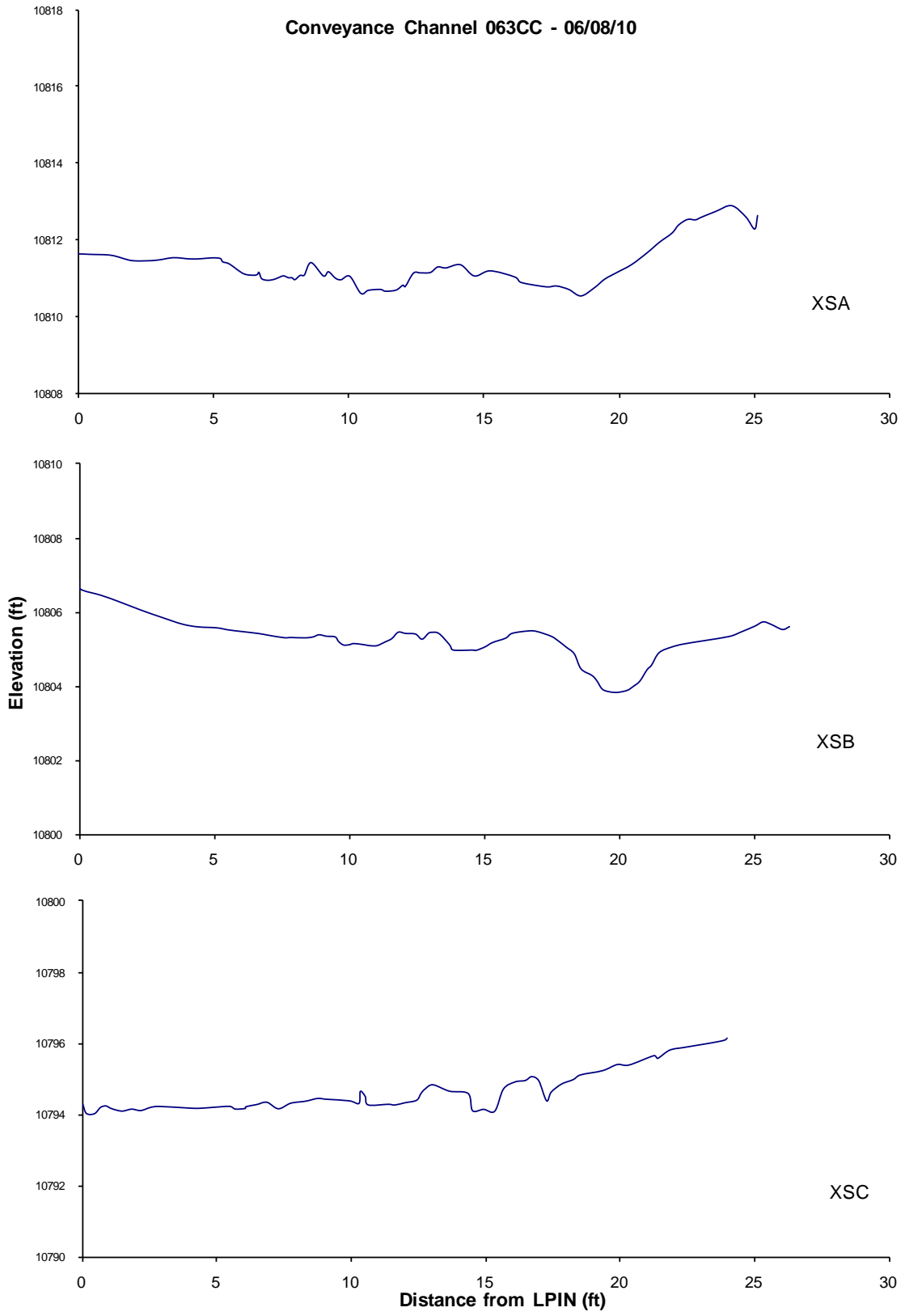


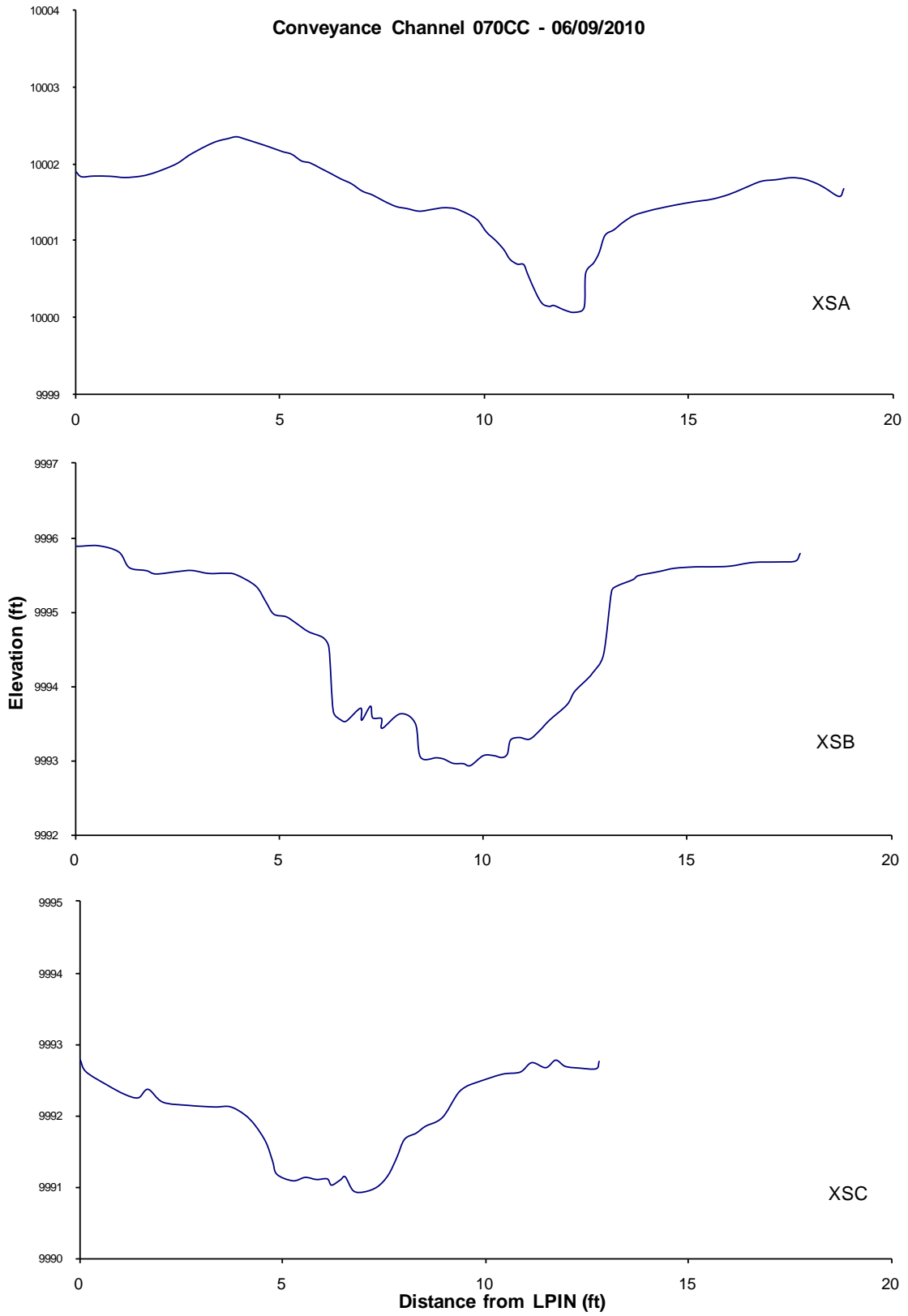


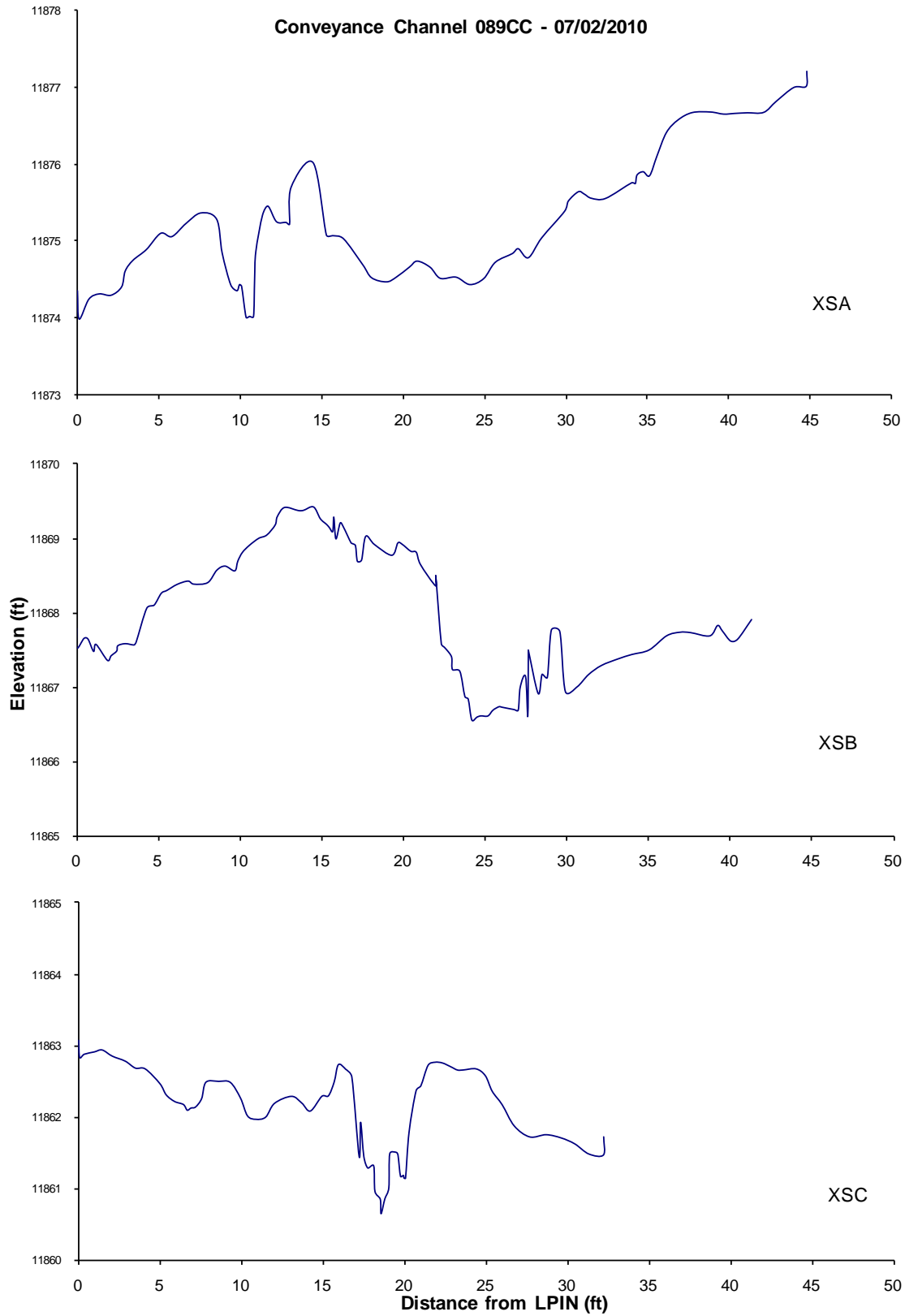


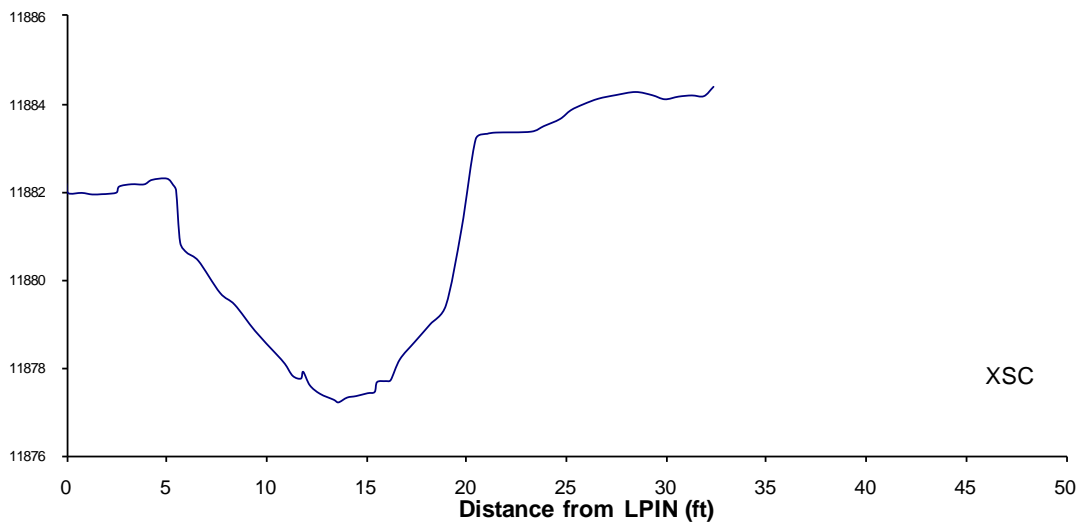
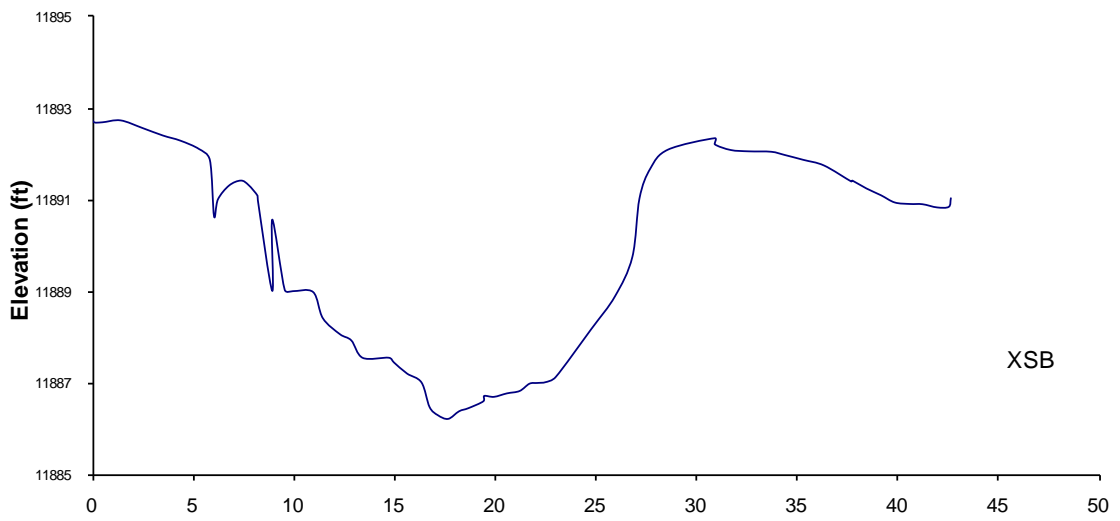
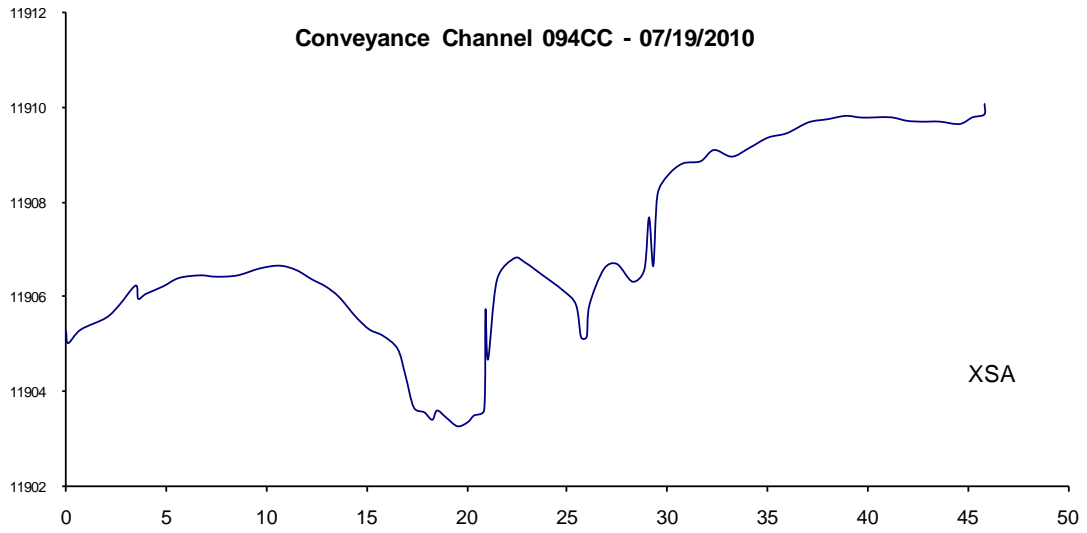


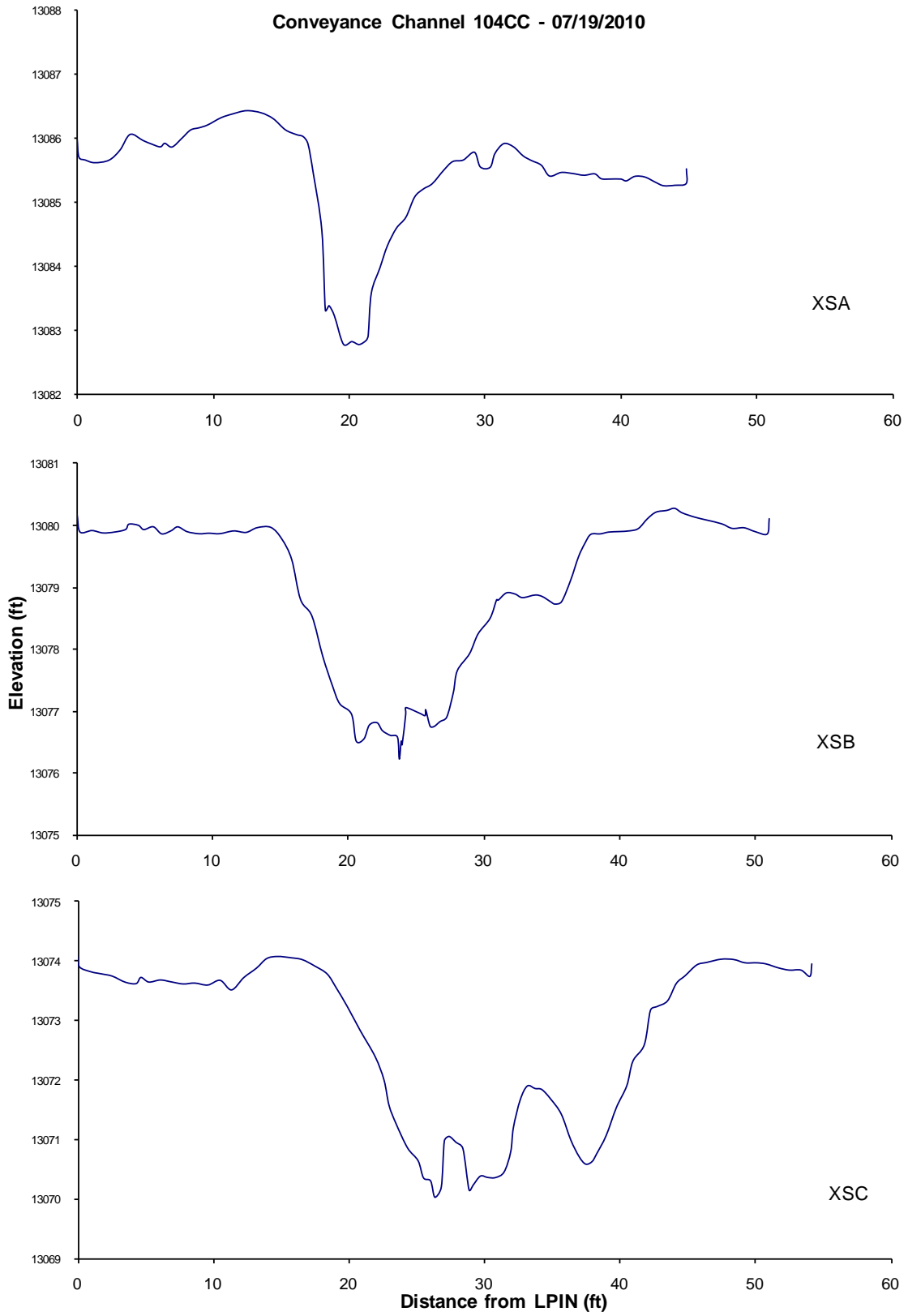




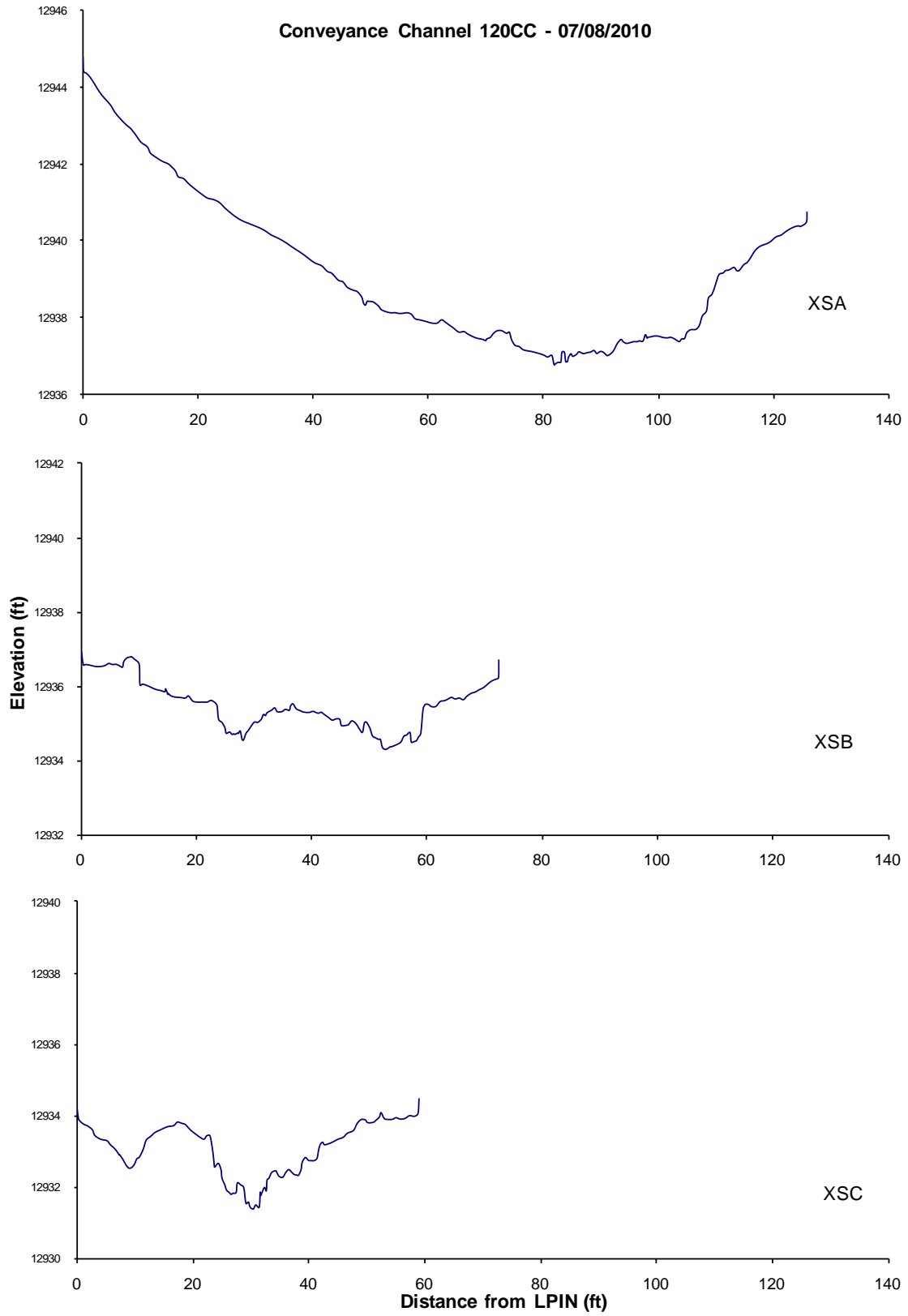


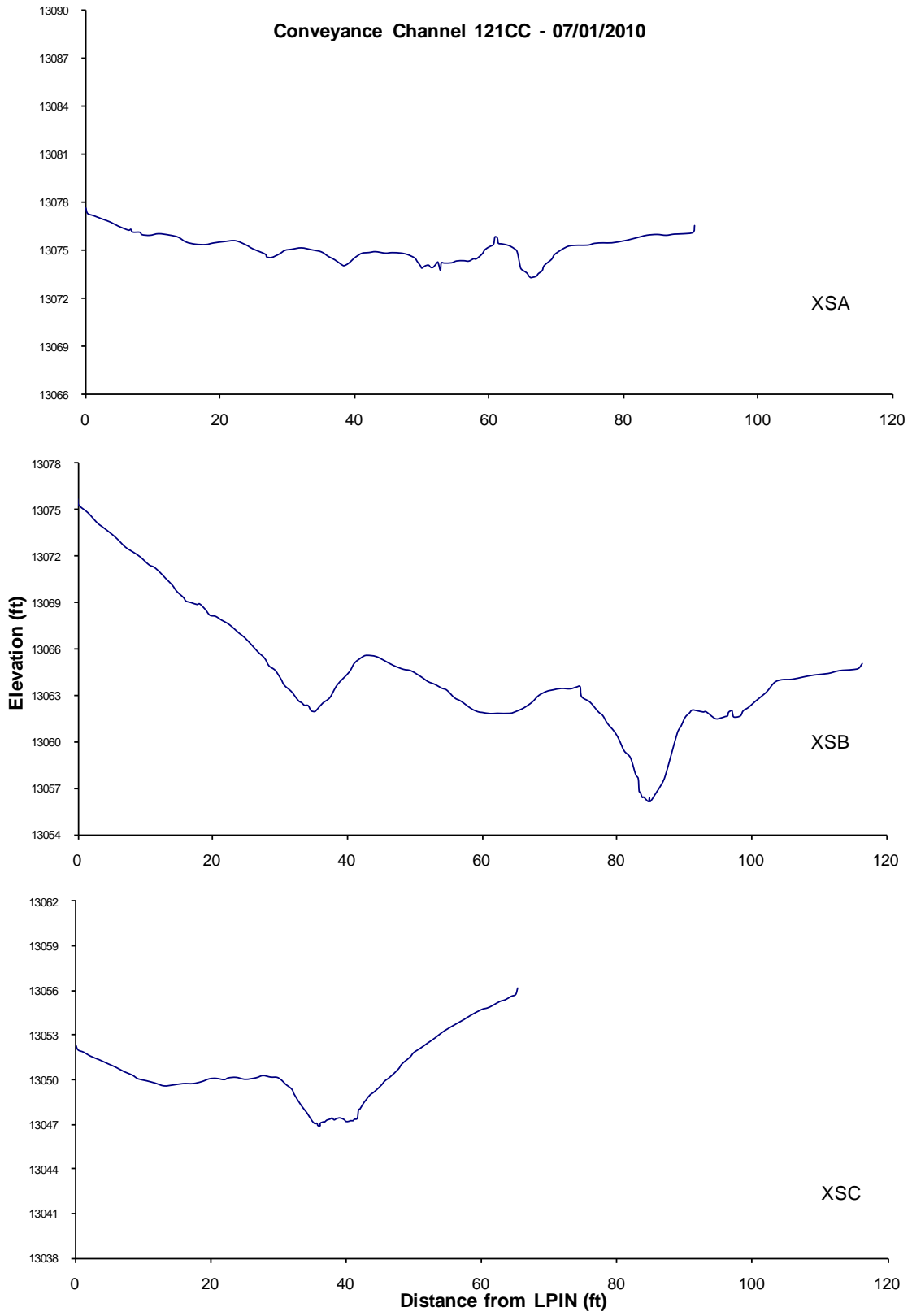


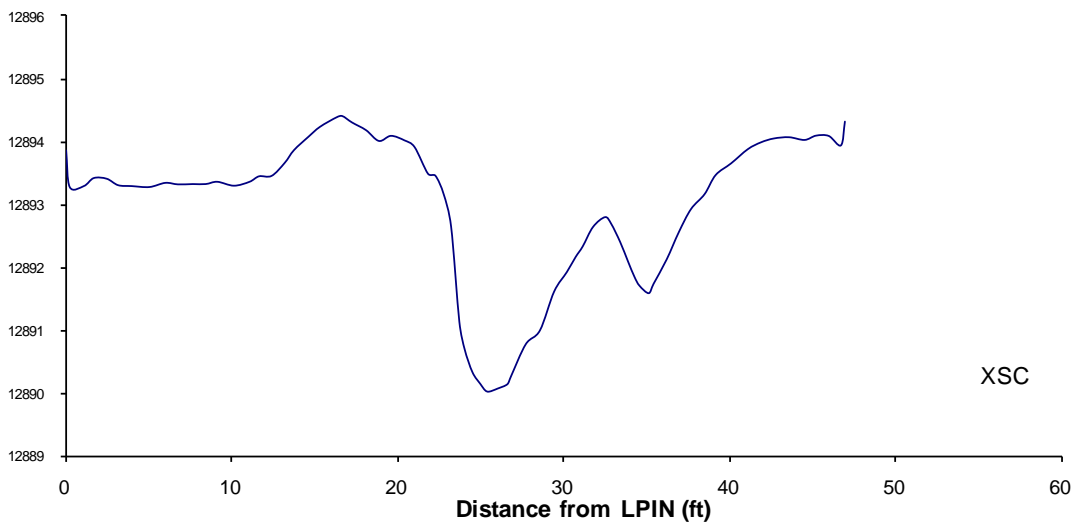
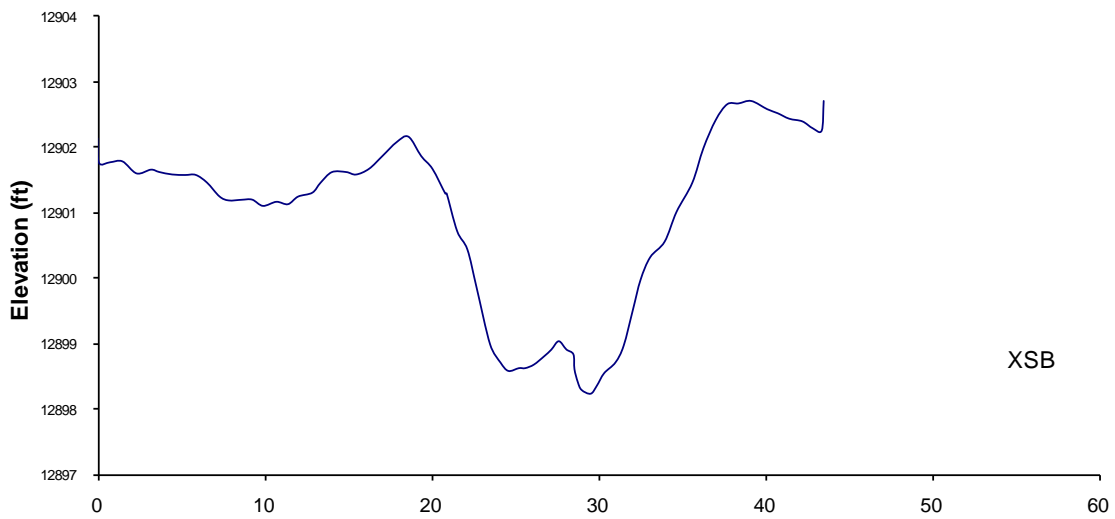
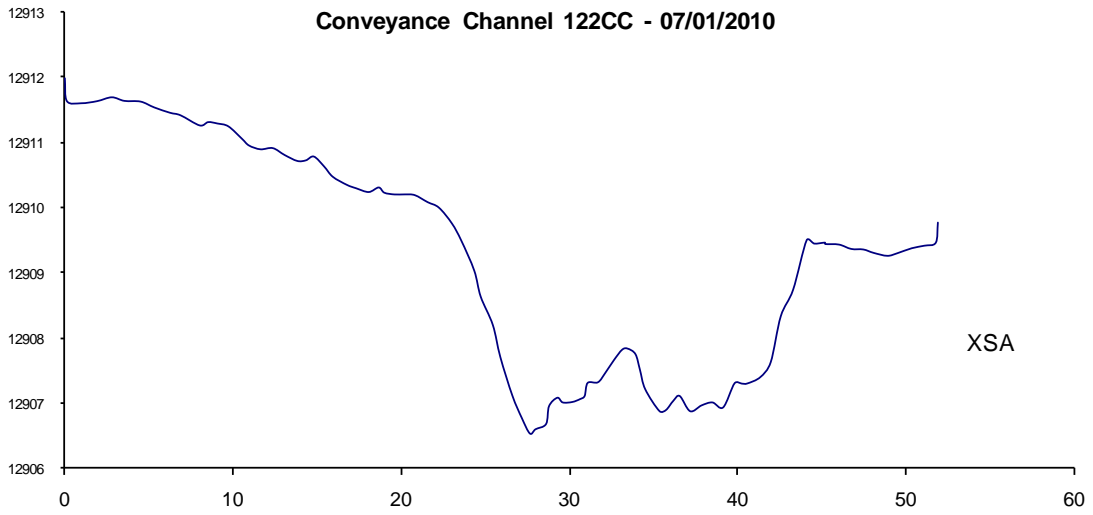


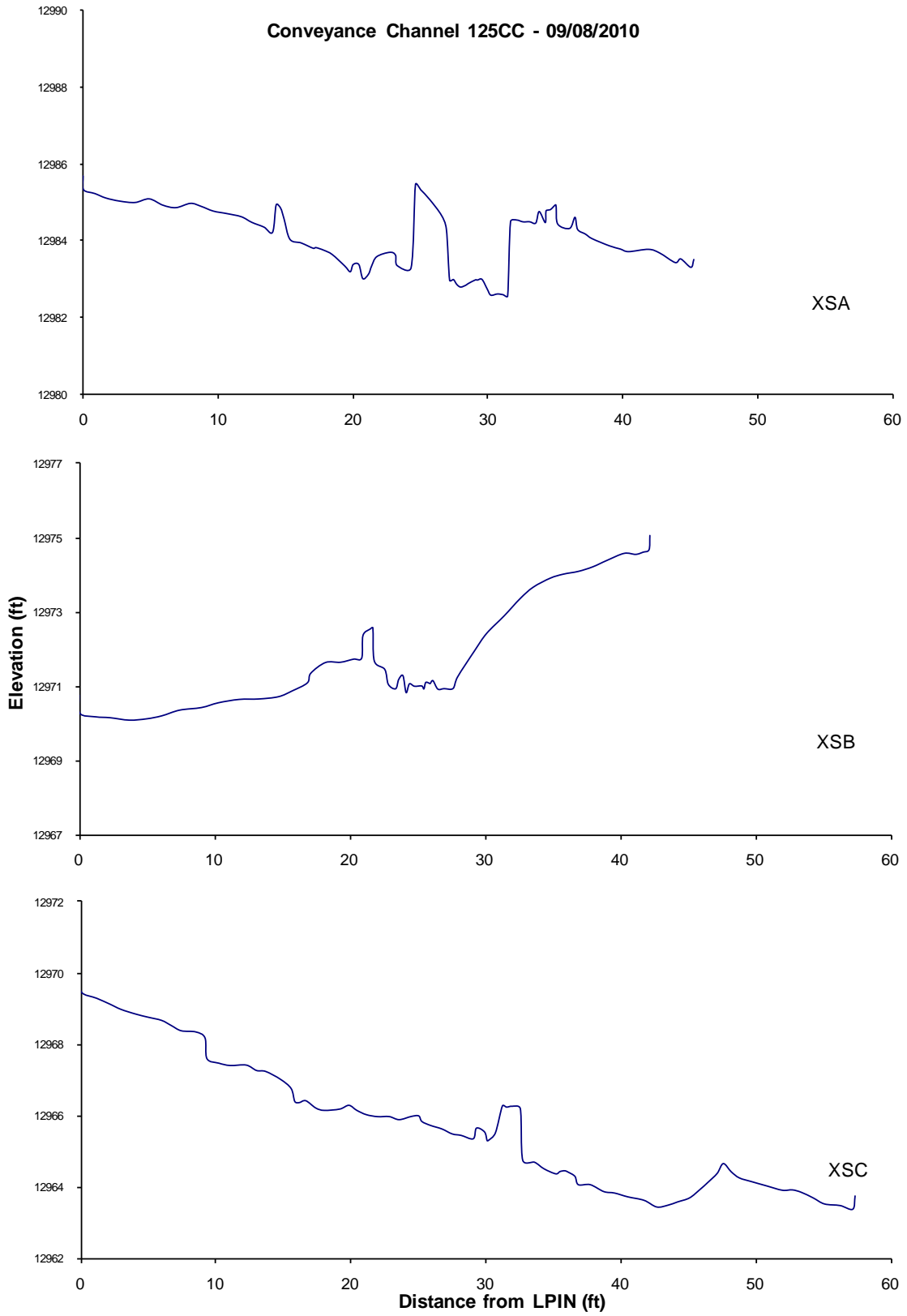


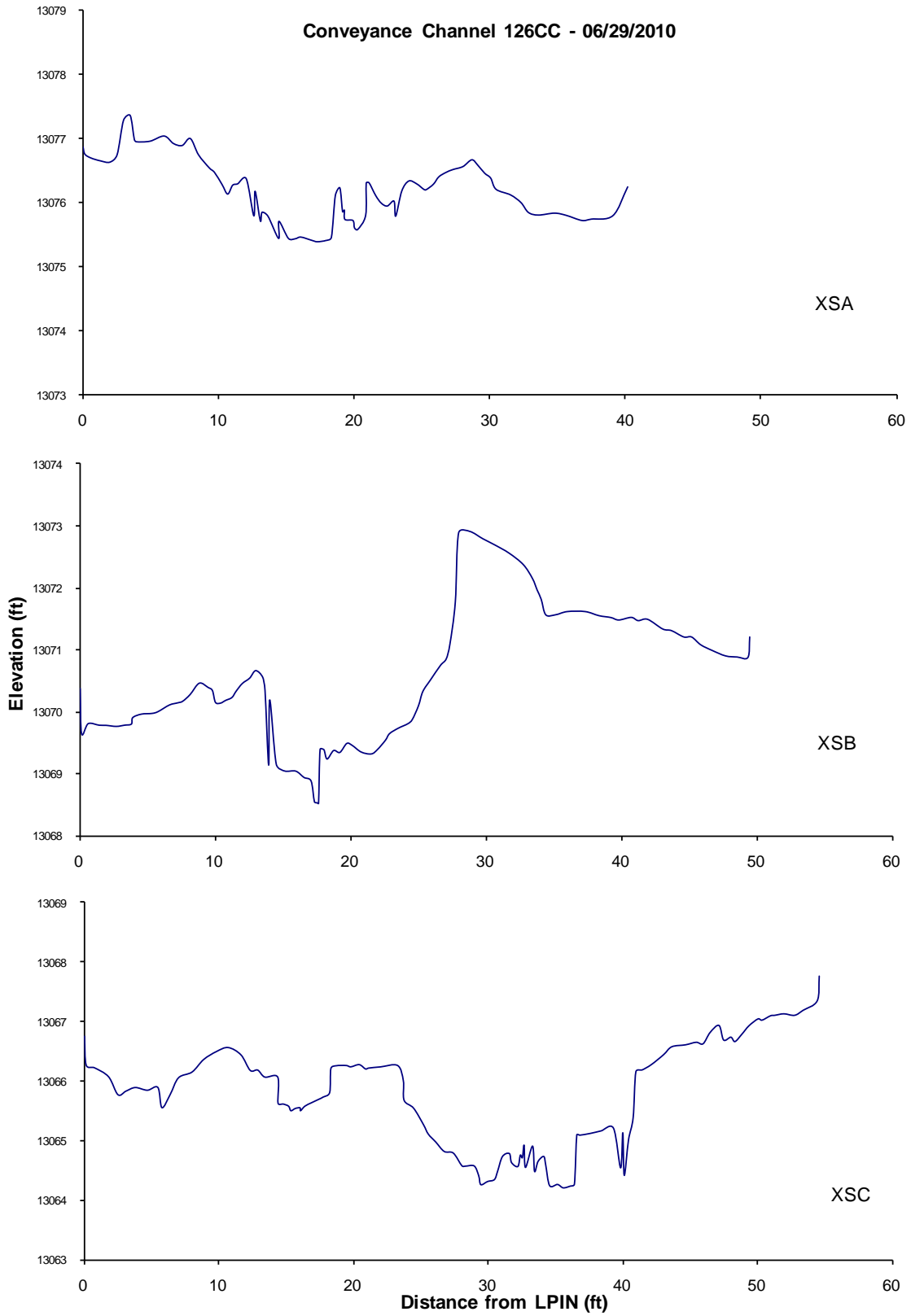


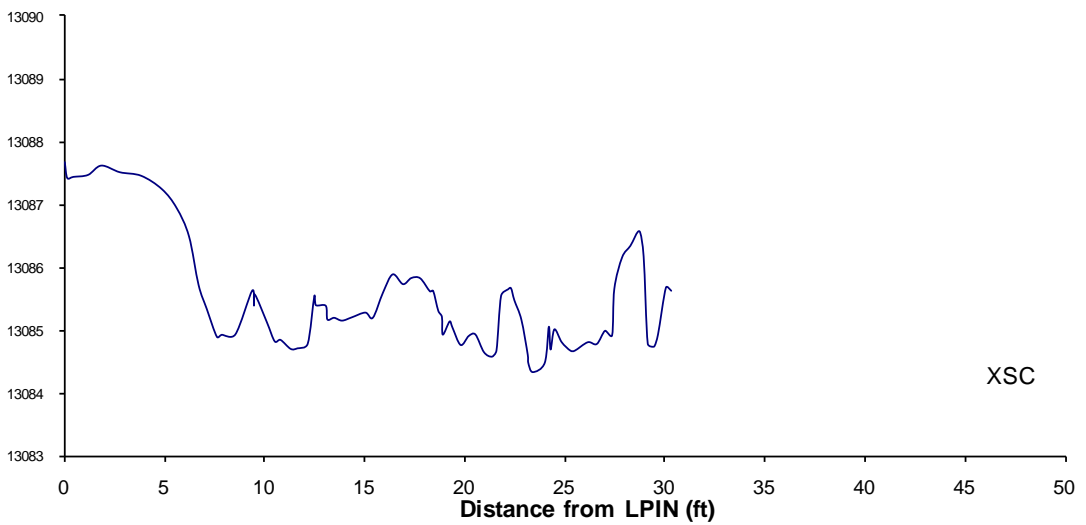
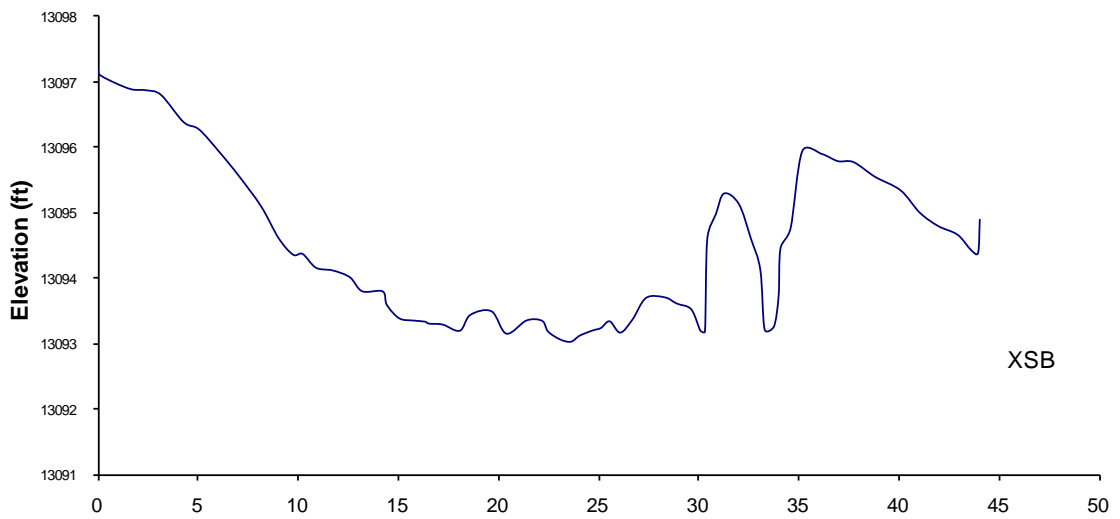
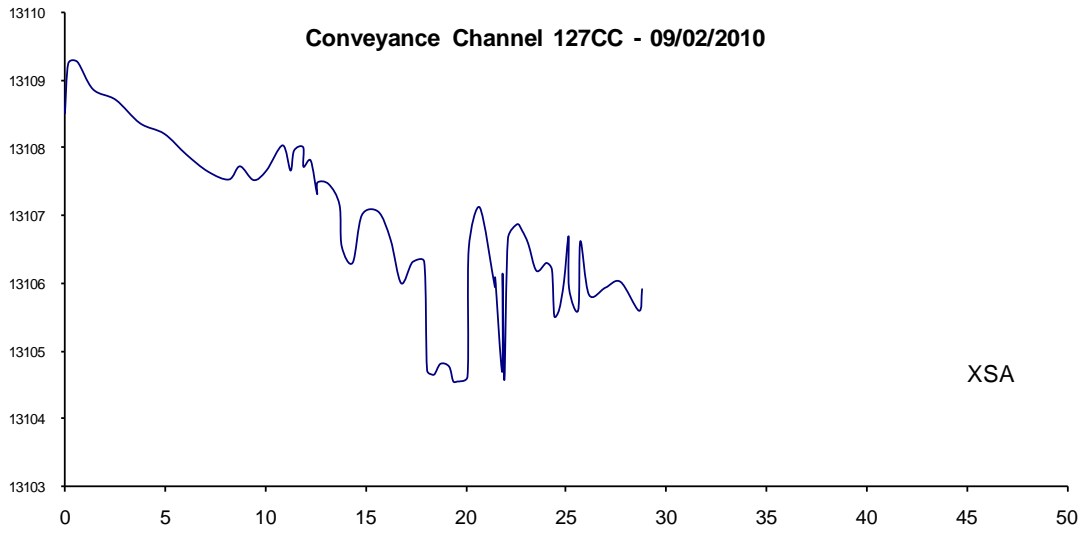


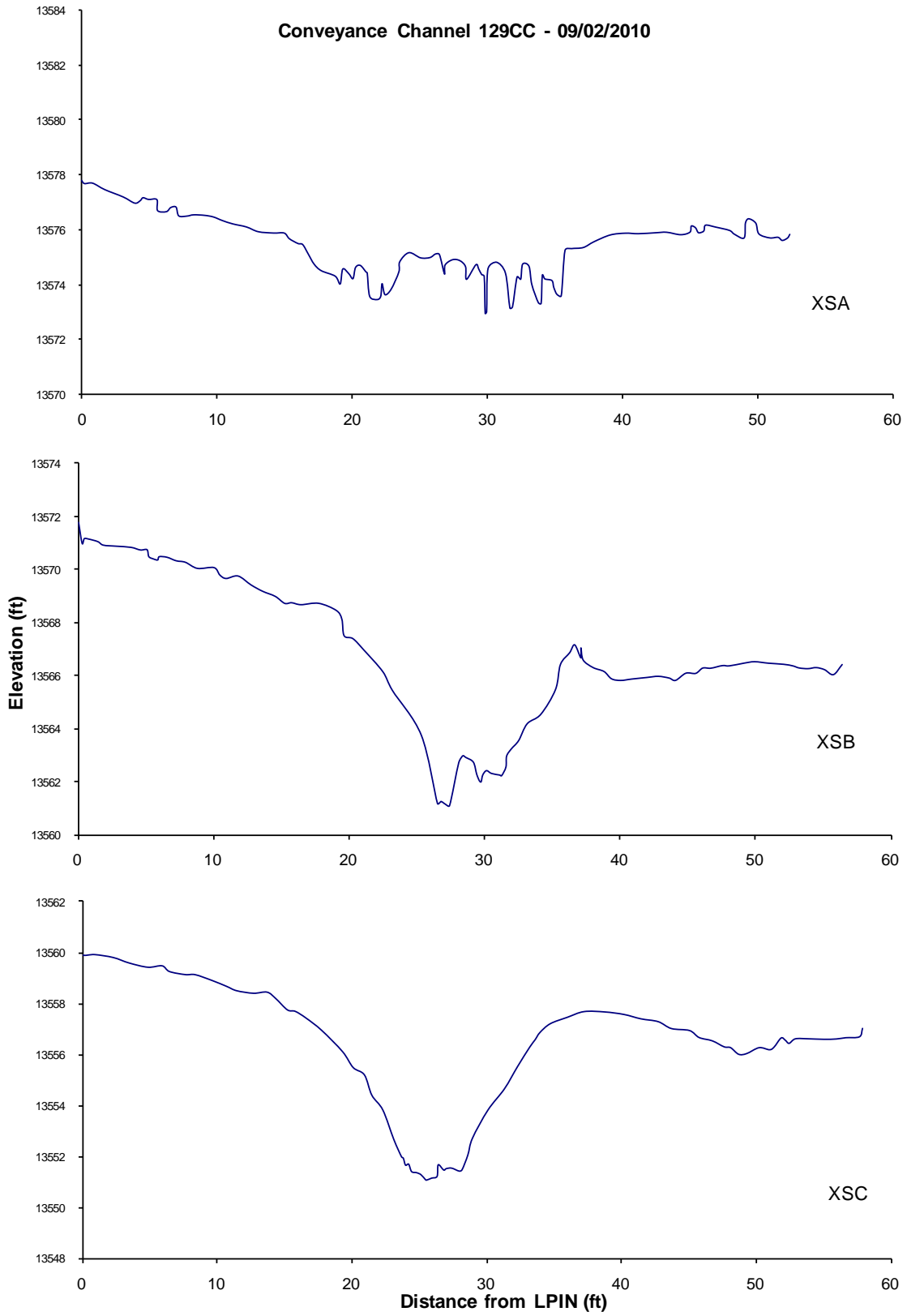


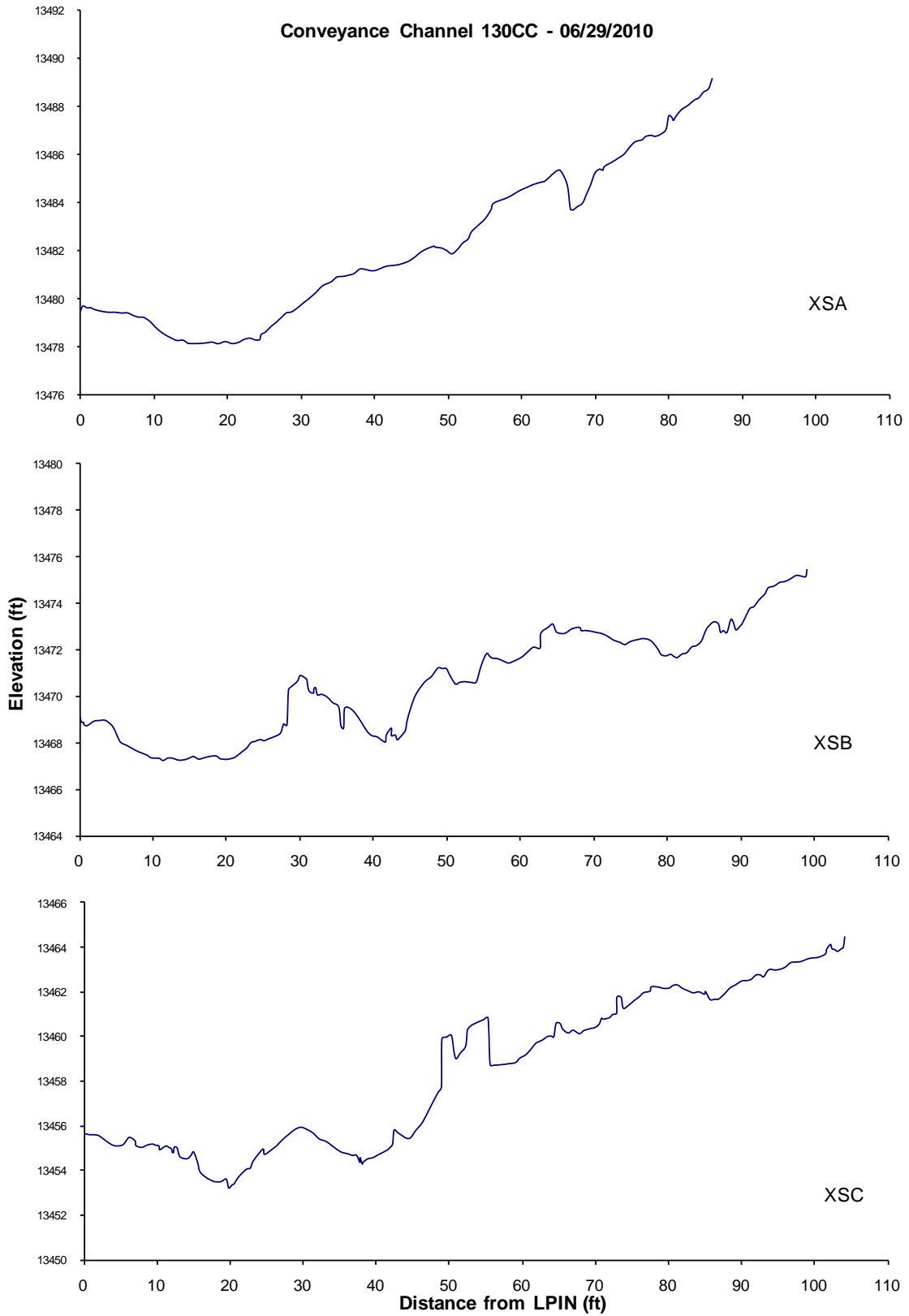




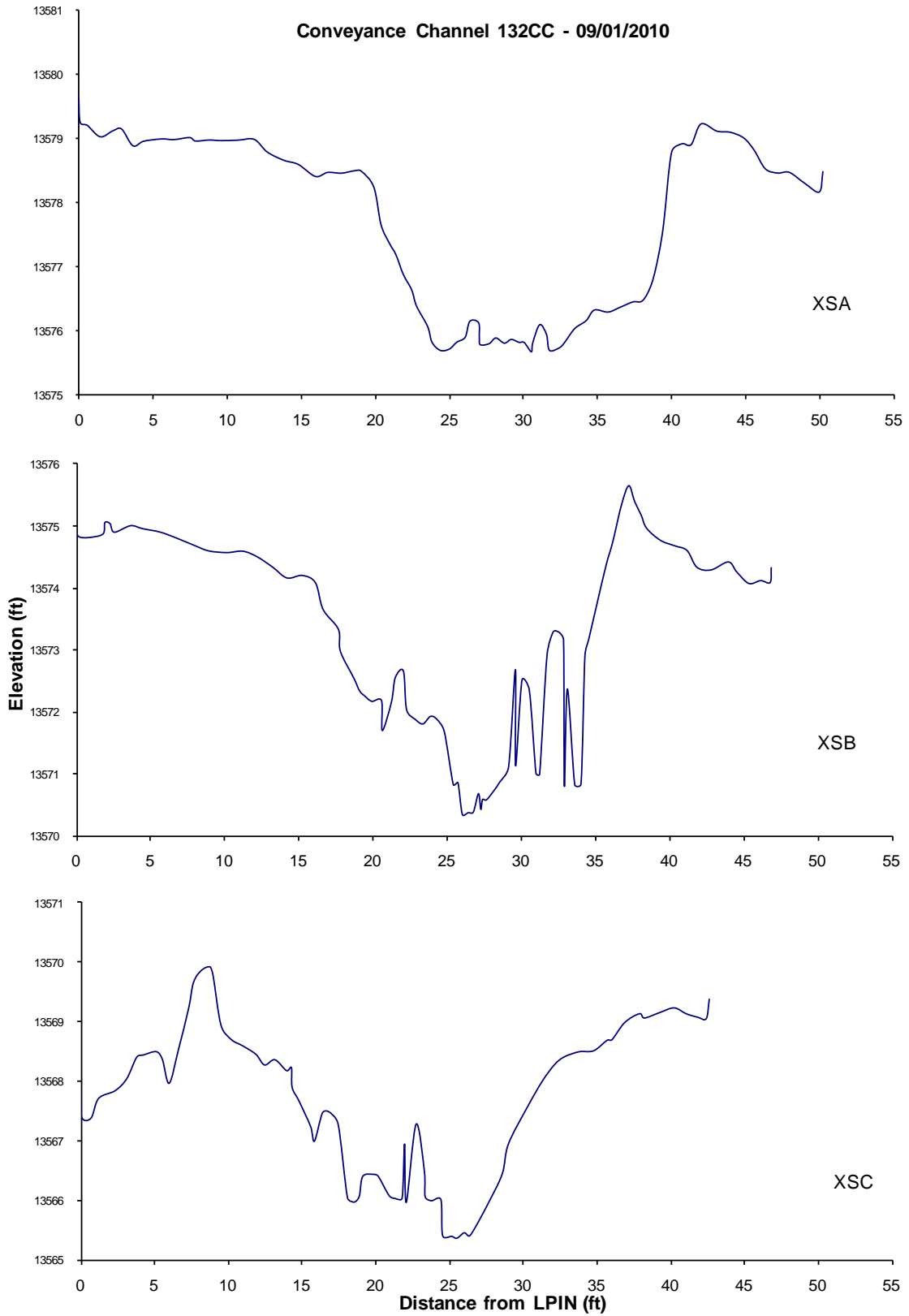


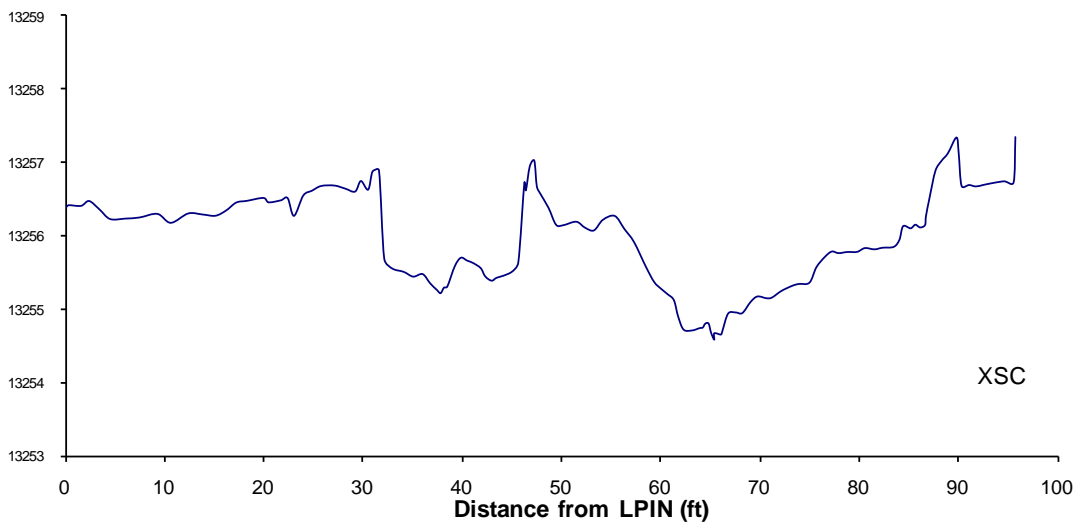
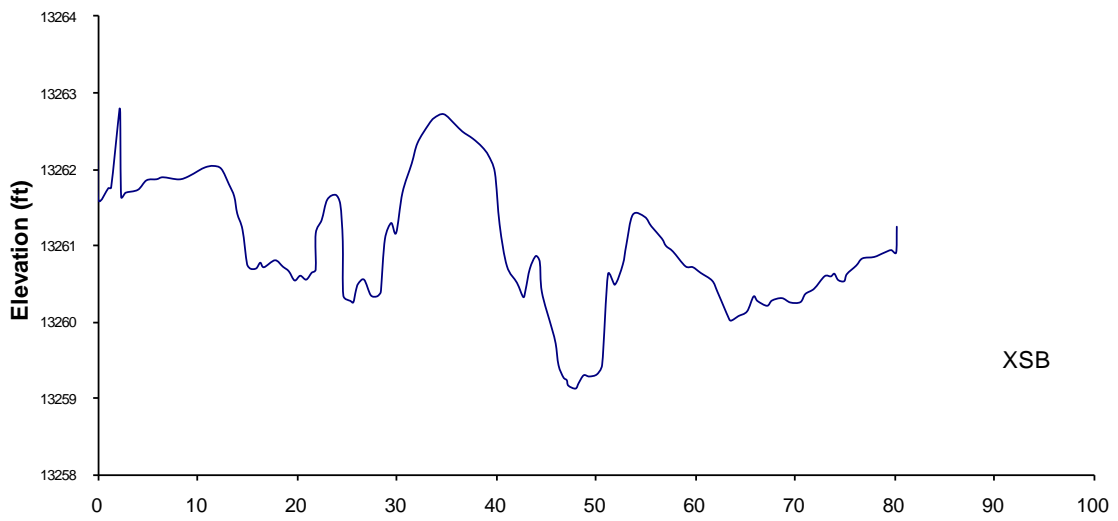
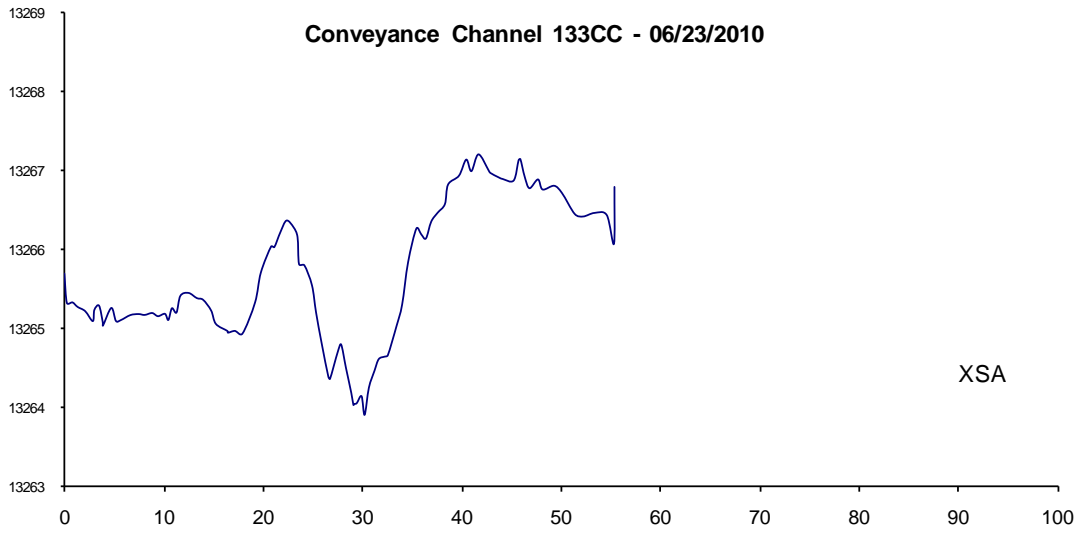


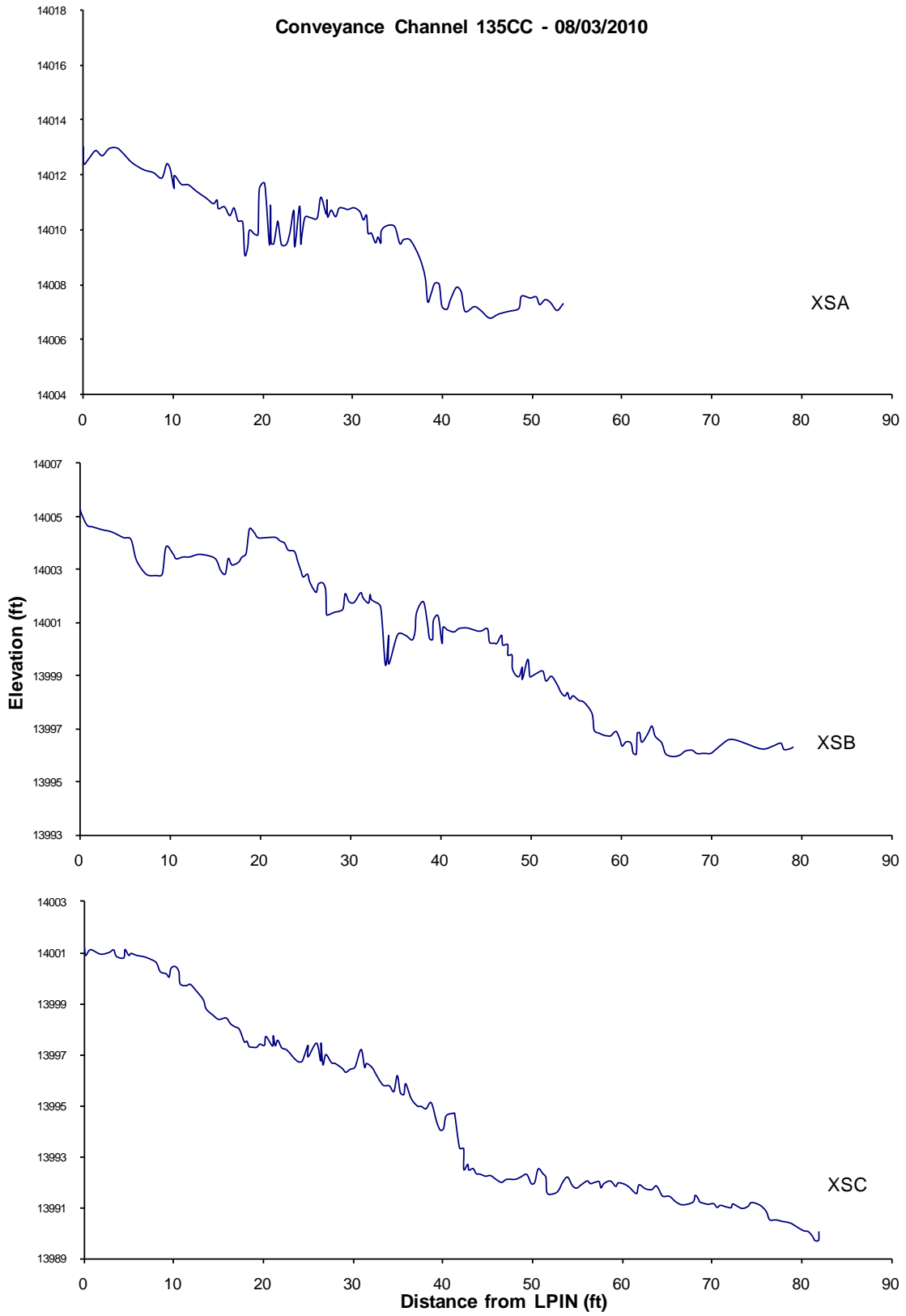


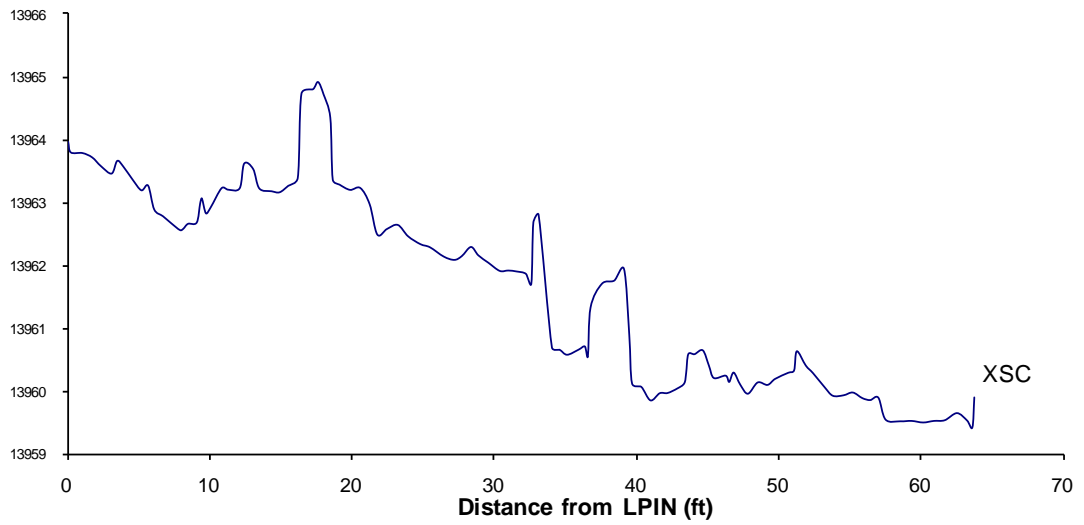
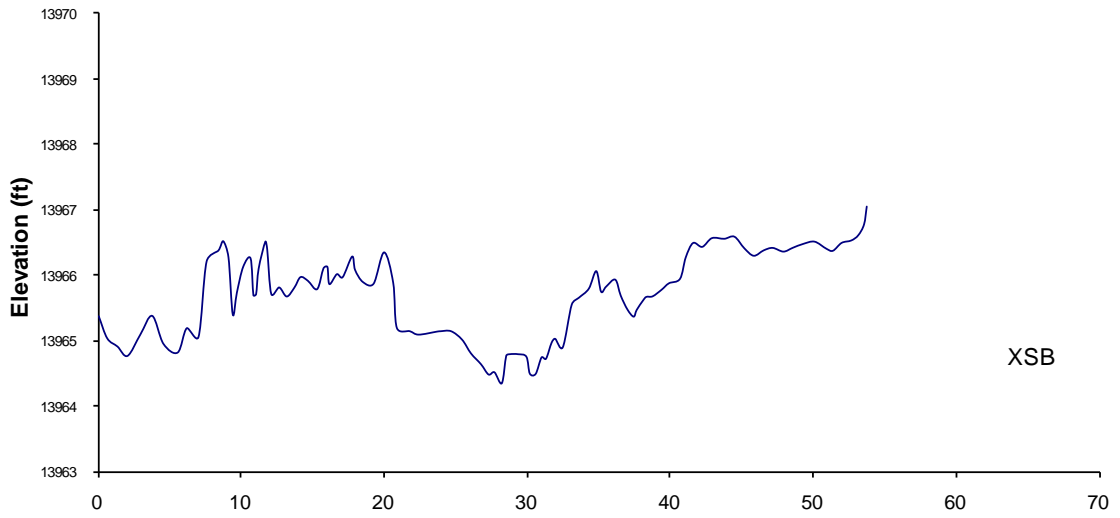
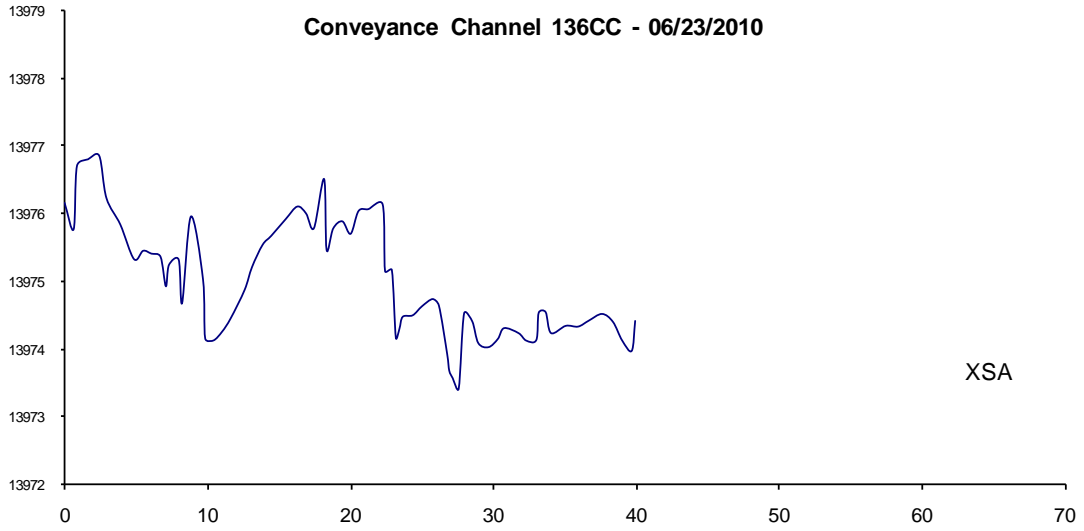


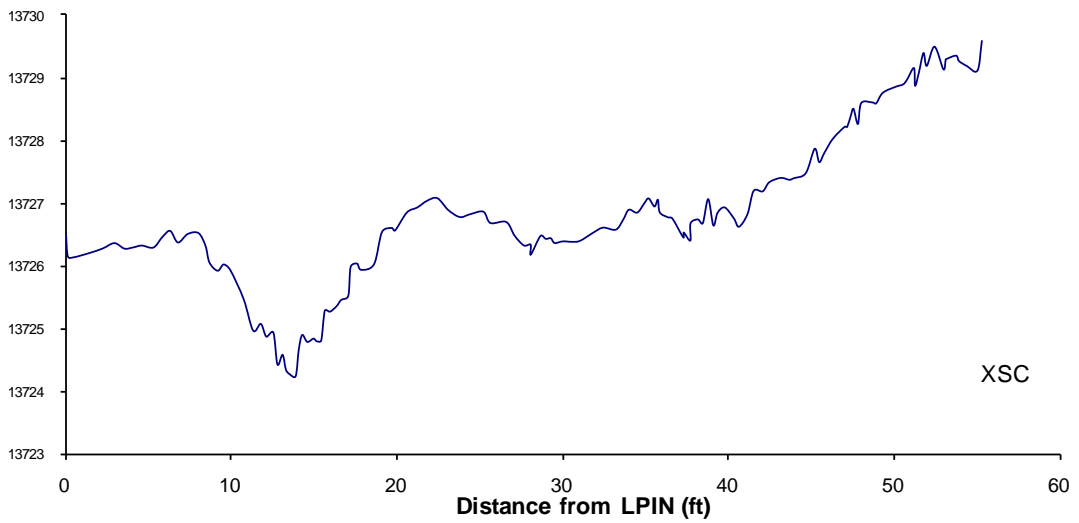
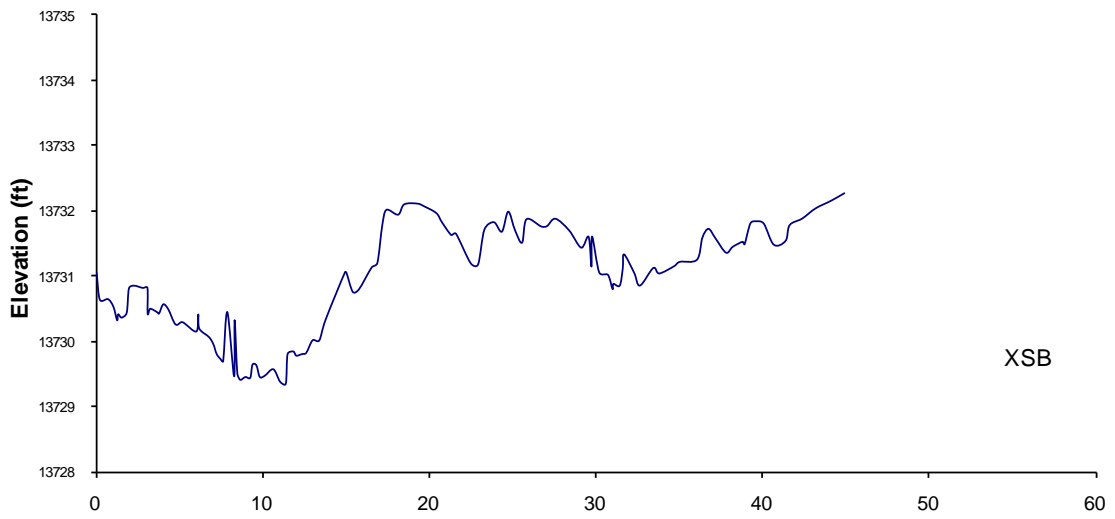
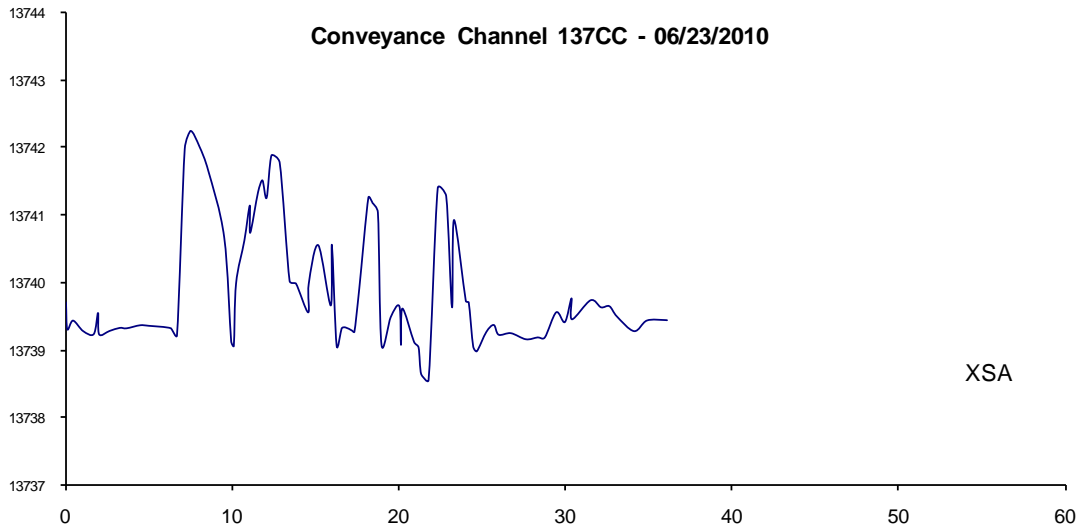


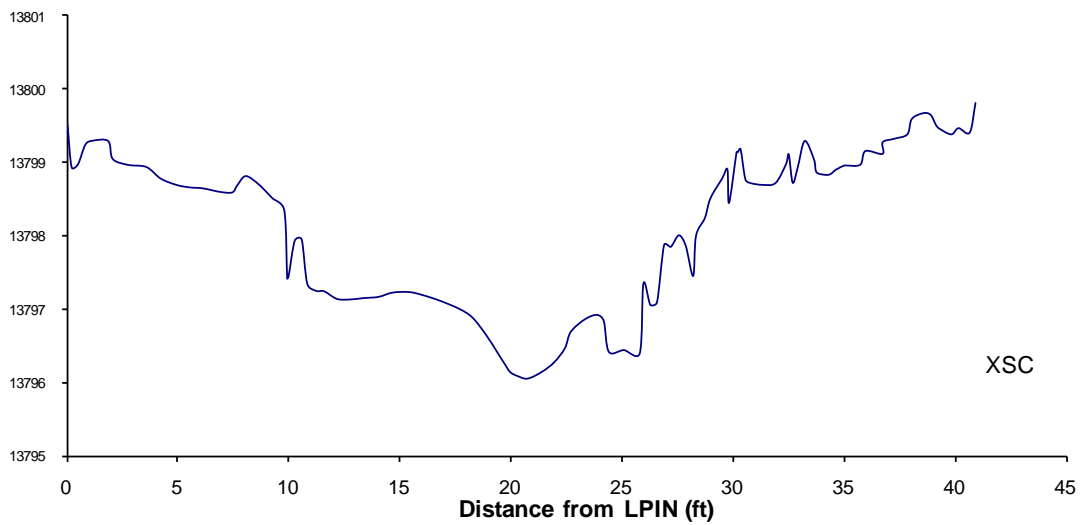
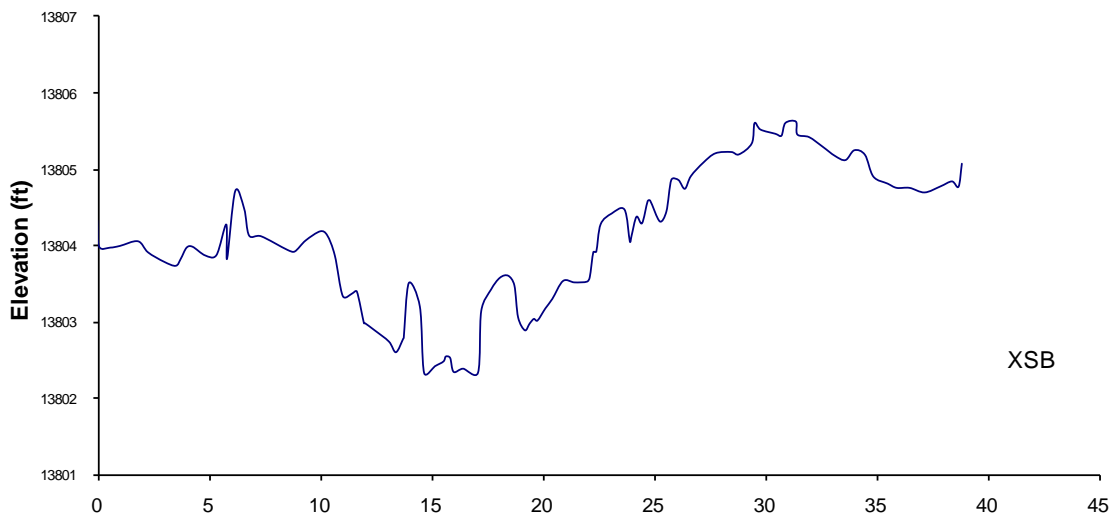
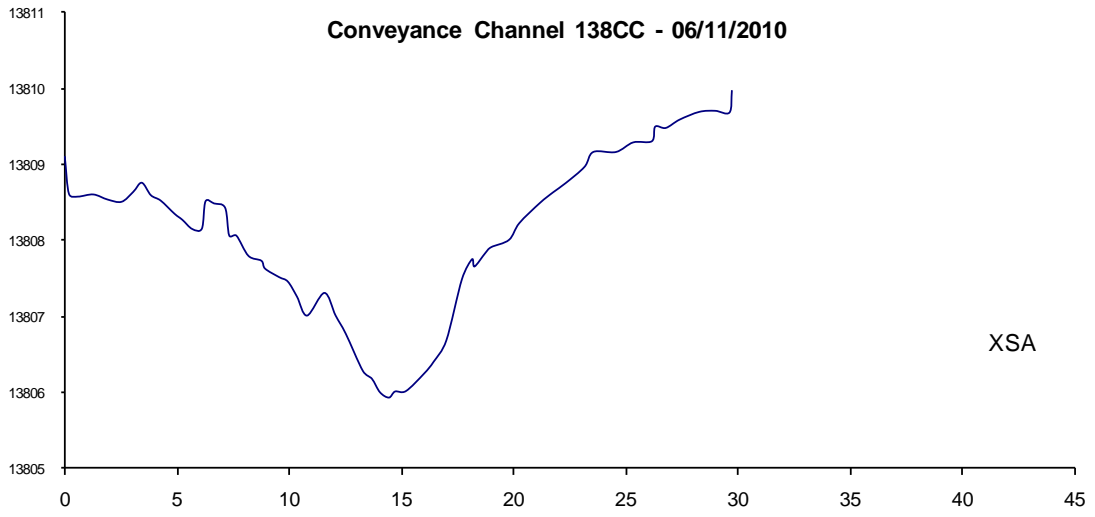


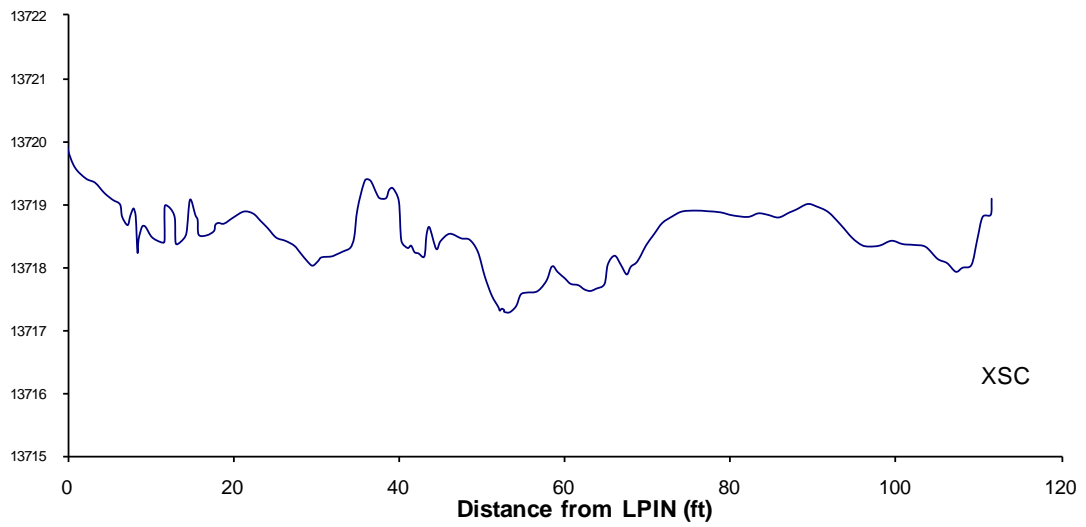
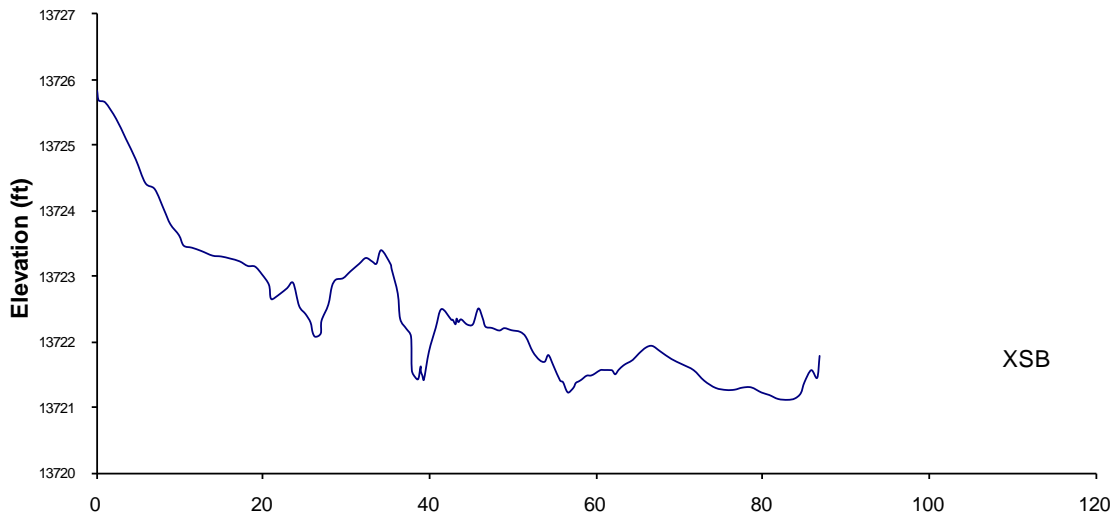
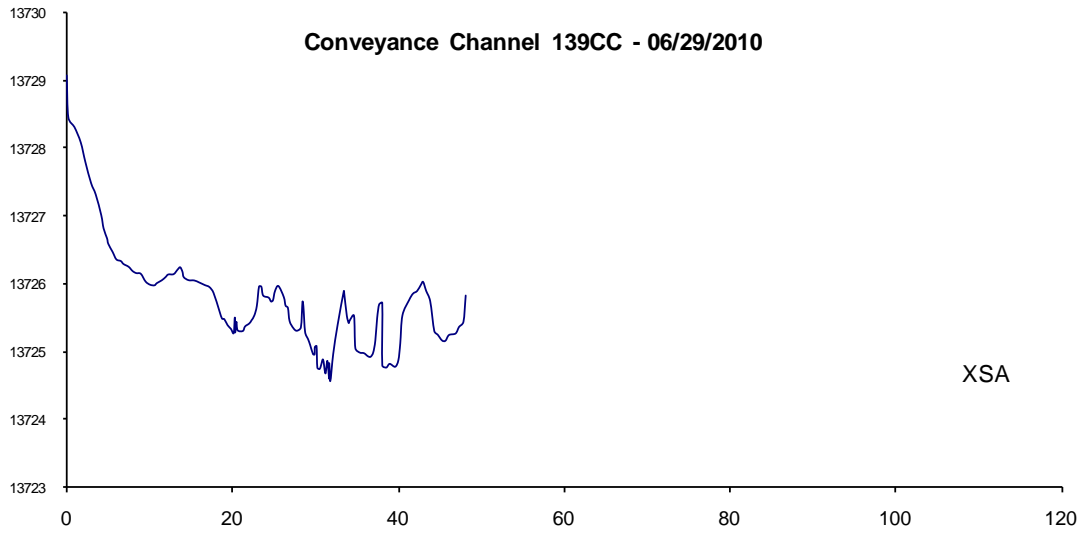


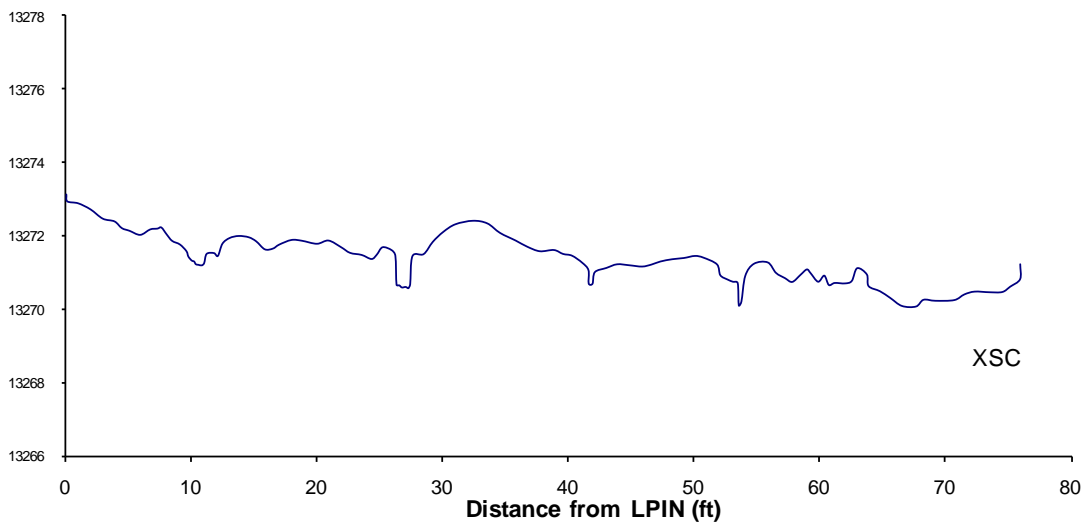
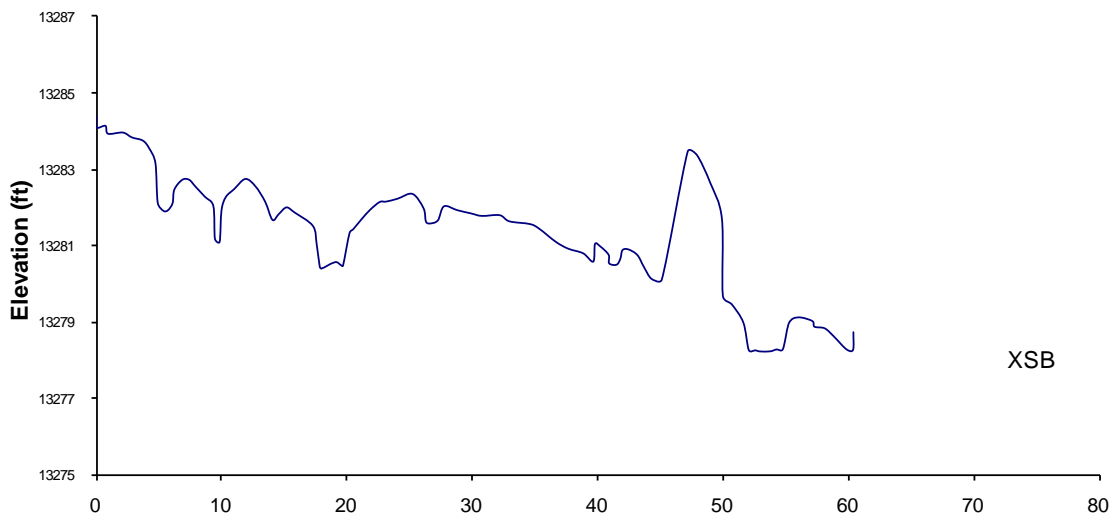
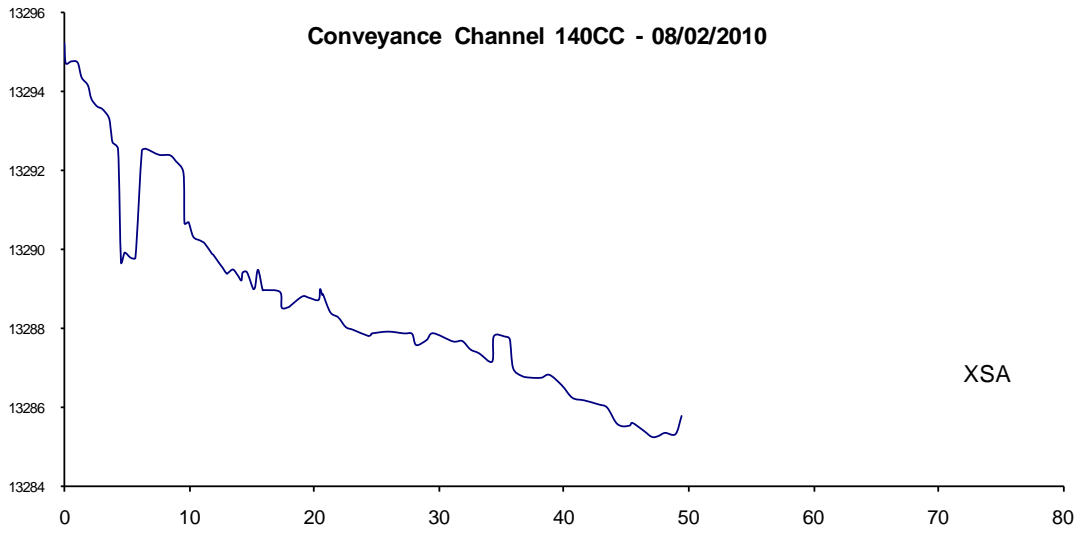




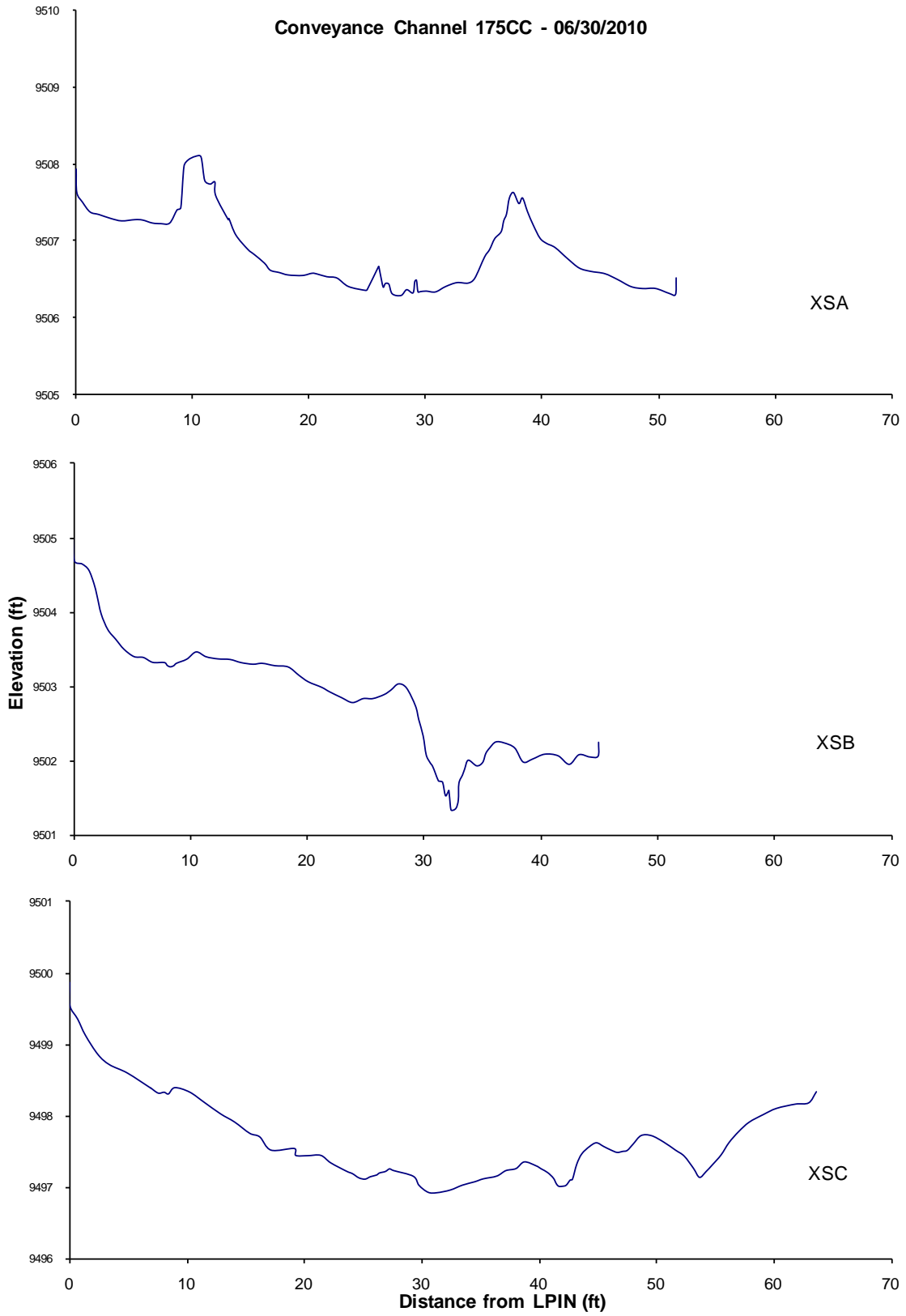


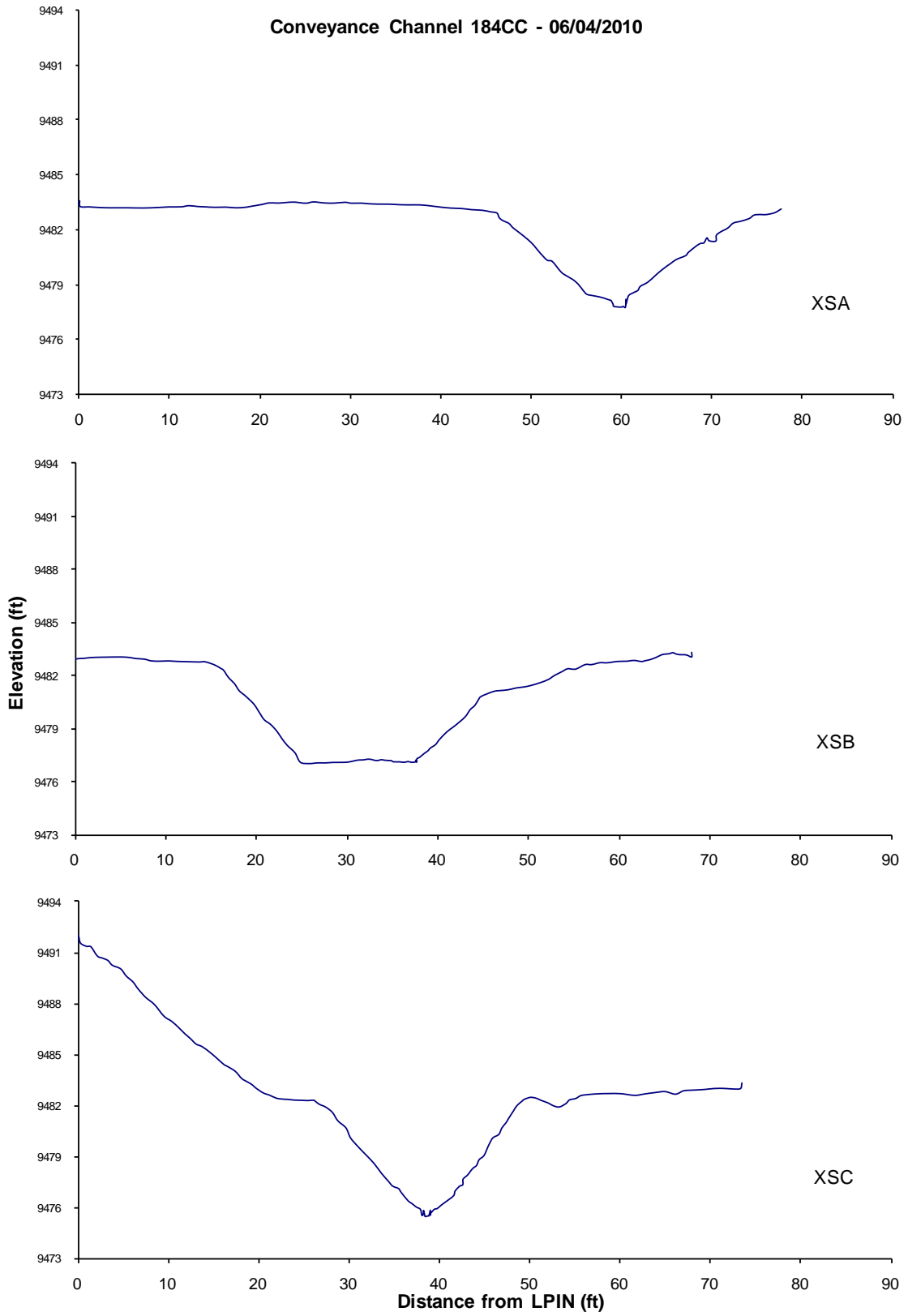


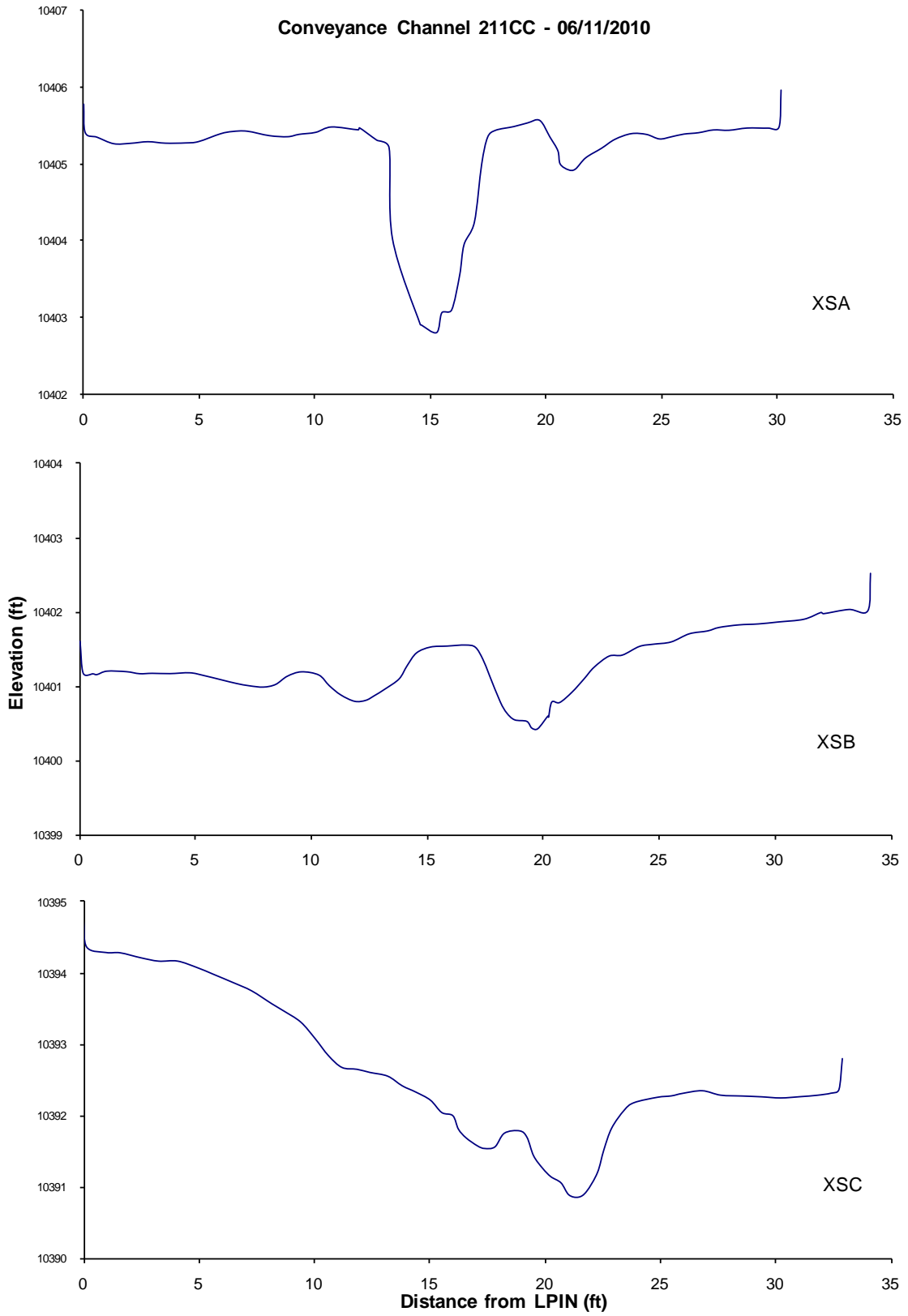


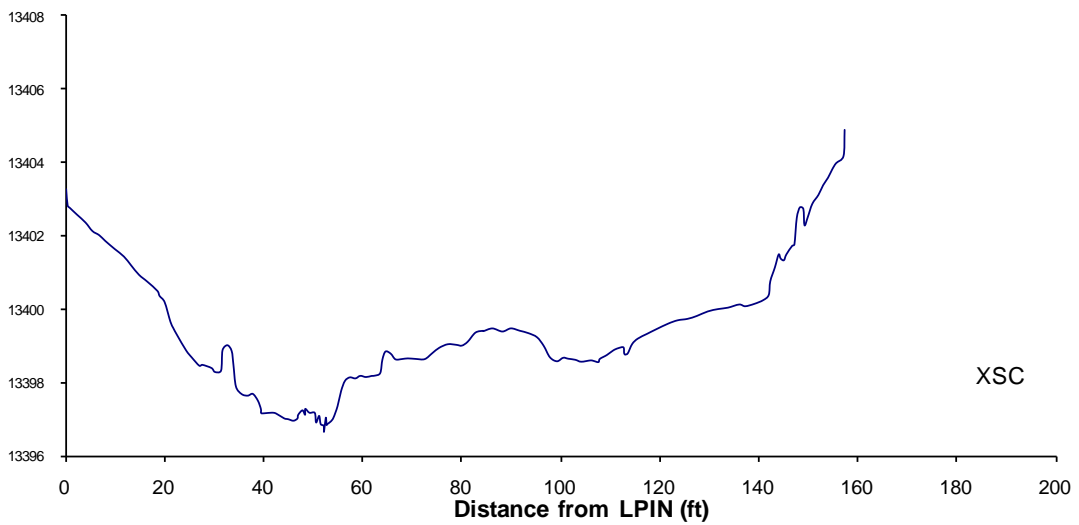
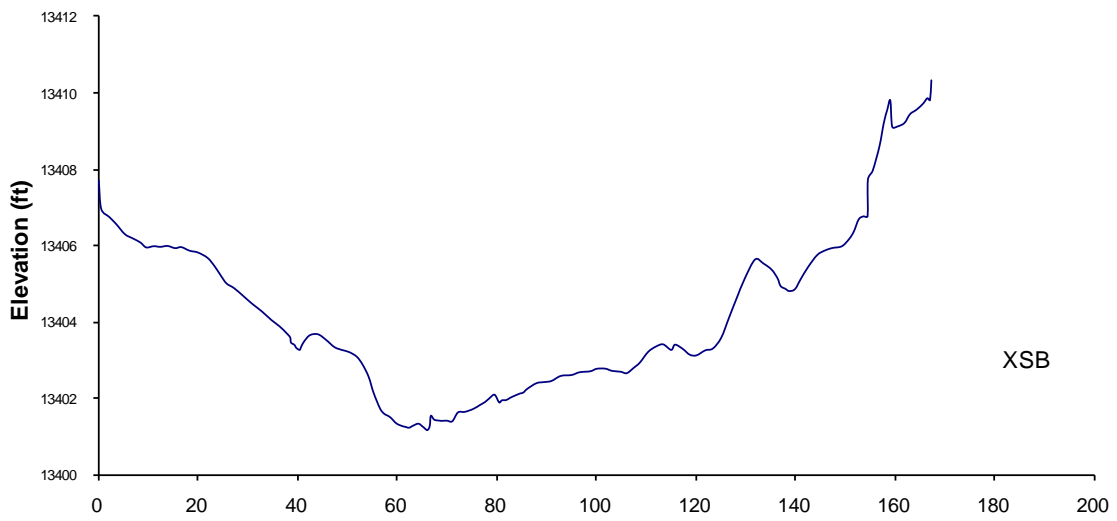
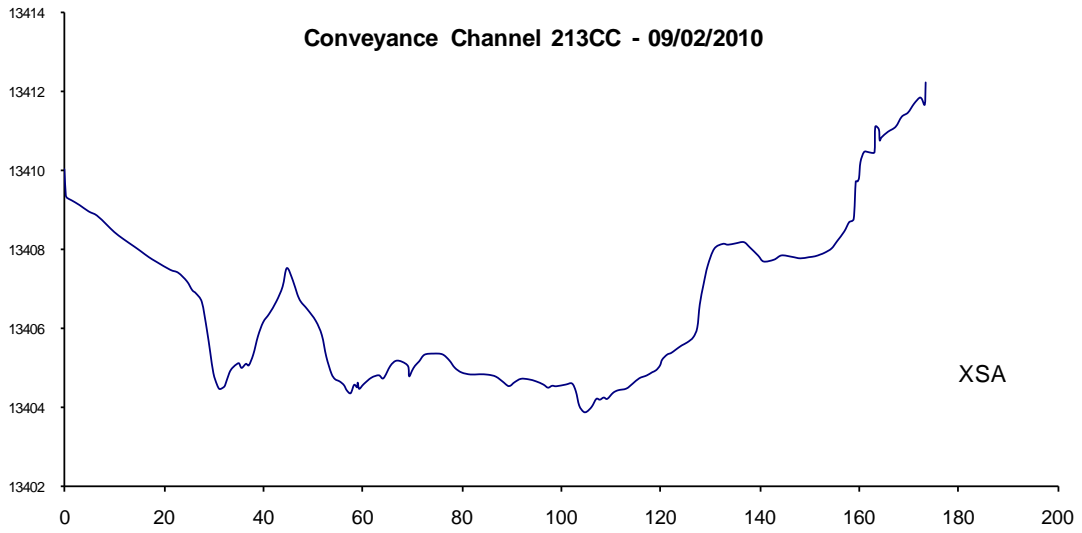


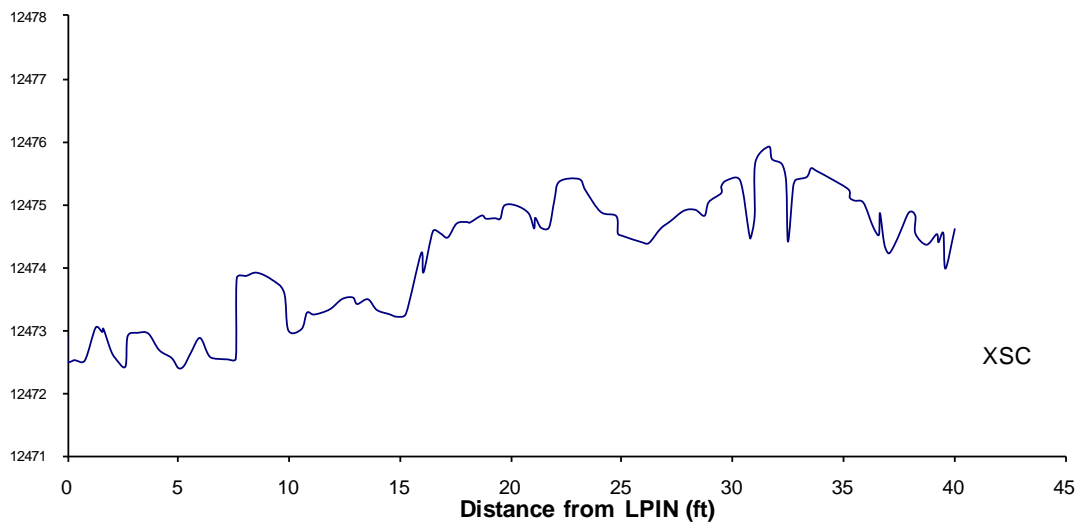
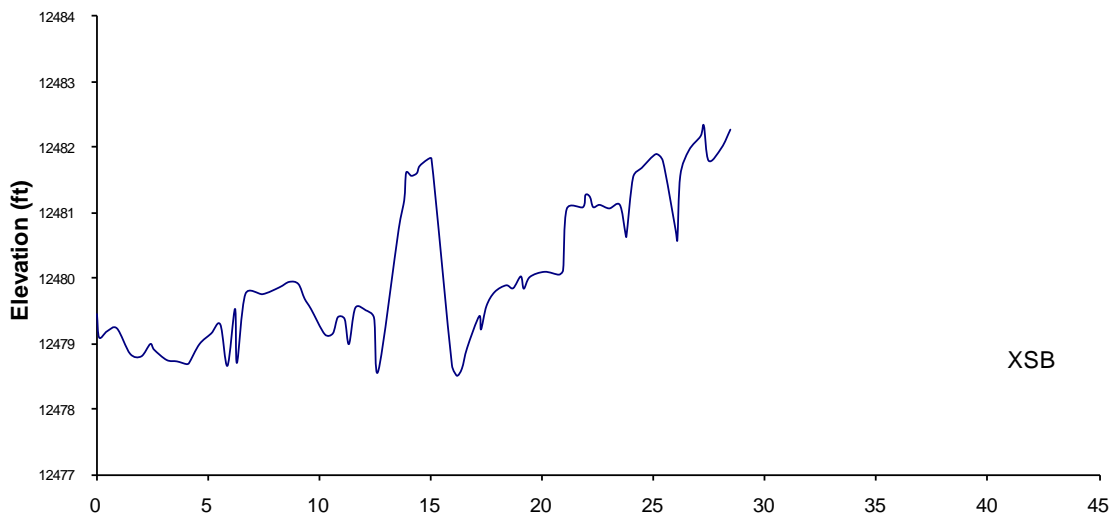
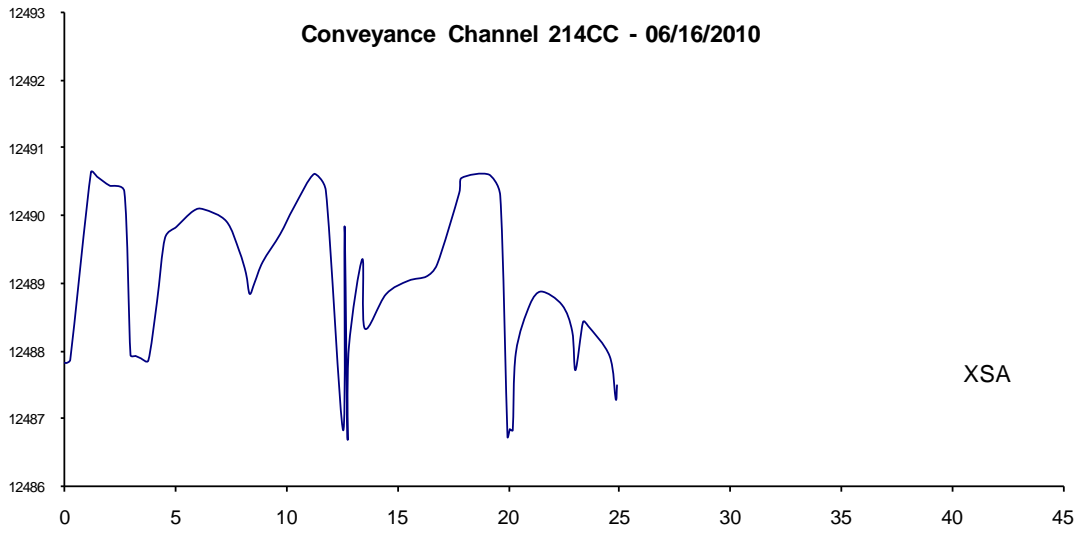


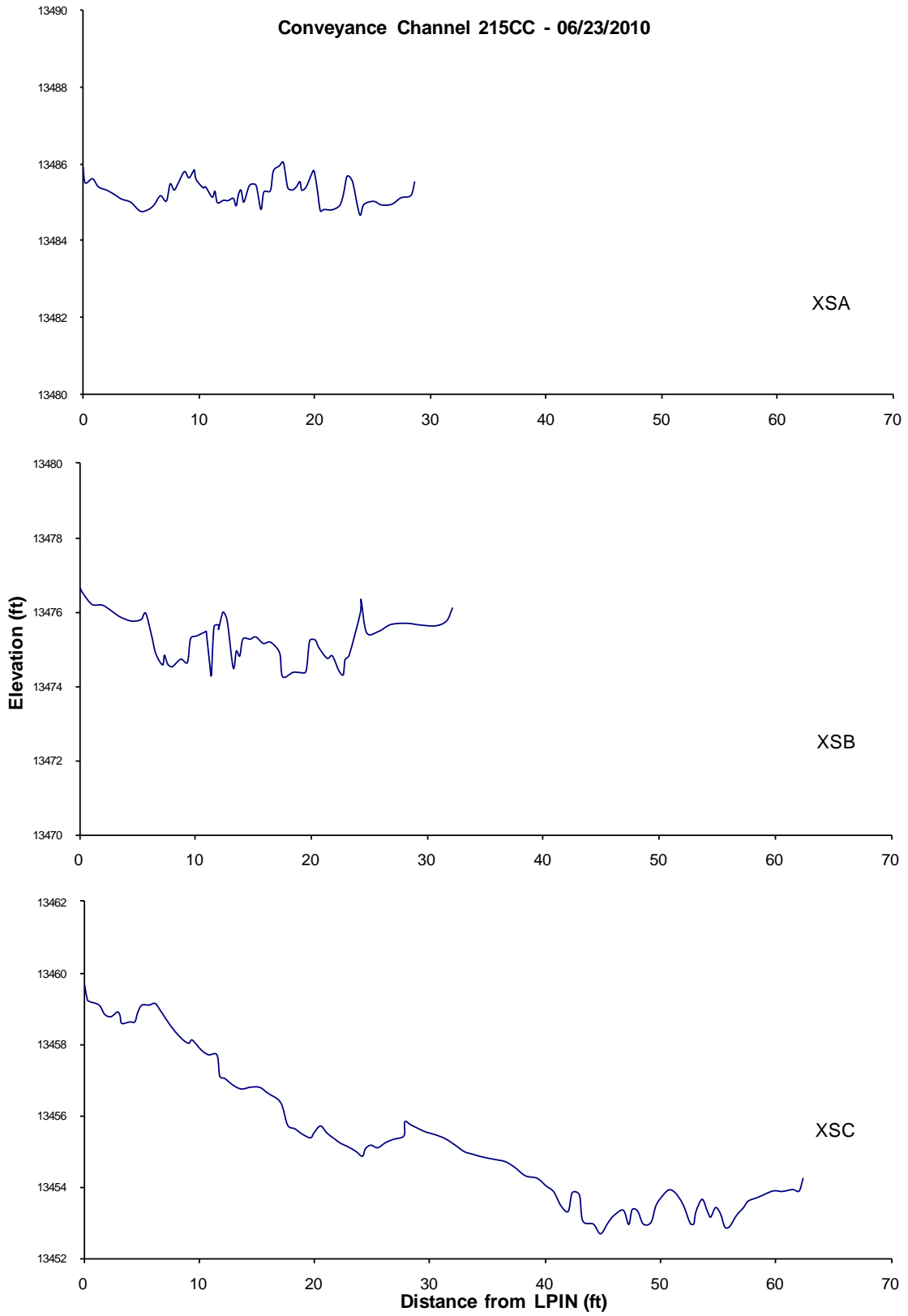


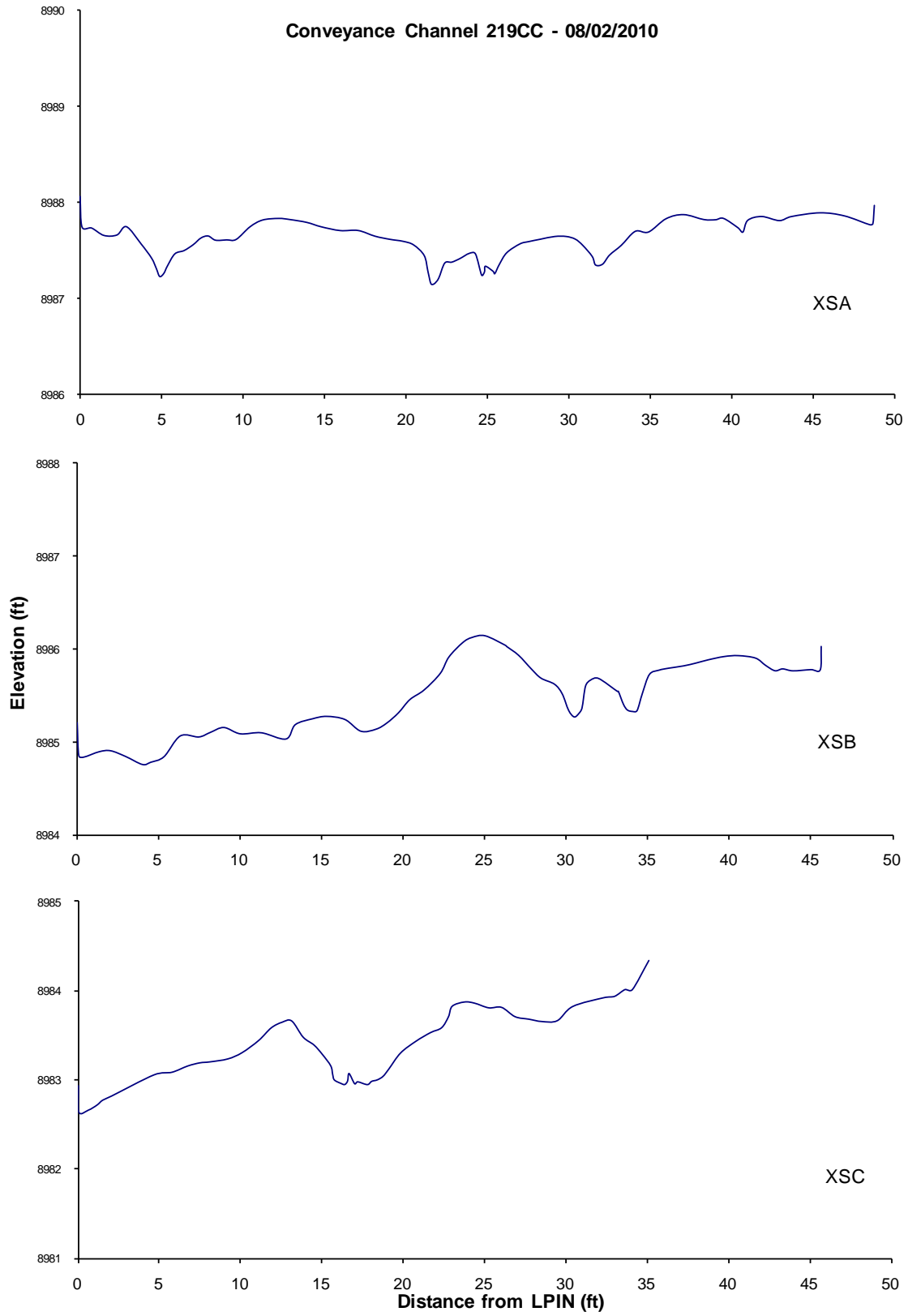


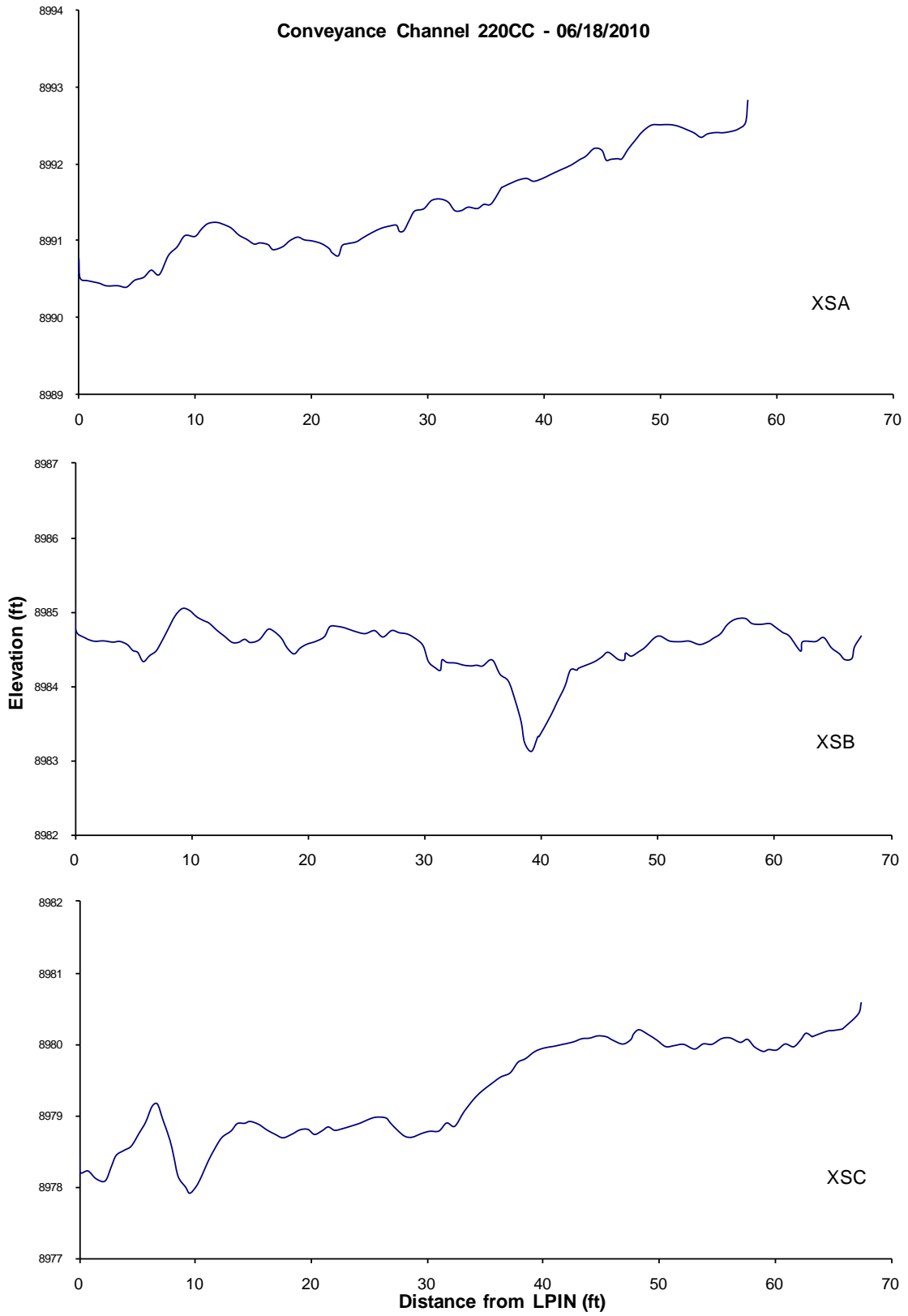




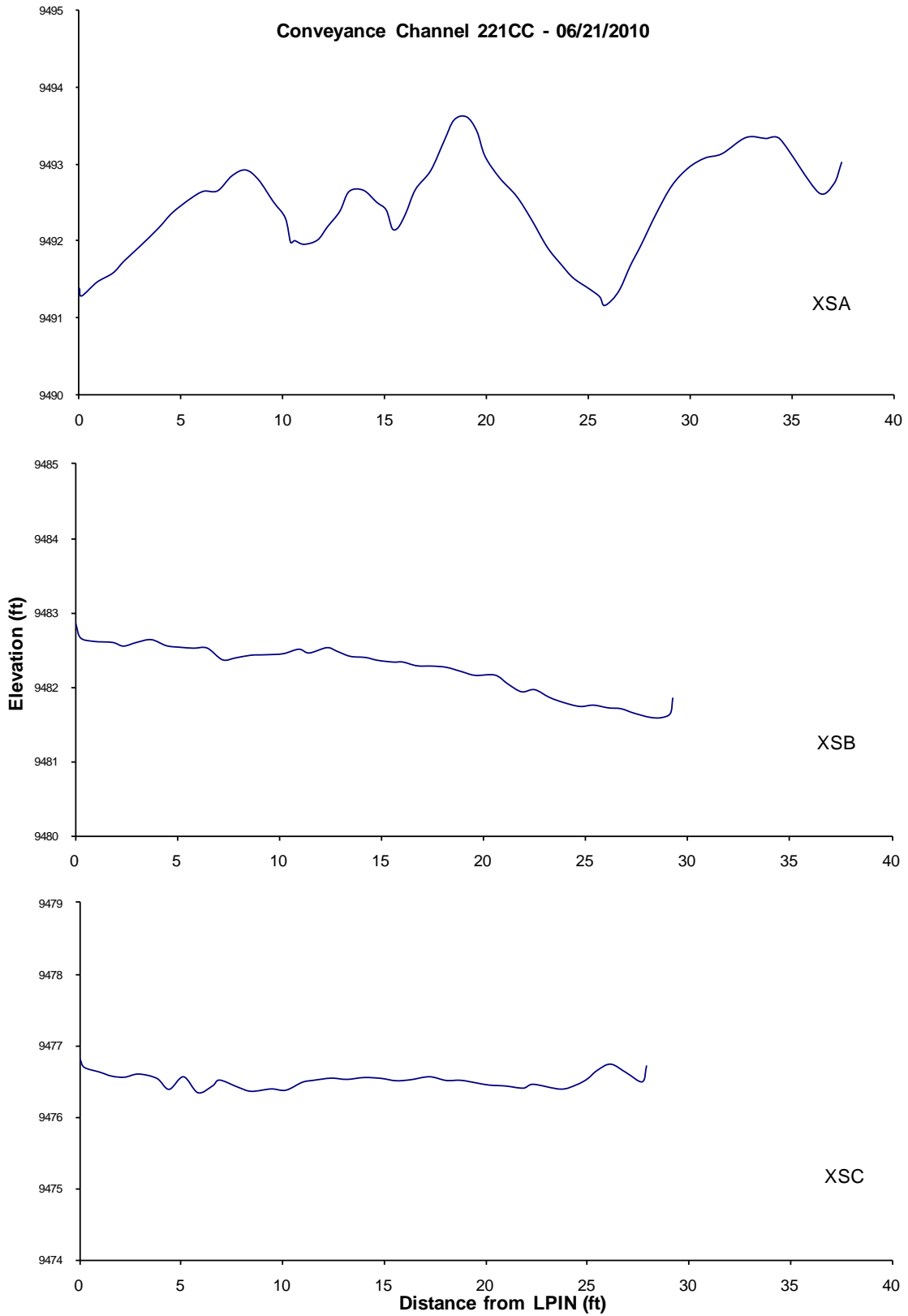


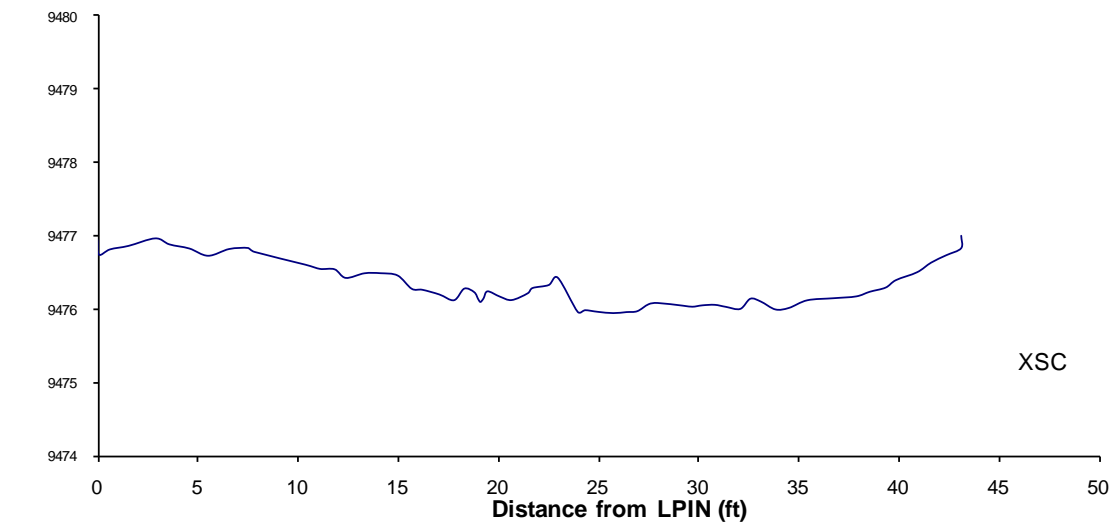
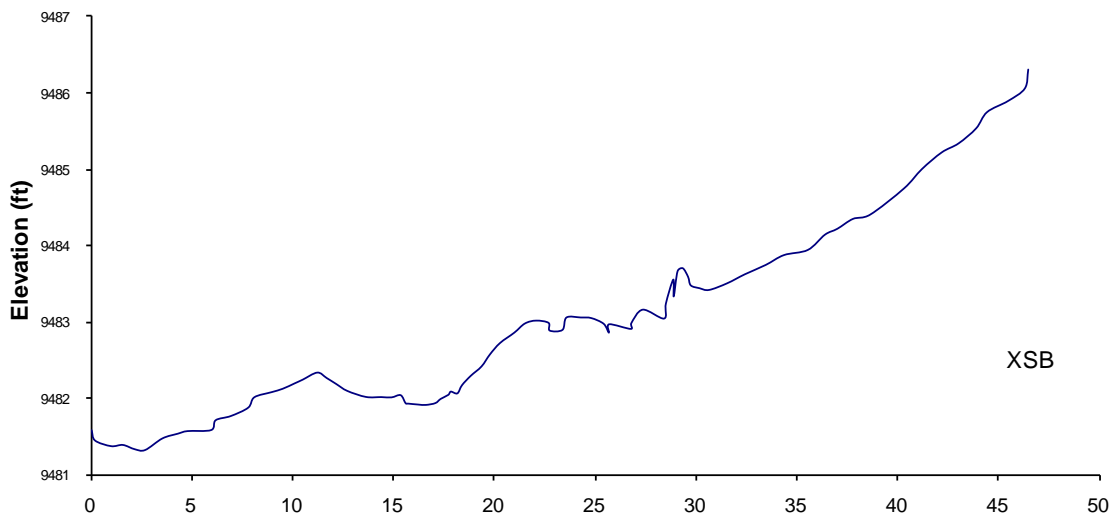
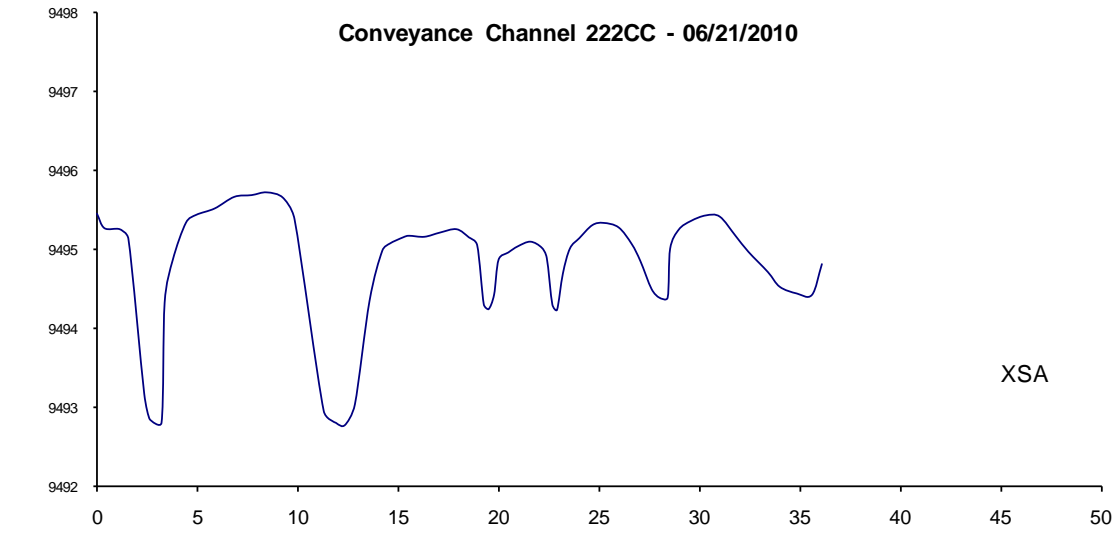


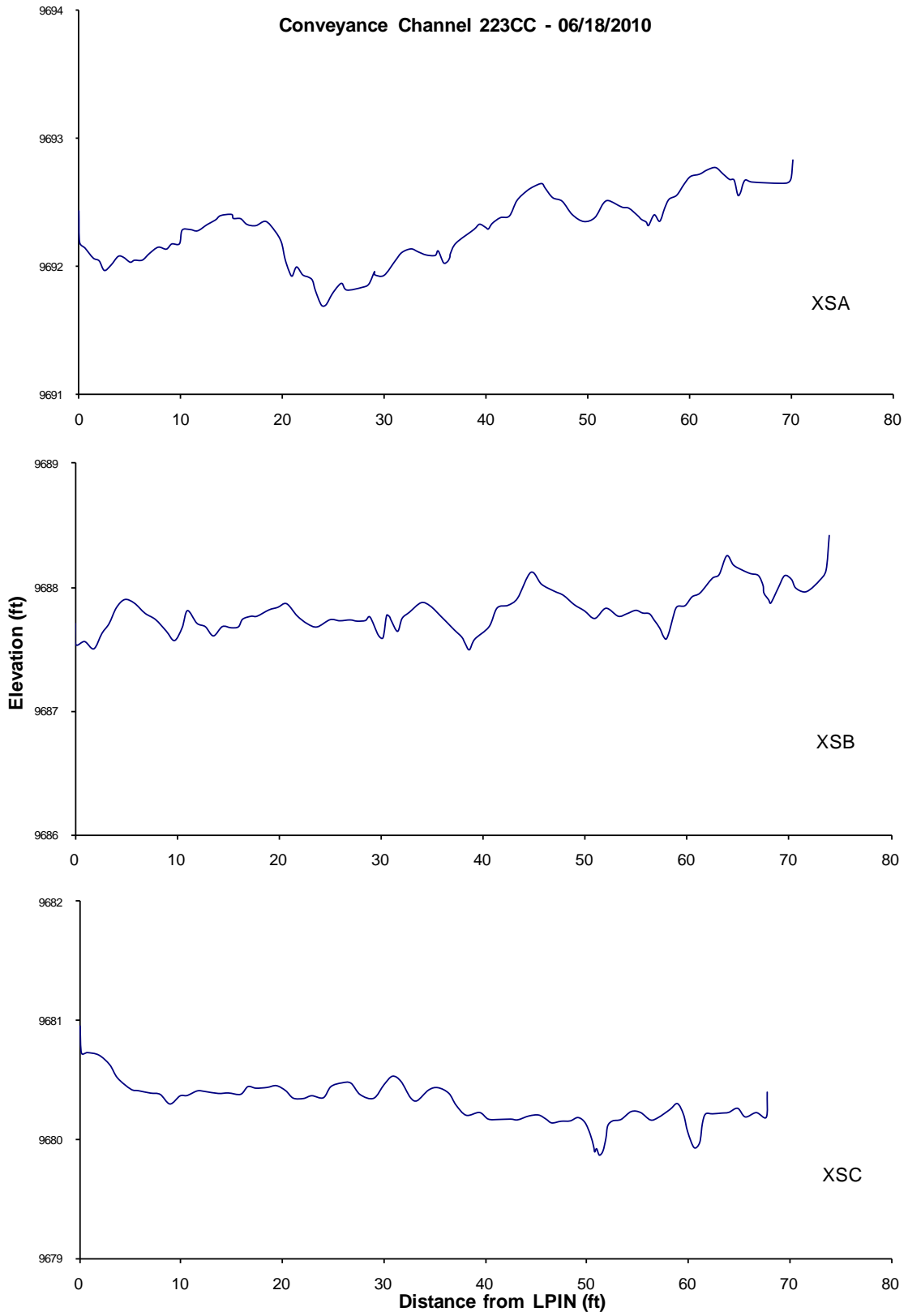


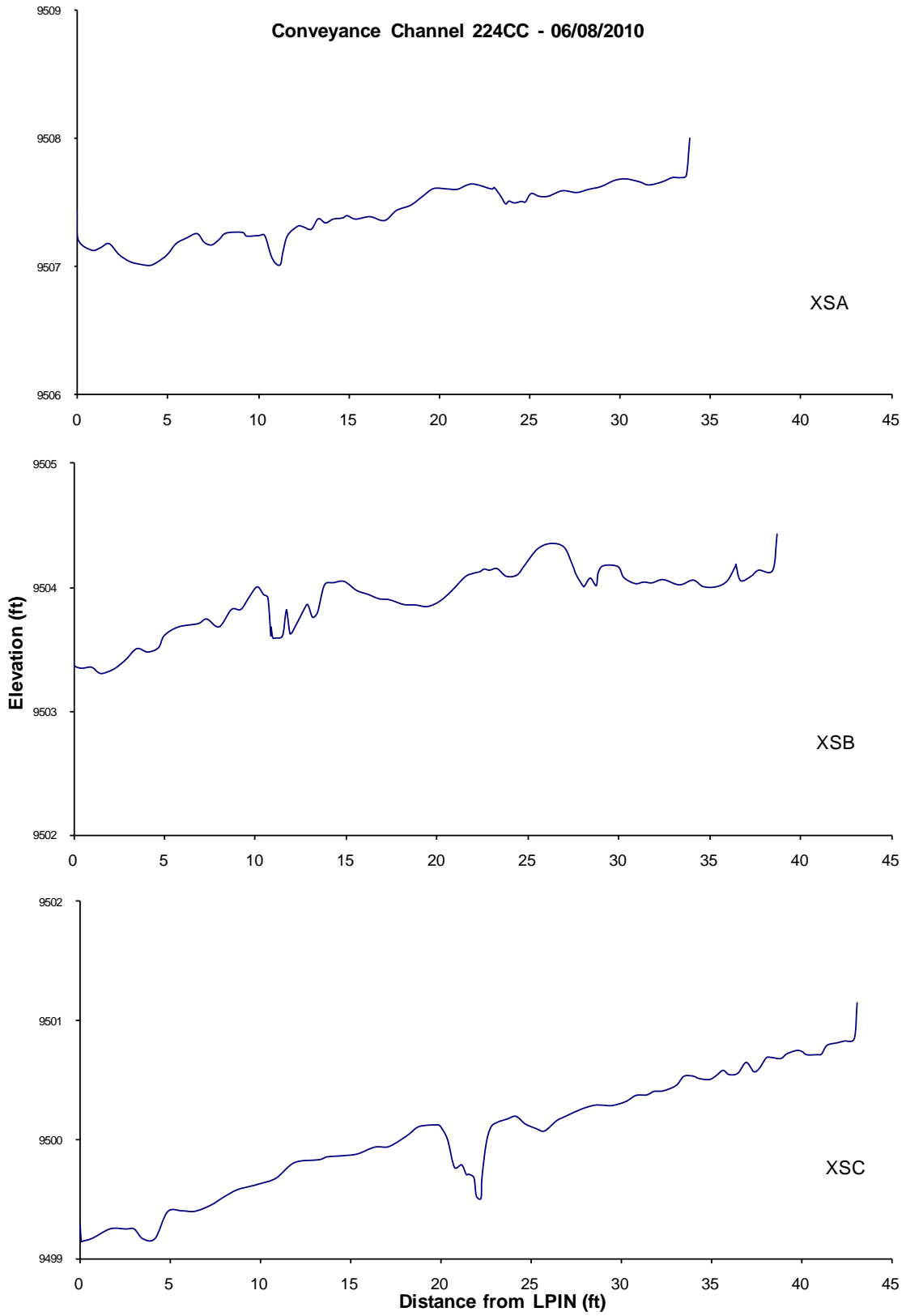


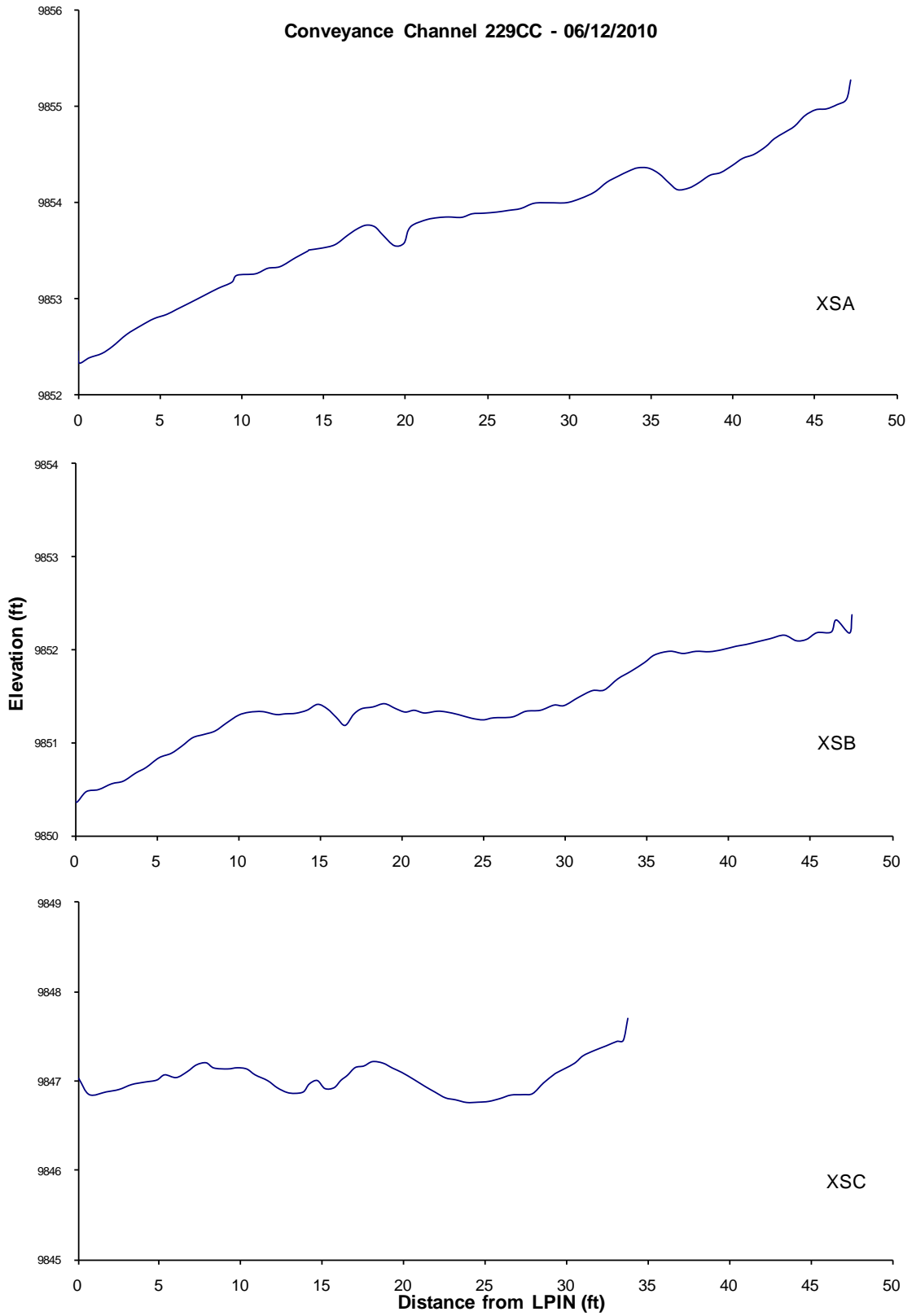


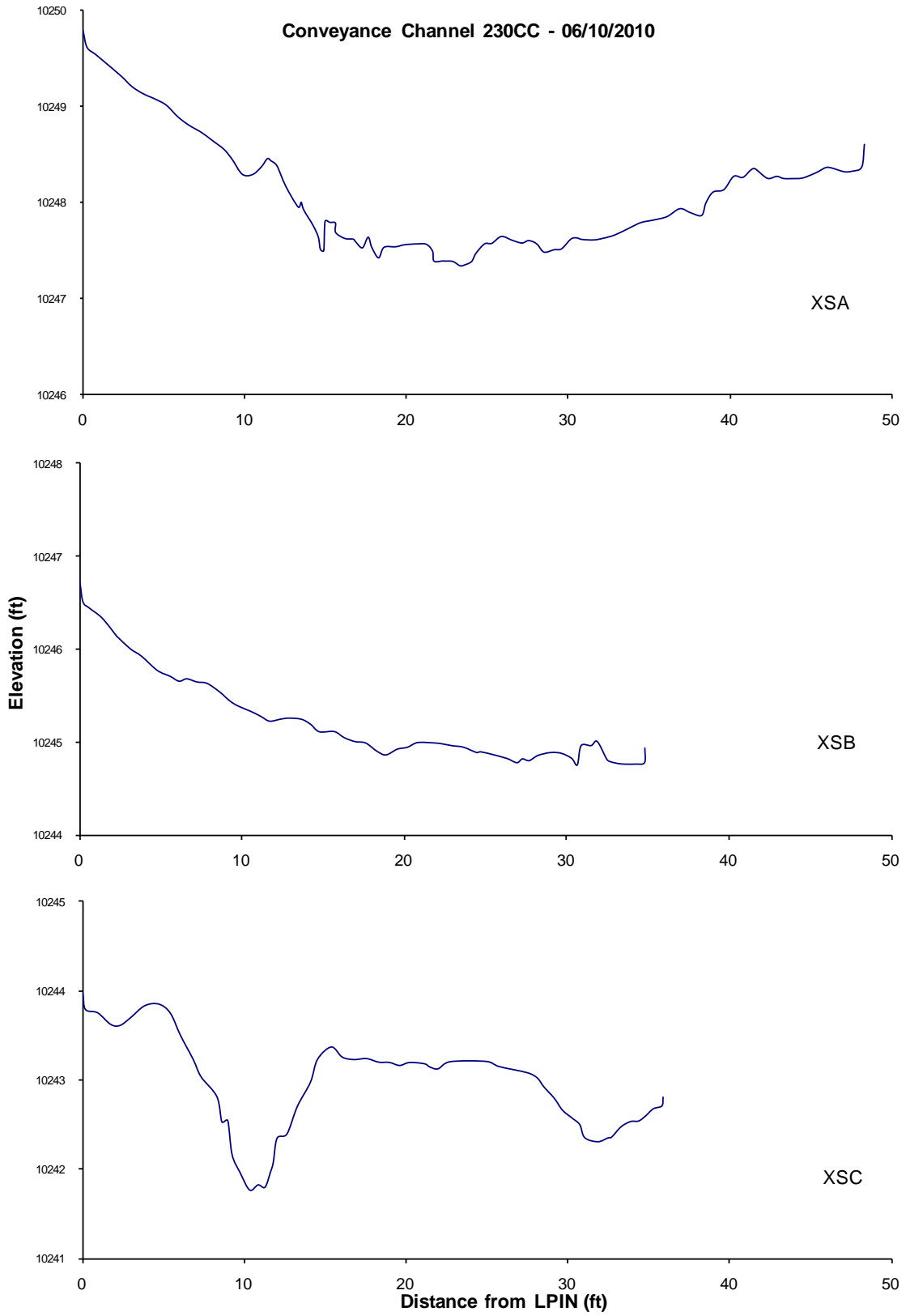


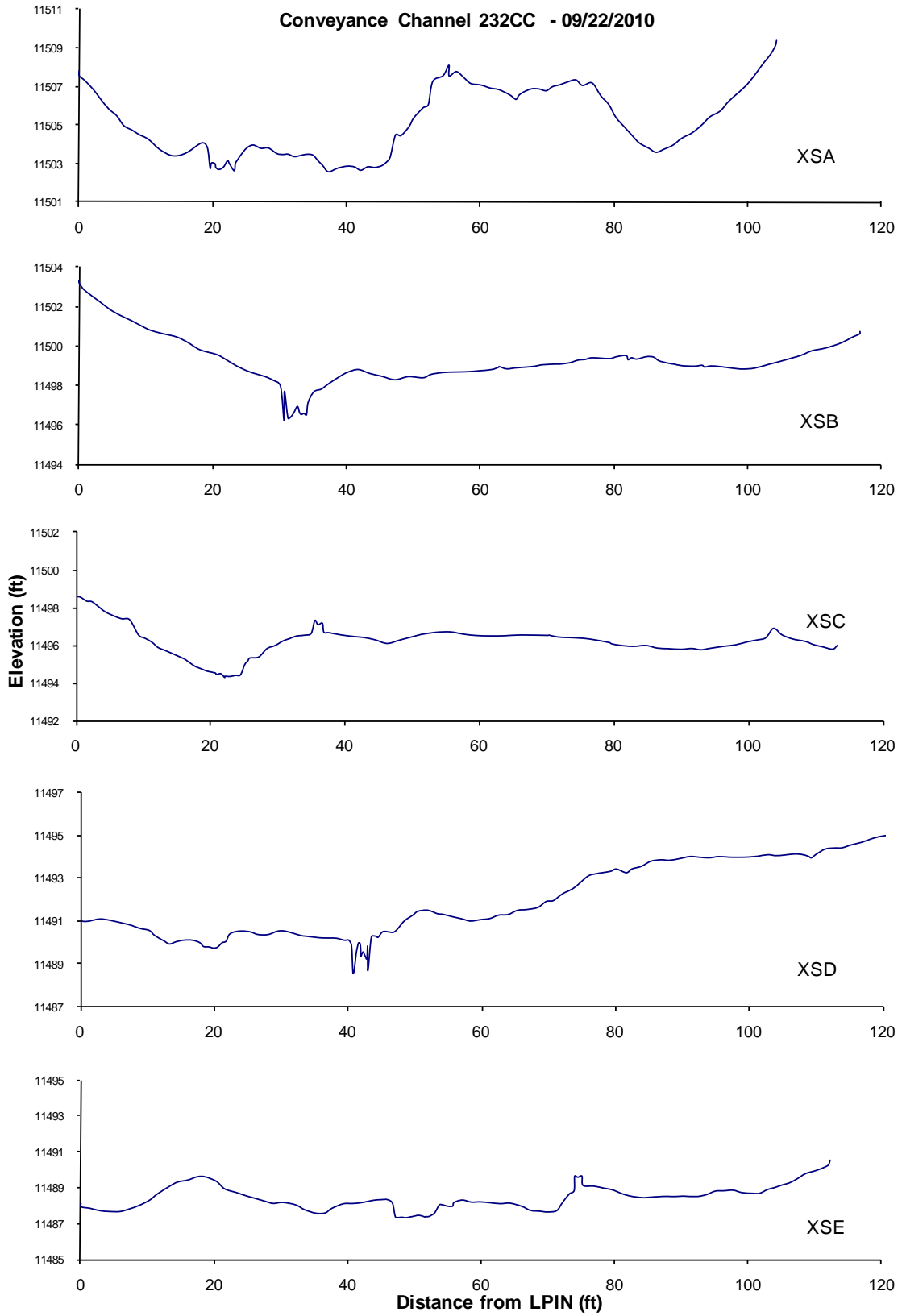


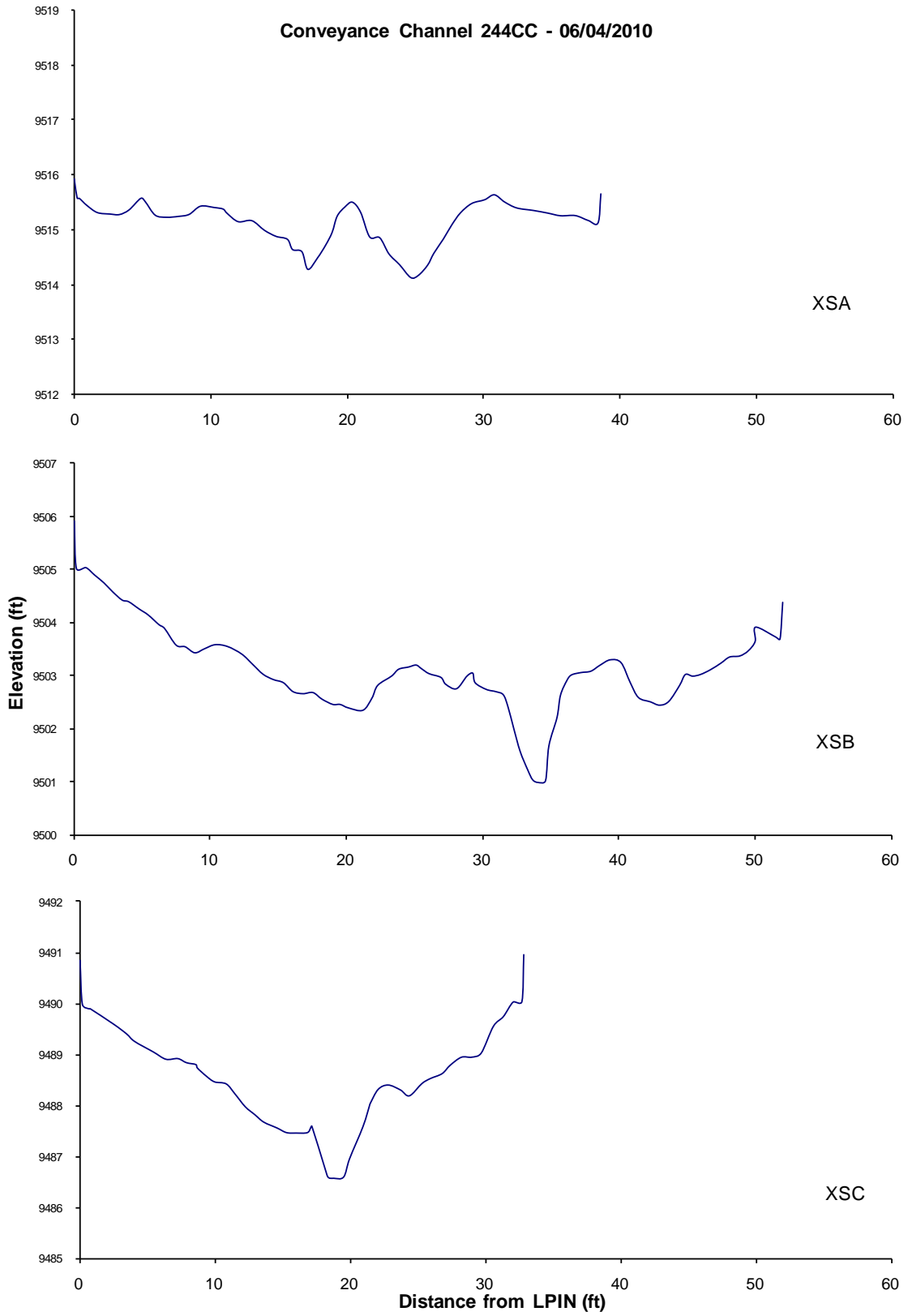




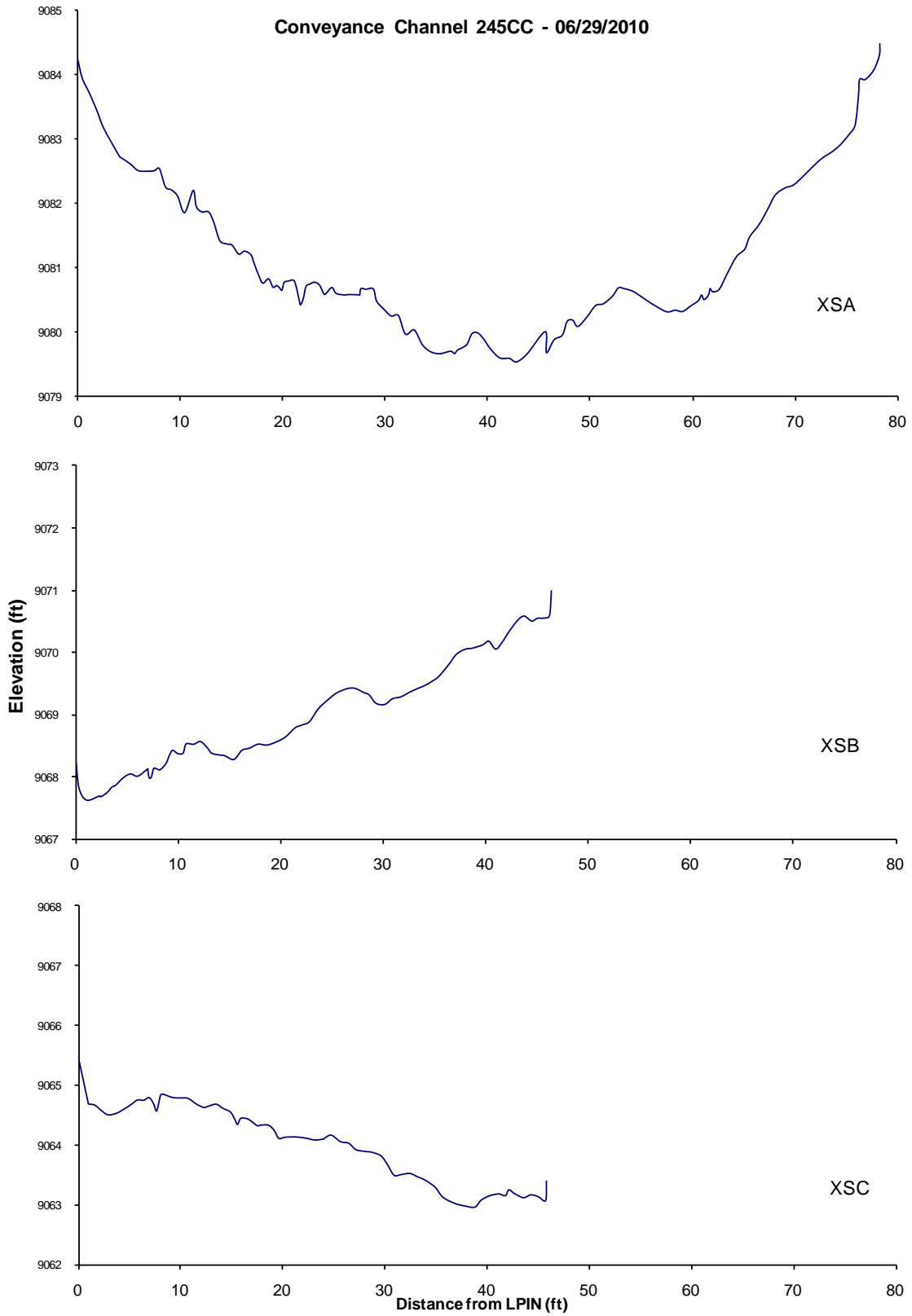














# Appendix K

## Rock Weir and Sediment Pond

### Site Visit Dates Sediment Accumulation and Sediment Pond Cross Section Graphs

2010

**Site Visit Dates of Rock Weir (Sediment Trap) Silt Fences on Pikes Peak, 2010**

Site ID	Site Visit Dates of Rock Weir (Sediment Trap) Silt Fences on Pikes Peak, 2010														
	5/7	5/14	5/17	5/24	6/7	6/16	6/21	7/6	7/16	7/18	7/26	8/9	8/12	9/8	10/4
002RW	X		X	X	X		X	X	X		X	X		X	X
003RW	X		X	X	X		X	X	X		X	X		X	X
006RW	X		X	X	X		X	X	X		X	X		X	X
008RW	X		X	X	X		X	X	X		X	X		X	X
009RA	X		X	X	X		X	X	X		X	X		X	X
161RW	X		X	X	X		X	X	X		X	X		X	X
176RW	X		X	X	X		X	X	X		X	X		X	X
178RW	X		X	X	X		X	X	X		X	X		X	X
179RW	X	X	X	X	X		X	X	X		X	X		X	X
180RW	X		X	X	X		X	X		X	X	X		X	X
181RW	X		X	X	X		X	X		X	X	X		X	X
200RW	X		X	X	X		X	X	X		X	X		X	X
201RW	X		X	X	X		X	X	X		X	X		X	X
202RW	X		X	X	X	X	X	X	X		X	X	X	X	X

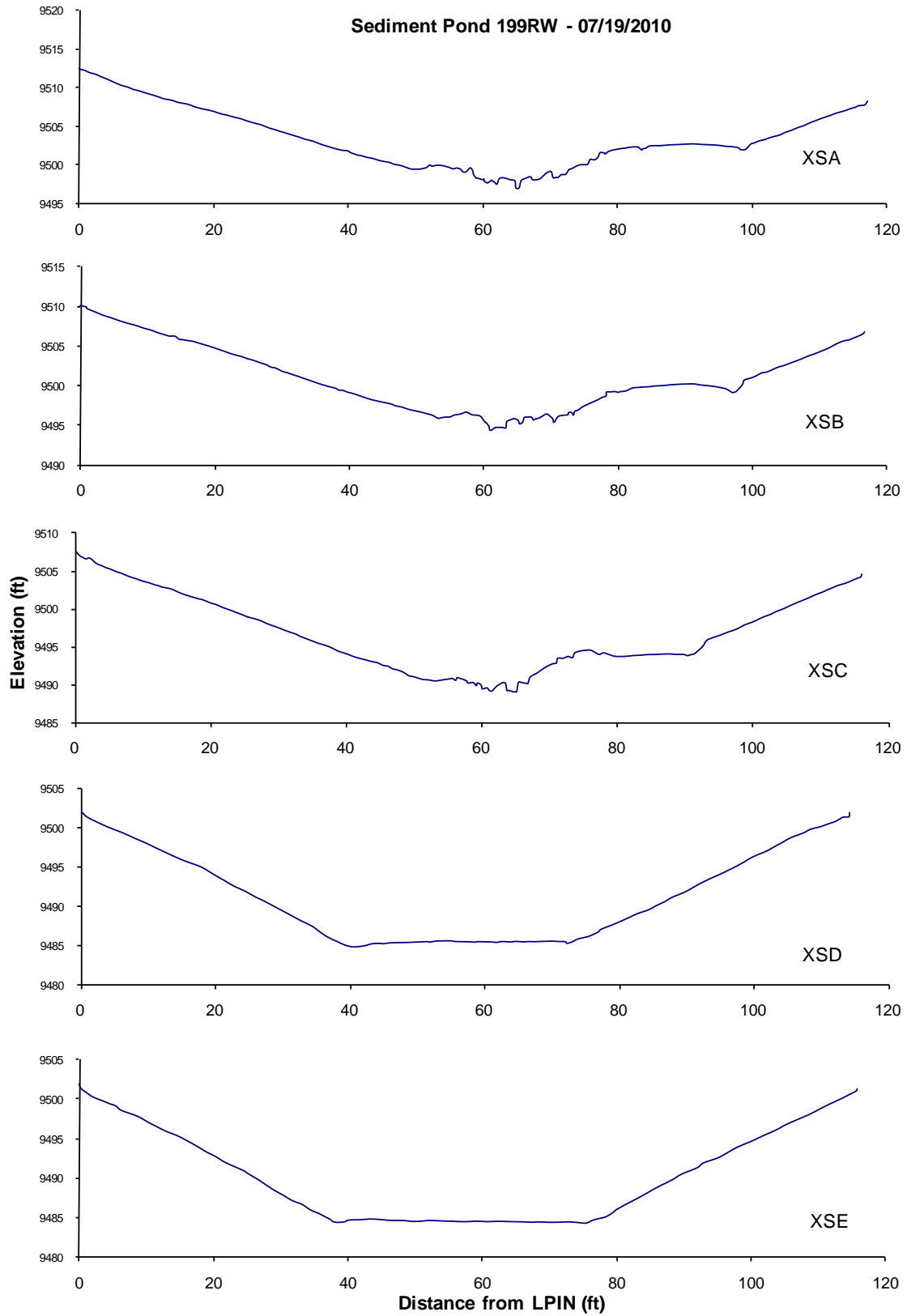
**Sediment Accumulation in Rock Weir Silt Fences on Pikes Peak, 2010**

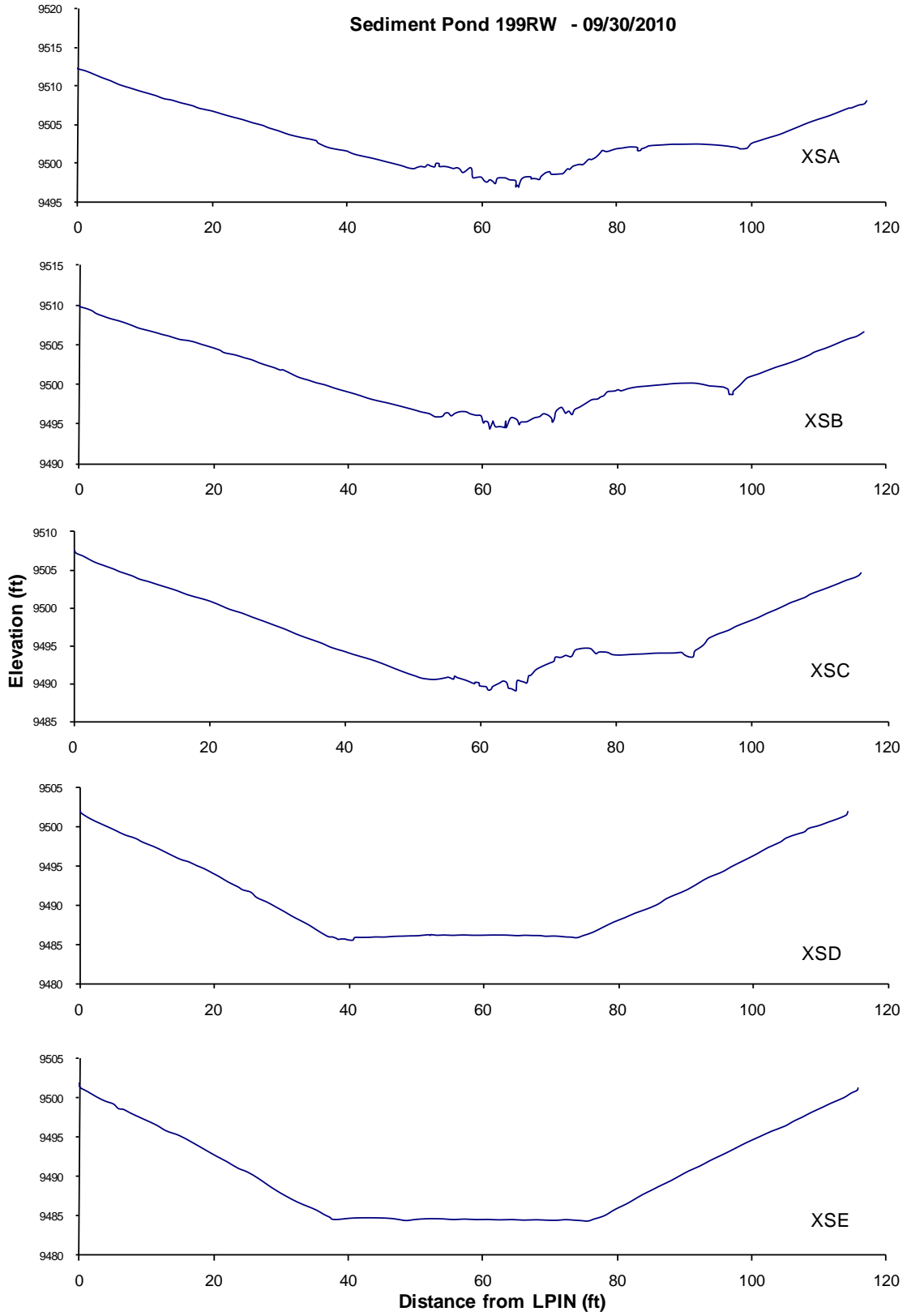
<b>Site ID</b>	<b>Location</b>	<b>Date</b>	<b>Volume (ft<sup>3</sup>)</b>	<b>Grab Sample</b>
179RW	Silt Fence	5/14/10	0.07	Yes
176RW	Silt Fence	5/24/10	0.07	Yes
202RW	Silt Fence	6/16/10	0.07	Yes
180RW	Silt Fence	6/18/10	0.07	Yes
180RW	Silt Fence	7/6/10	0.40	Yes
202RW	Silt Fence	7/6/10	0.33	Yes
180RW	Silt Fence	7/26/10	0.40	Yes
181RW	Silt Fence	7/26/10	0.13	Yes
180RW	Silt Fence	8/9/10	6.68	Yes
181RW	Silt Fence	8/9/10	0.40	Yes
202RW	Silt Fence	8/12/10	0.40	Yes
180RW	Silt Fence	9/8/10	4.48	Yes
181RW	Silt Fence	9/20/10	0.20	Yes
178RW	Silt Fence	9/29/10	0.13	Yes

### Rock Weir Sediment Accumulation Values on Pikes Peak, 2010

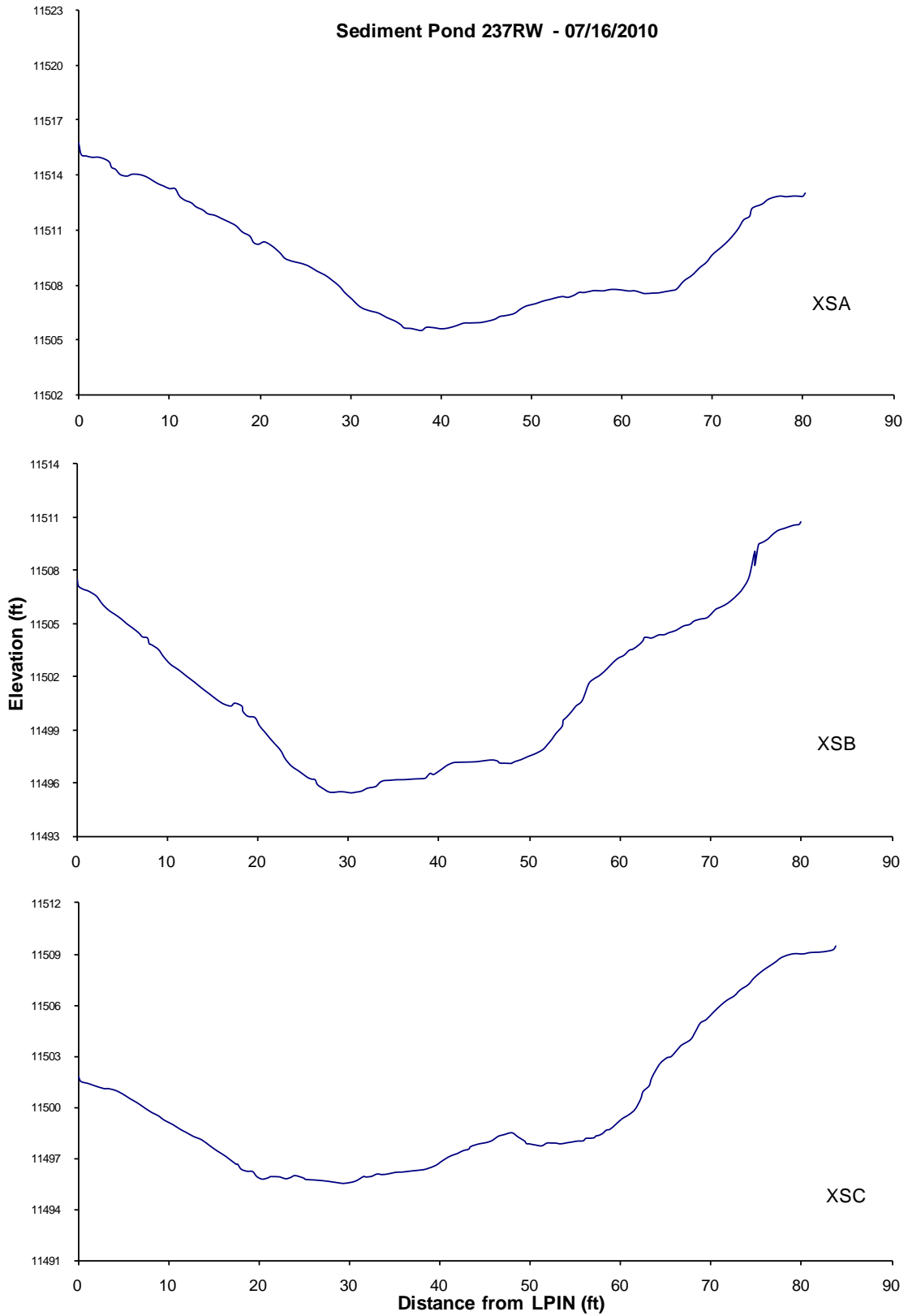
Site ID	Area (sq ft)	Survey1		Survey 2				Survey 3			
		Date	Average Elevation (ft)	Date	Average Elevation (ft)	Elevation Change (ft) †	Volume Change (ft <sup>3</sup> ) †	Date	Average Elevation (ft)	Elevation Change (ft) †	Volume Change (ft <sup>3</sup> ) †
002RW	1679	5/25/10	8998.05	9/21/10	8997.16	-0.89	-1494.31				
003RW	521	6/3/10	8991.18	6/3/10	8991.21	0.03	15.63	9/21/10	8991.14	-0.07	-36.47
006RW	798	5/26/10	8997.07	9/22/10	8997.02	-0.05	-39.90				
008RW	1044	6/4/10	9499.10	9/20/10	9499.04	-0.06	-62.64				
009RA	905	5/26/10	9695.77	9/21/10	9695.79	0.02	18.10				
152RW	817	5/27/10	9791.91	9/28/10	9791.93	0.02	16.34				
153RW	1568	5/27/10	9452.32	9/15/10	9452.38	0.06	94.08				
161RW	263	5/25/10	9504.94	9/15/10	9504.93	-0.01	-2.63				
162RW	130	9/20/10	9512.14								
176RW	372	5/27/10	10193.90	9/29/10	10193.88	-0.02	-7.44				
178RW	377	6/18/10	10201.79	9/29/10	10202.31	0.52	196.04				
179RW	792	6/18/10	10214.66	9/30/10	10214.67	0.01	7.92				
180RW	542	6/18/10	10235.20	9/14/10	10234.84	-0.36	-195.12				
181RW	1299	6/19/10	10252.88	9/20/10	10252.63	-0.25	-324.75				
200RW	412	6/4/10	9194.70	9/29/10	9194.80	0.10	41.20				
201RW	183	6/4/10	9588.56	9/29/10	9588.61	0.05	9.15				
202RW	179	5/26/10	9690.44	9/15/10	9690.52	0.08	14.32				
233RW	359	6/19/10	11902.03	9/14/10	11902.17	0.14	50.26				
234RW	514	6/19/10	12100.16								
239RW	381	91/2010	12799.01								
240RW	634	6/19/10	12897.08	9/14/10	12897.18	0.10	63.40				
241RW	1015	8/4/10	12551.54								
242RW	1170	9/1/10	12901.06								

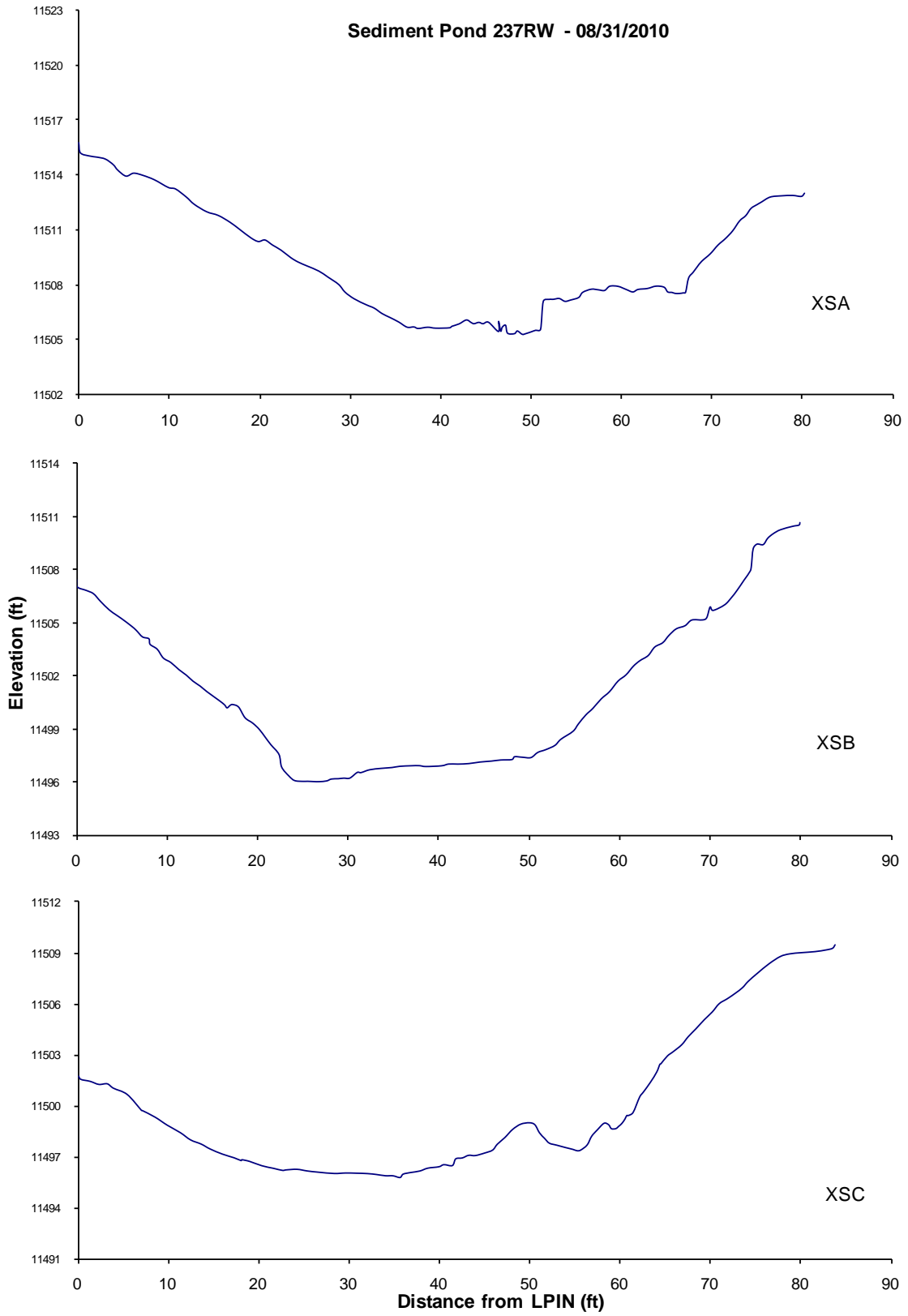
† Negative values imply a decrease in estimate of sediment accumulation between two surveys











# Appendix L

## Rock Weir and Sediment Pond

### Particle Size Distribution and Graphs and Suspended Sediment Data

2010

**Summary of Rock Weir and Silt Fence Particle Size Distribution from Sieve Analysis of Grab Samples on  
Pikes Peak, 2010**

			<b>Particle Size Distribution–Grab Samples 2010</b>					
<b>Site Name</b>	<b>ID</b>	<b>Date</b>	<b>D15</b>	<b>D35</b>	<b>D50</b>	<b>D84</b>	<b>D95</b>	<b>D100</b>
Pikes Peak Highway - Rock Weir	008RW Rock Weir	9/20/2010	0.108	1.104	2.161	6.486	10.893	21.0
Pikes Peak Highway - Rock Weir	009RA Rock Weir	5/26/2010	0.335	1.495	2.681	7.304	11.661	28.0
Pikes Peak Highway - Rock Weir	161RW Rock Weir	5/25/2010	0.179	1.294	2.432	7.076	11.970	30.0
Pikes Peak Highway - Rock Weir	180RW Rock Weir	7/18/2010	0.011	0.043	0.118	1.527	2.735	8.0
Pikes Peak Highway - Rock Weir	181RW Rock Weir	6/19/2010	0.091	0.817	1.404	4.845	8.588	15.0
Pikes Peak Highway - Rock Weir	199RW Sed Pond	7/19/2010	0.664	1.561	2.452	5.907	9.328	17.0
Pikes Peak Highway - Rock Weir	200RW Rock Weir	6/4/2010	0.095	0.797	1.423	6.122	12.973	20.0
Pikes Peak Highway - Rock Weir	237RW Sed Pond	8/31/2010	0.904	2.424	3.504	7.432	13.702	20.0
Pikes Peak Highway - Rock Weir	240RW Rock Weir	9/14/2010	0.064	0.995	2.080	9.701	20.371	30.0

**Sieve Analysis Worksheet**

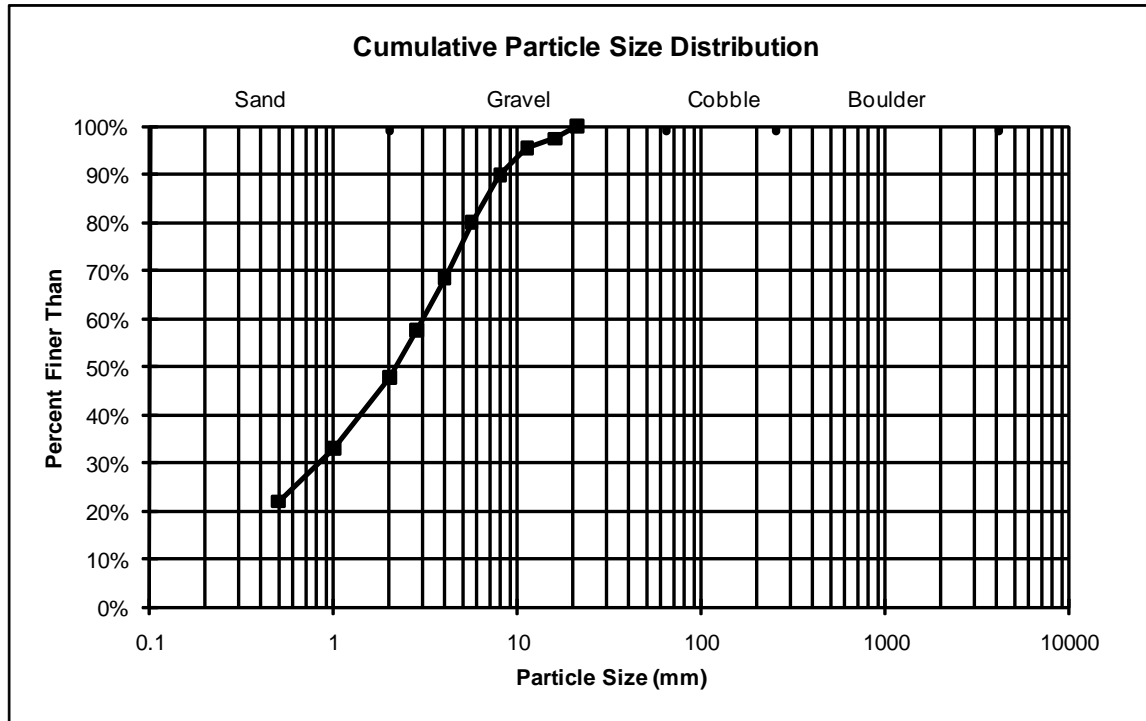
Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	191.40	21.9%	
0.5	96.00	11.0%	21.9%
1.0	130.30	14.9%	32.9%
2.0	84.50	9.7%	47.8%
2.8	95.40	10.9%	57.4%
4.0	101.40	11.6%	68.4%
5.6	85.80	9.8%	80.0%
8.0	49.80	5.7%	89.8%
11.2	17.10	2.0%	95.5%
16.0	22.50	2.6%	97.4%
21.0	*		100.0%
32.0			-
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	874.20		

\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

**SITE NAME:** Pike's Peak Highway - Rock Weir  
**ID NUMBER:** 008RW Rock Weir  
**DATE:** 9/20/20010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.108	1.104	2.161	6.486	10.893	21.0



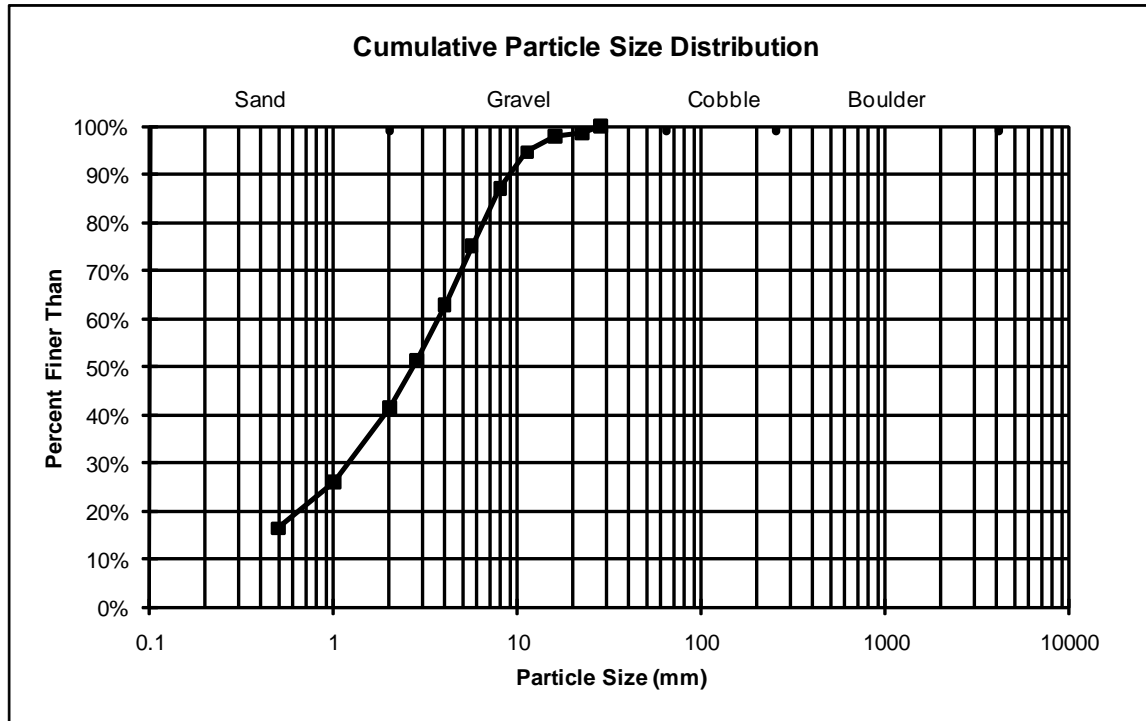
**Sieve Analysis Worksheet**

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	179.80	16.3%	
0.5	106.30	9.7%	16.3%
1.0	170.50	15.5%	26.0%
2.0	107.20	9.7%	41.5%
2.8	126.40	11.5%	51.3%
4.0	135.70	12.3%	62.8%
5.6	131.60	12.0%	75.1%
8.0	83.20	7.6%	87.1%
11.2	37.20	3.4%	94.6%
16.0	5.20	0.5%	98.0%
22.4	16.80	1.5%	98.5%
28.0	*		100.0%
45.0			-
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1099.90		

**SITE NAME:** Pike's Peak Highway - Rock Weir  
**ID NUMBER:** 009RA Rock Weir  
**DATE:** 5/26/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.335	1.495	2.681	7.304	11.661	28.0



\*Measured value of the largest particle in the sample and not a sieve weight

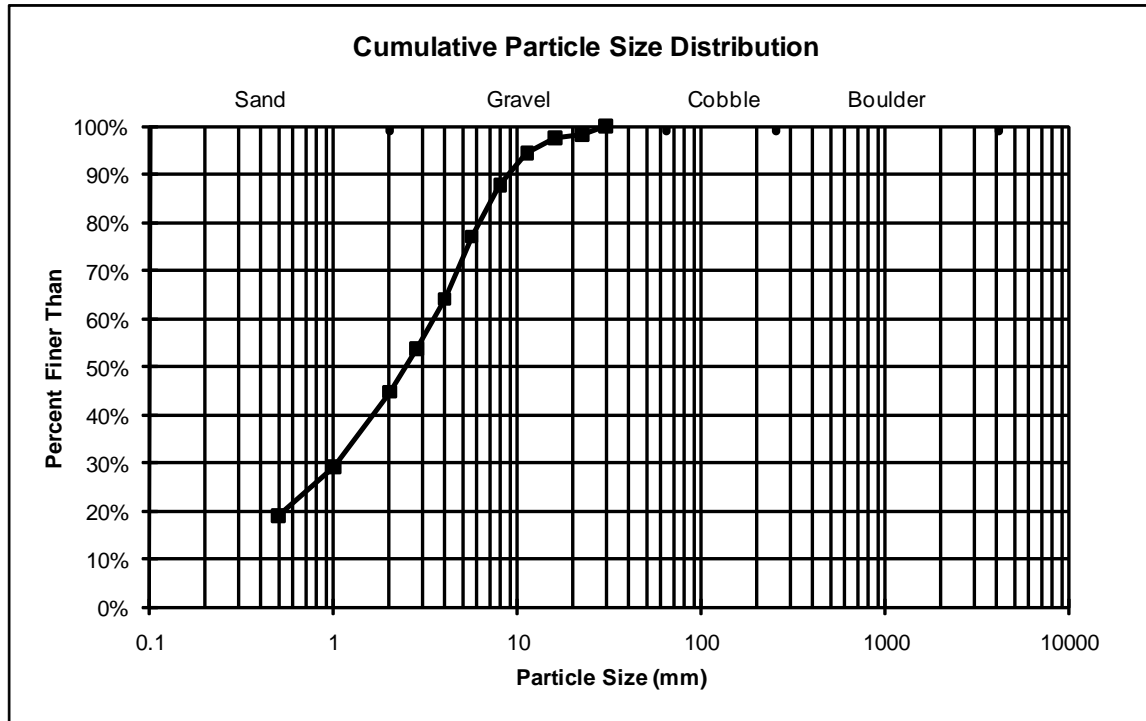
**Sieve Analysis Worksheet**

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	212.30	19.0%	
0.5	113.60	10.2%	19.0%
1.0	172.90	15.5%	29.2%
2.0	100.90	9.0%	44.7%
2.8	114.40	10.3%	53.8%
4.0	144.70	13.0%	64.0%
5.6	118.60	10.6%	77.0%
8.0	75.40	6.8%	87.7%
11.2	34.60	3.1%	94.4%
16.0	9.10	0.8%	97.5%
22.4	18.50	1.7%	98.3%
30.0	*		100.0%
45.0			-
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1115.00		

**SITE NAME:** Pike's Peak Highway - Rock Weir  
**ID NUMBER:** 161RW Rock Weir  
**DATE:** 5/25/20010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.179	1.294	2.432	7.076	11.970	30.0



\*Measured value of the largest particle in the sample and not a sieve weight

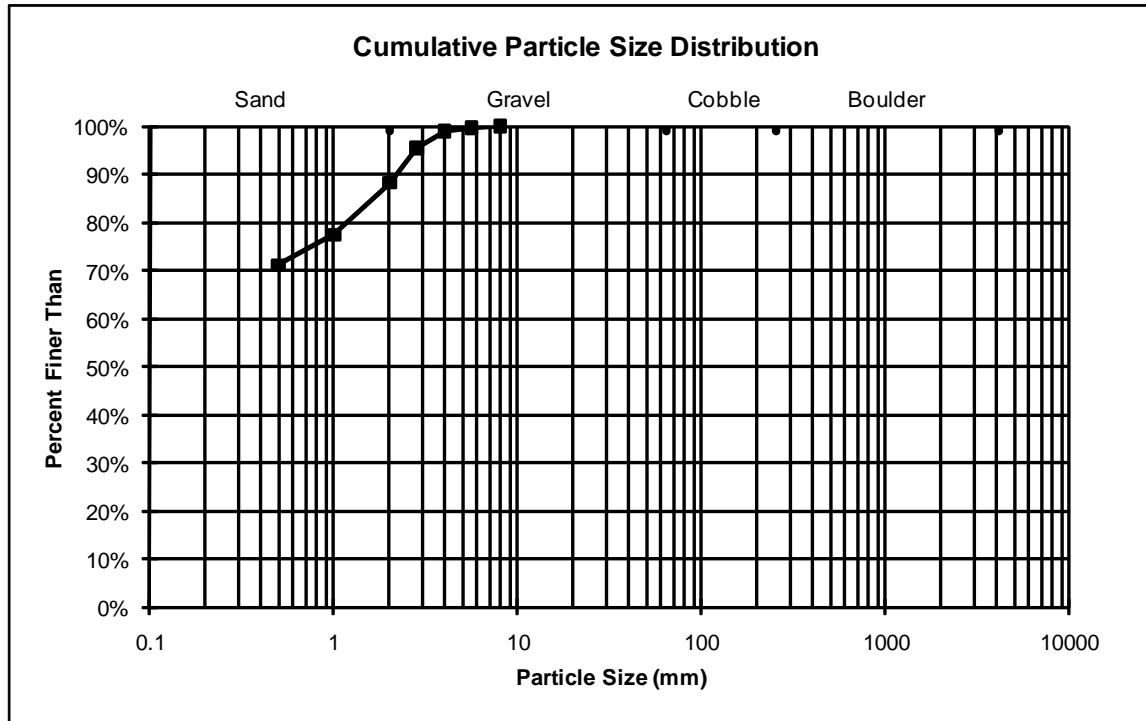
**Sieve Analysis Worksheet**

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	514.00	71.1%	
0.5	45.40	6.3%	71.1%
1.0	78.50	10.9%	77.4%
2.0	52.60	7.3%	88.2%
2.8	25.40	3.5%	95.5%
4.0	4.60	0.6%	99.0%
5.6	2.50	0.3%	99.7%
8.0	*		100.0%
11.2			-
16.0			
22.4			
32.0			
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	723.00		

**SITE NAME:** Pike's Peak Highway - Rock Weir  
**ID NUMBER:** 180RW Rock Weir  
**DATE:** 7/18/20010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.011	0.043	0.118	1.527	2.735	8.0



\*Measured value of the largest particle in the sample and not a sieve weight



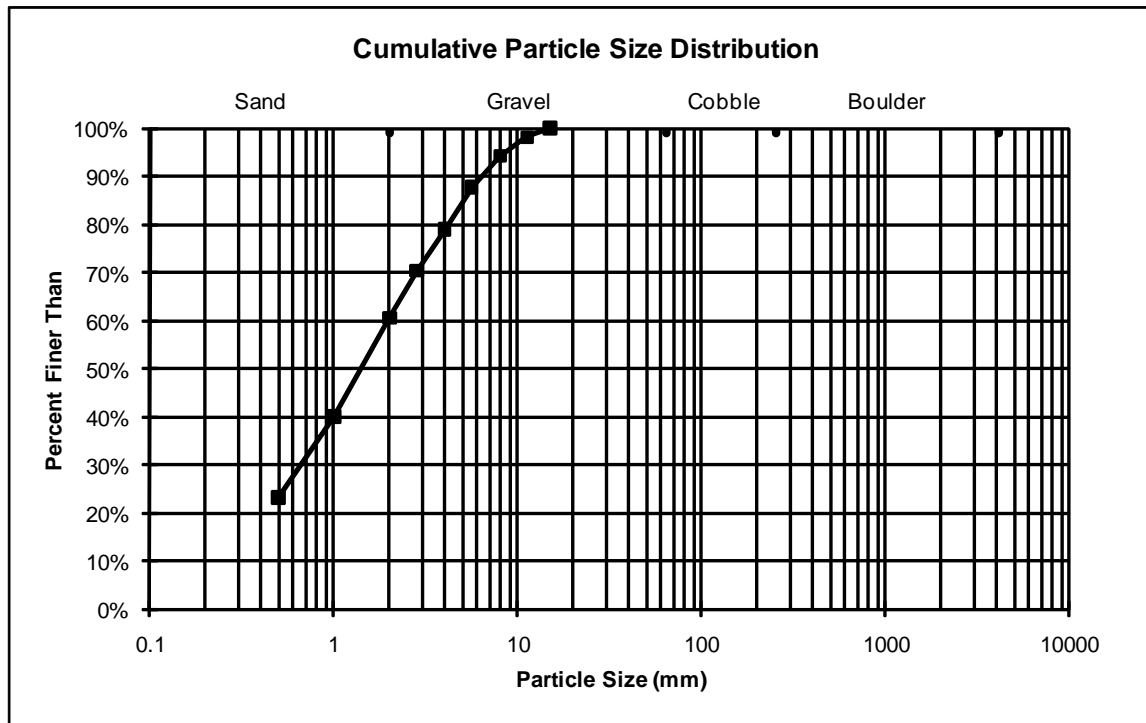
**Sieve Analysis Worksheet**

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	201.50	23.1%	
0.5	146.60	16.8%	23.1%
1.0	180.20	20.7%	39.9%
2.0	85.40	9.8%	60.6%
2.8	75.80	8.7%	70.3%
4.0	76.20	8.7%	79.0%
5.6	55.90	6.4%	87.8%
8.0	34.50	4.0%	94.2%
11.2	16.40	1.9%	98.1%
15.0	*		100.0%
22.4			-
32.0			
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	872.50		

**SITE NAME:** Pike's Peak Highway - Rock Weir  
**ID NUMBER:** 181RW Rock Weir  
**DATE:** 6/19/20010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.091	0.817	1.404	4.845	8.588	15.0



\*Measured value of the largest particle in the sample and not a sieve weight

**Sieve Analysis Worksheet**

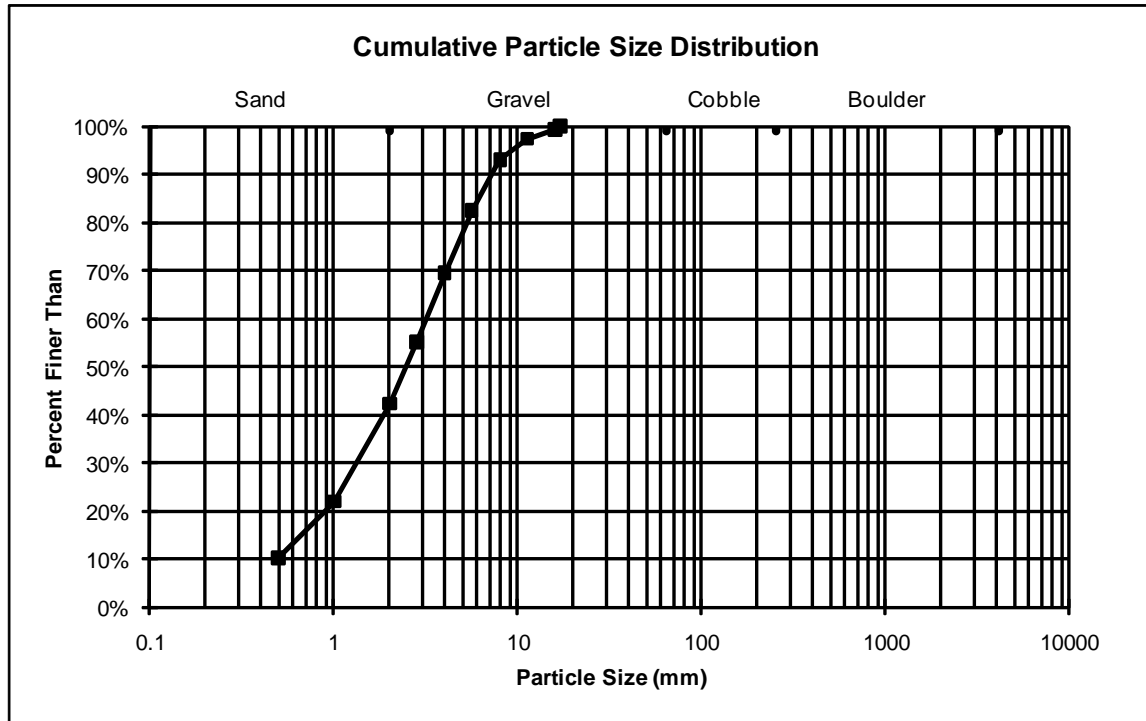
Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	119.10	10.2%	
0.5	135.90	11.7%	10.2%
1.0	237.40	20.4%	21.9%
2.0	148.50	12.8%	42.3%
2.8	167.60	14.4%	55.0%
4.0	151.20	13.0%	69.4%
5.6	123.90	10.6%	82.4%
8.0	49.90	4.3%	93.0%
11.2	23.60	2.0%	97.3%
16.0	7.50	0.6%	99.4%
17.0	*		100.0%
32.0			-
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1164.60		

\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

**SITE NAME:** Pike's Peak Highway - Rock Weir  
**ID NUMBER:** 199RW Sediment Pond  
**DATE:** 7/19/20010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.664	1.561	2.452	5.907	9.328	17.0



**Sieve Analysis Worksheet**

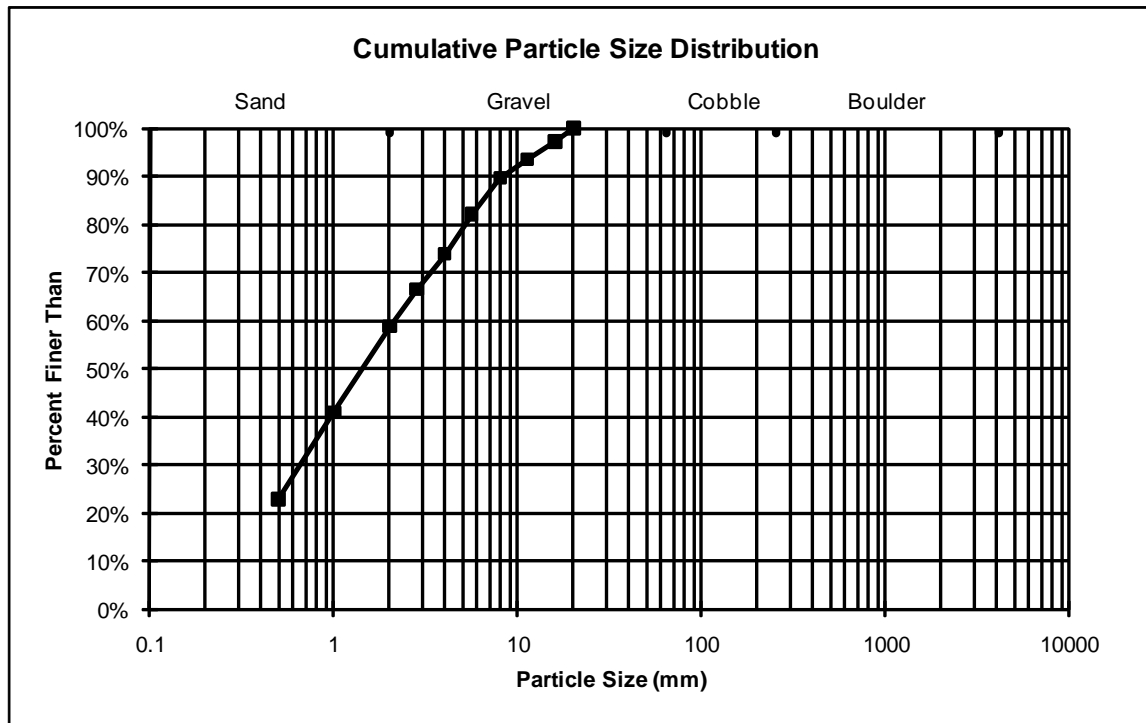
Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	246.70	22.8%	
0.5	196.20	18.1%	22.8%
1.0	192.80	17.8%	40.9%
2.0	83.40	7.7%	58.7%
2.8	80.10	7.4%	66.4%
4.0	89.50	8.3%	73.8%
5.6	81.40	7.5%	82.1%
8.0	41.80	3.9%	89.6%
11.2	39.30	3.6%	93.5%
16.0	31.00	2.9%	97.1%
20.0	*		100.0%
32.0			-
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1082.20		

\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

**SITE NAME:** Pike's Peak Highway - Rock Weir  
**ID NUMBER:** 200RW Rock Weir  
**DATE:** 6/4/20010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.095	0.797	1.423	6.122	12.973	20.0



**Sieve Analysis Worksheet**

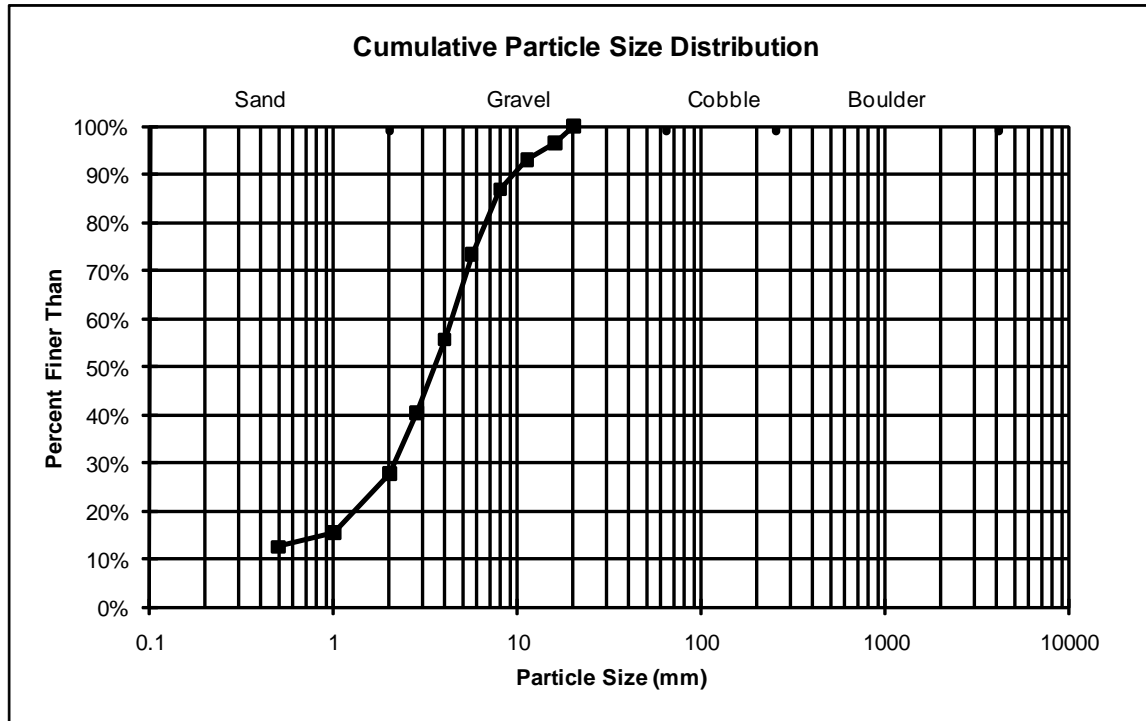
Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	104.60	12.5%	
0.5	24.70	2.9%	12.5%
1.0	103.40	12.3%	15.4%
2.0	106.00	12.7%	27.8%
2.8	127.70	15.2%	40.4%
4.0	147.70	17.6%	55.7%
5.6	113.10	13.5%	73.3%
8.0	51.90	6.2%	86.8%
11.2	29.90	3.6%	93.0%
16.0	28.90	3.4%	96.6%
20.0	*		100.0%
32.0			-
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	837.90		

\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

**SITE NAME:** Pike's Peak Highway - Rock Weir  
**ID NUMBER:** 237RW Sediment Pond  
**DATE:** 8/31/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.904	2.424	3.504	7.432	13.702	20.0



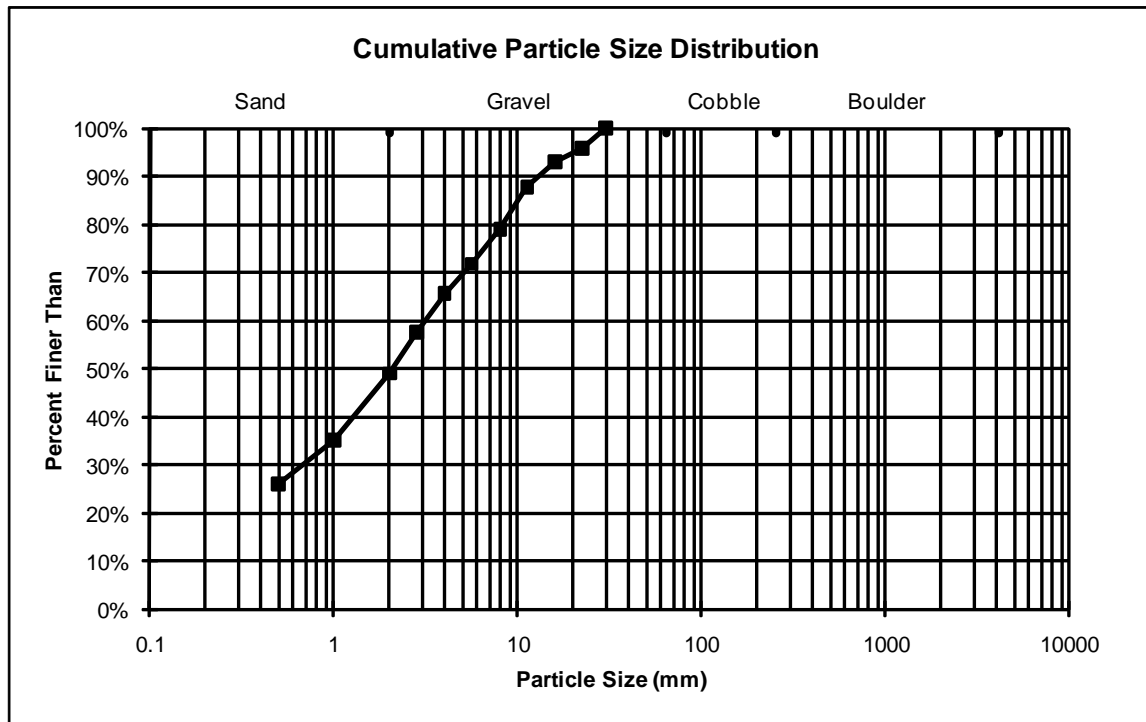
**Sieve Analysis Worksheet**

**COMMENTS:** Grab Sample of 2010 Sediment Accumulation

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	234.10	26.1%	
0.5	80.80	9.0%	26.1%
1.0	125.10	13.9%	35.1%
2.0	76.90	8.6%	49.0%
2.8	72.20	8.0%	57.6%
4.0	55.40	6.2%	65.6%
5.6	64.70	7.2%	71.8%
8.0	78.60	8.8%	79.0%
11.2	46.90	5.2%	87.7%
16.0	25.50	2.8%	93.0%
22.4	37.70	4.2%	95.8%
30.0	*		100.0%
45.0			-
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	897.90		

**SITE NAME:** Pike's Peak Highway - Rock Weir  
**ID NUMBER:** 240RW Rock Weir  
**DATE:** 9/14/20010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.064	0.995	2.080	9.701	20.371	30.0



\*Measured value of the largest particle in the sample and not a sieve weight

**Summary of Sediment Pond 199RW and 237RW Suspended Sediment Analysis of Grab Samples on Pikes Peak, 2010**

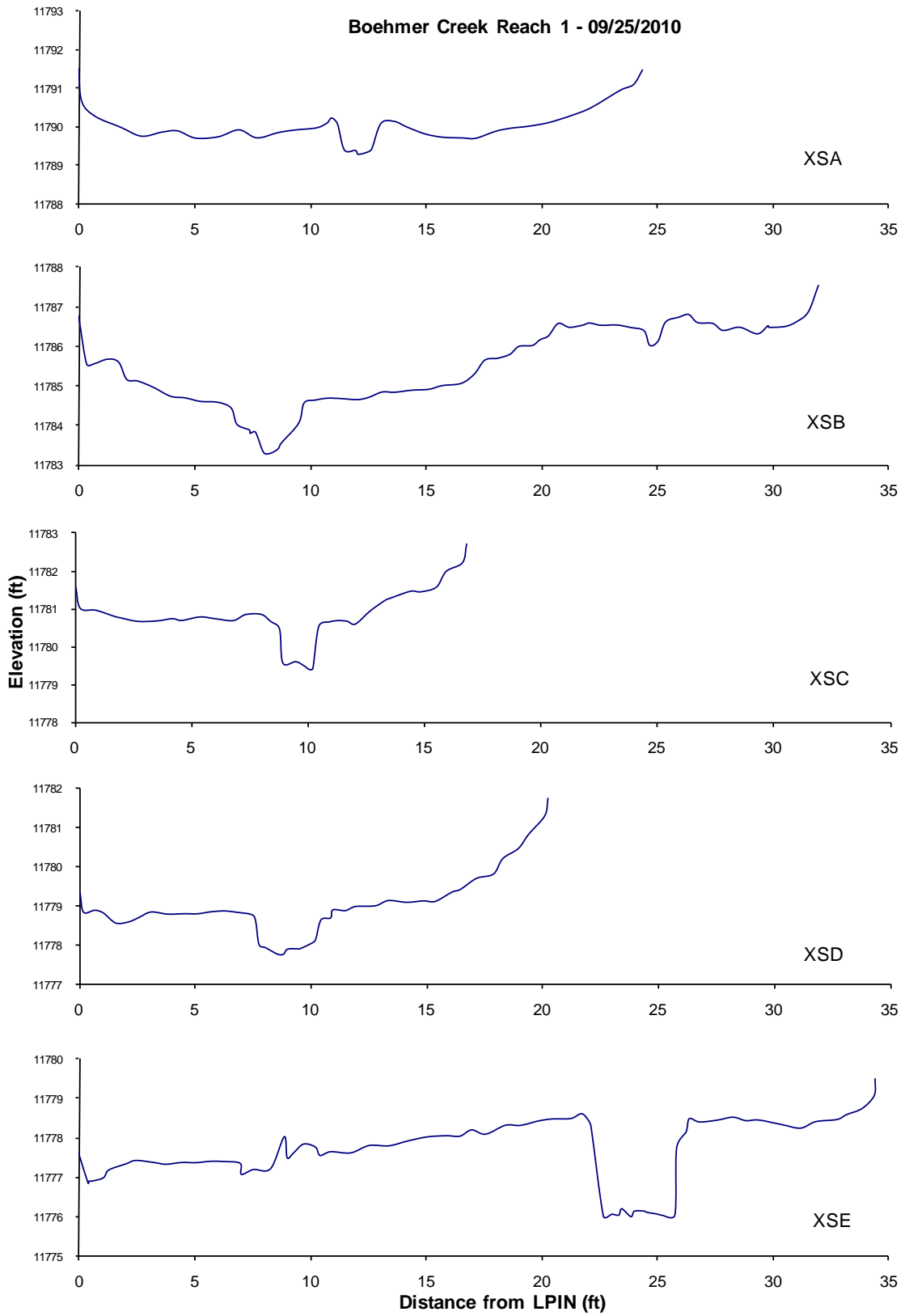
<b>Site ID</b>	<b>Date</b>	<b>Tin + Filter Initial (g)</b>	<b>Tin +Filter Final (g)</b>	<b>Bottle Initial (g)</b>	<b>Bottle Final (g)</b>	<b>Weight Sample (g)</b>	<b>Weight Solids (g)</b>	<b>Solids (mg/l)</b>
199RW Entrance Culvert	06/13/10	1.4411	2.1952	994.6	109.1	885.5	0.7541	851.6
199RW Above Sed Pond	06/13/10	1.4260	1.8848	995.9	105.3	890.6	0.4588	515.2
199RW Exit Culvert	06/13/10	1.4181	1.6858	1049.0	106.3	942.7	0.2677	284.0
199RW Entrance Culvert	07/01/10	1.4213	3.1049	1060.3	107.9	952.4	1.6836	1767.7
199RW Above Sed Pond	07/01/10	1.4335	7.6398	1088.0	108.7	979.3	6.2063	6337.5
199RW Exit Culvert	07/01/10	1.4069	1.4184	1030.4	106.6	923.8	0.0115	12.4
199RW Entrance Culvert	07/08/10	1.4350	4.4114	1125.0	107.2	1017.8	2.9764	2924.3
199RW Above Sed Pond	07/08/10	1.4110	4.6312	1057.7	110.5	947.2	3.2202	3399.7
199RW Exit Culvert	07/08/10	1.4095	1.9559	937.8	95.1	842.7	0.5464	648.4
199RW Entrance Culvert	08/12/10	1.4364	1.6604	1068.7	110.0	958.7	0.2240	233.6
199RW Above Sed Pond	08/12/10	1.3661	1.6871	1101.0	108.8	992.2	0.3210	323.5
199RW Exit Culvert	08/12/10	1.4331	1.4374	1046.0	106.8	939.2	0.0043	4.6
237RW Entrance Culvert	07/08/10	1.4107	6.4457	1122.2	109.0	1013.2	5.0350	4969.4
237RW Exit Culvert	07/08/10	1.4085	2.3398	1089.8	96.1	993.7	0.9313	937.2

# Appendix M

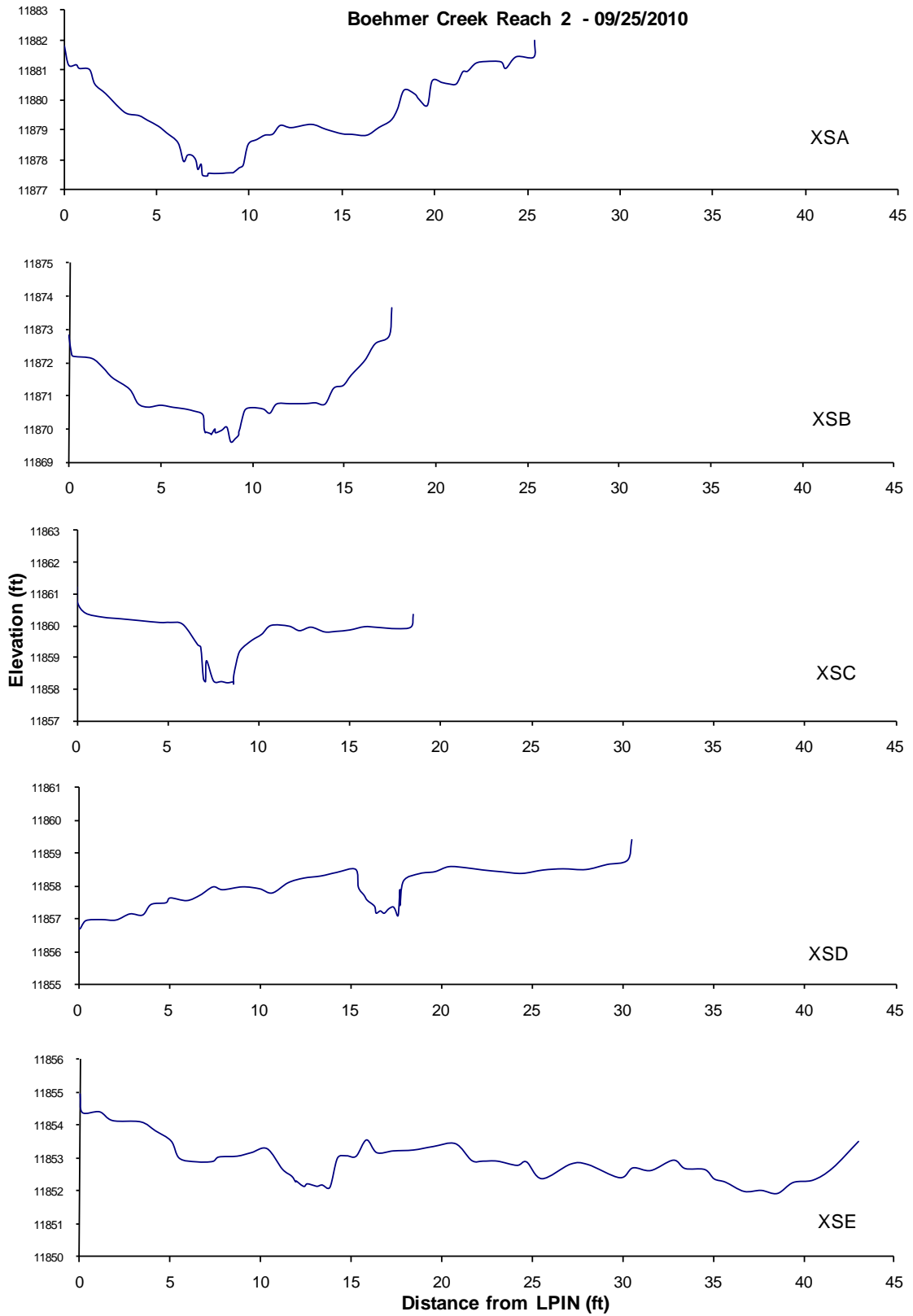
## Stream Channel

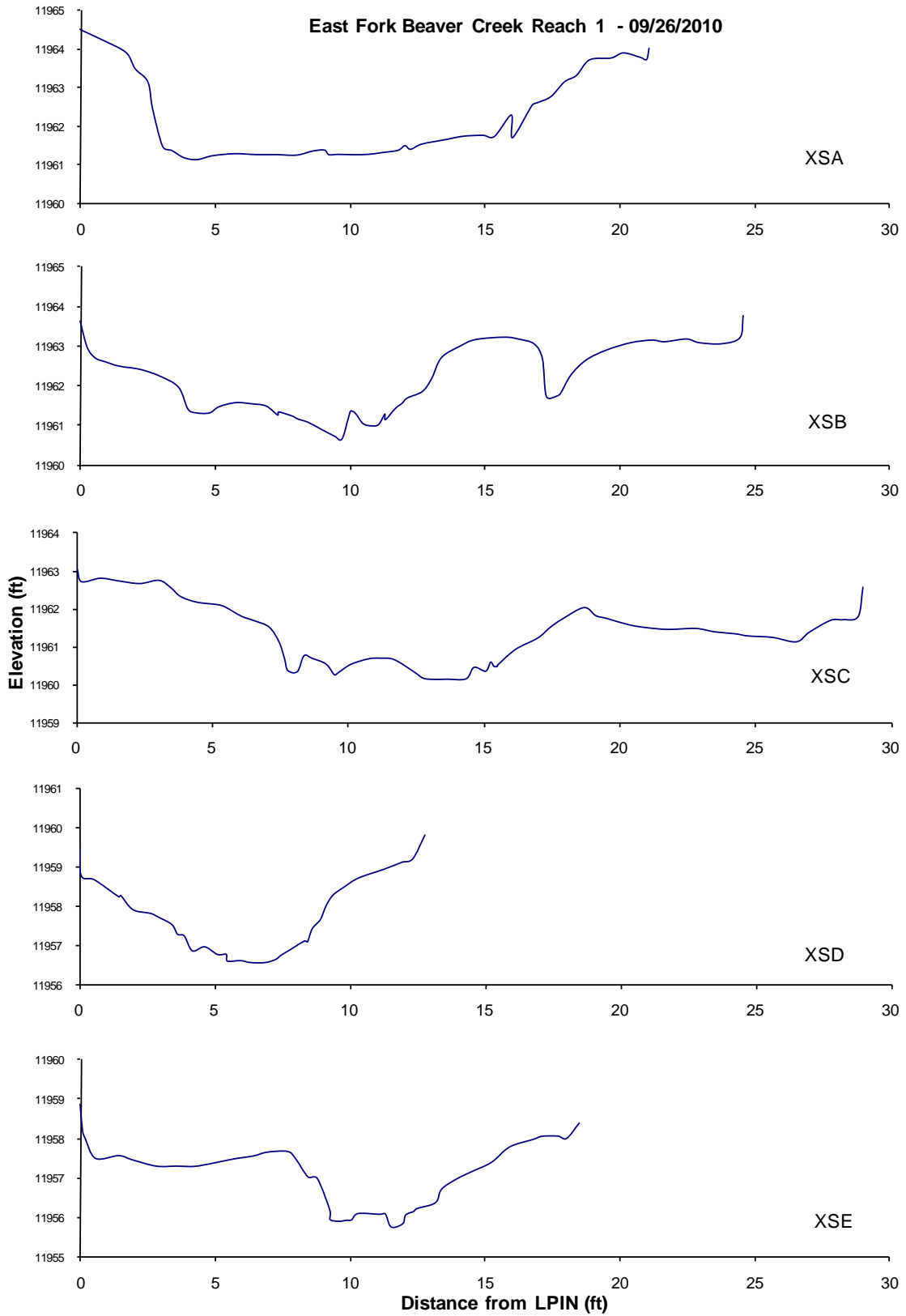
### Cross Section Graphs

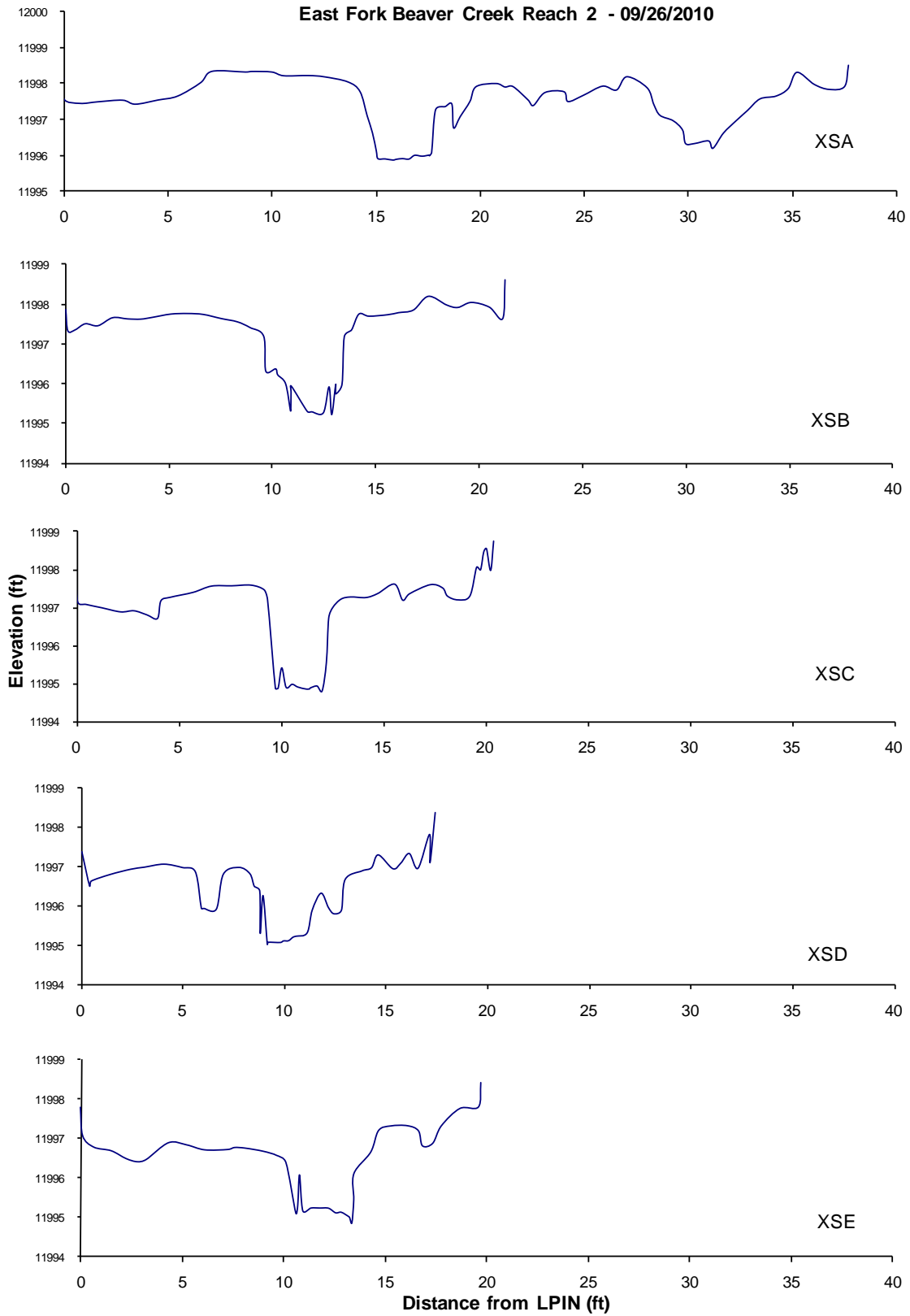
2010

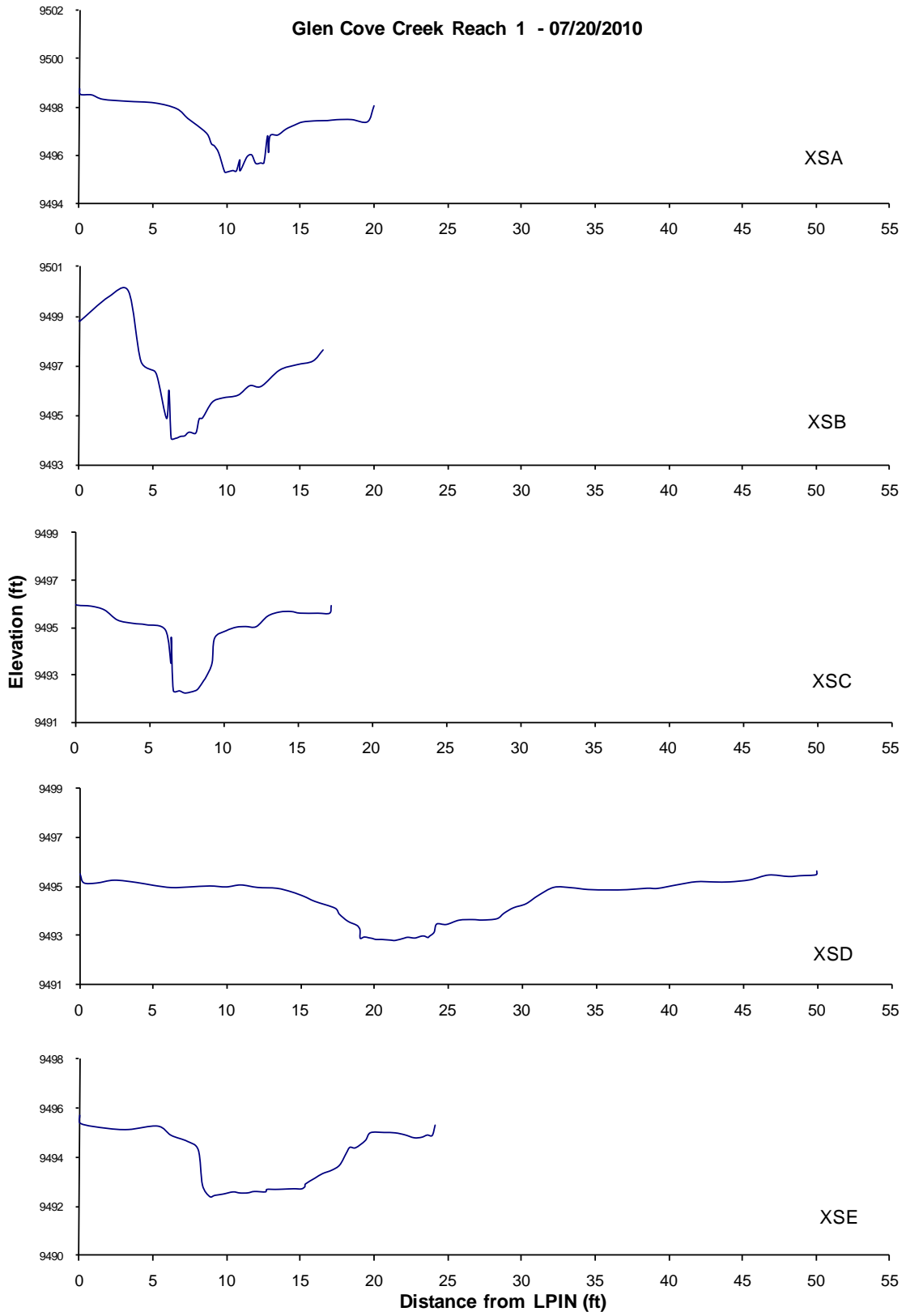


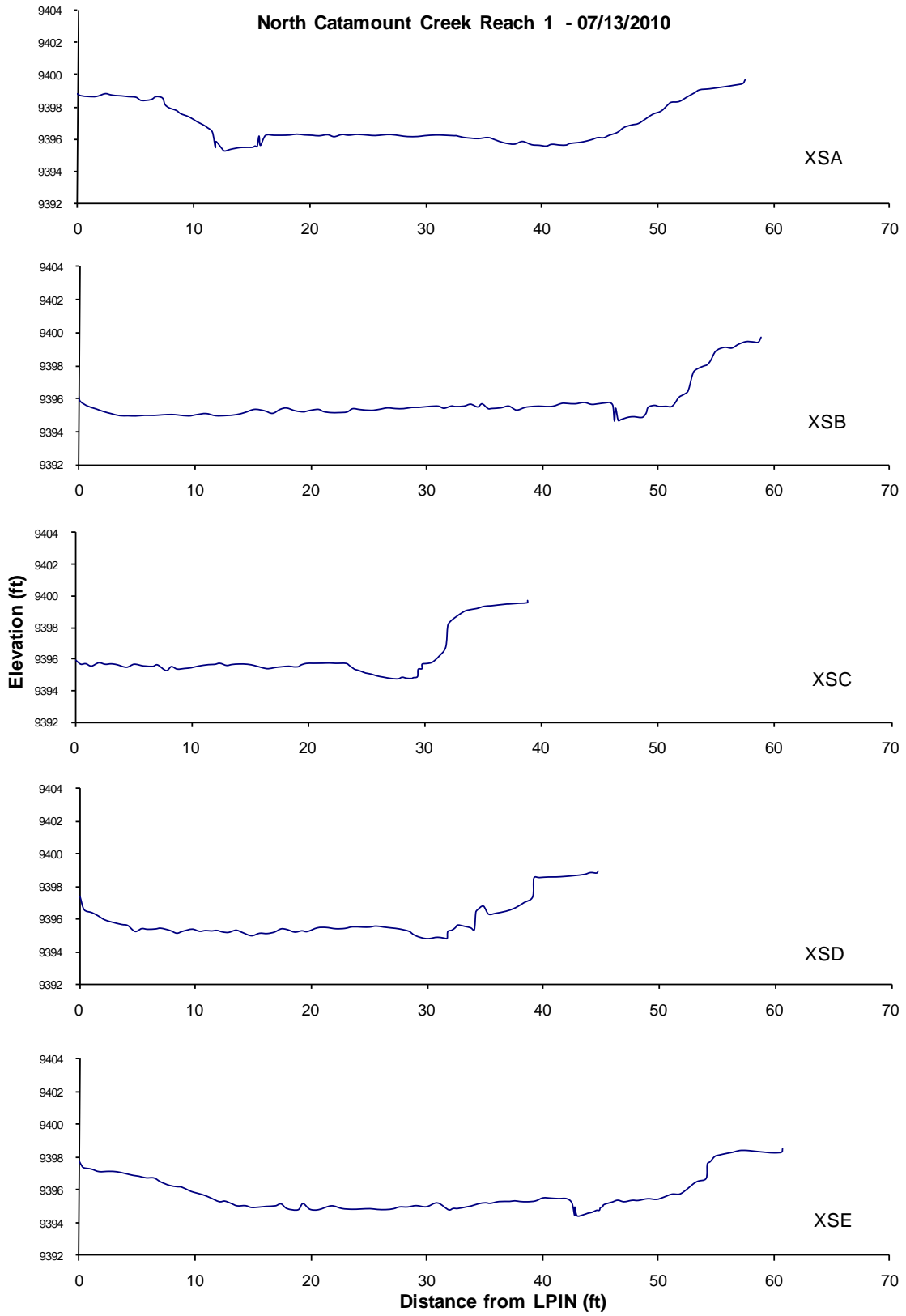


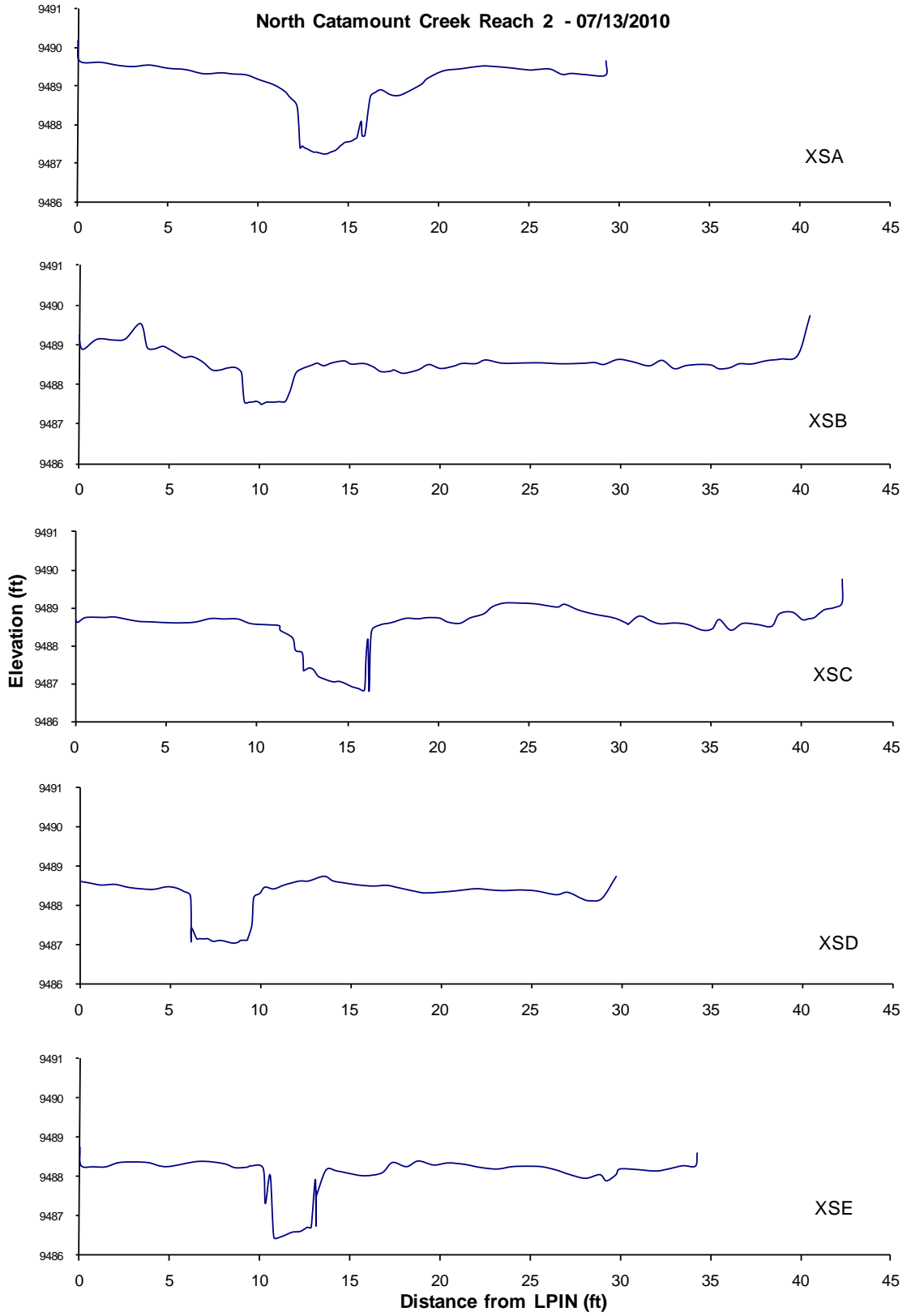


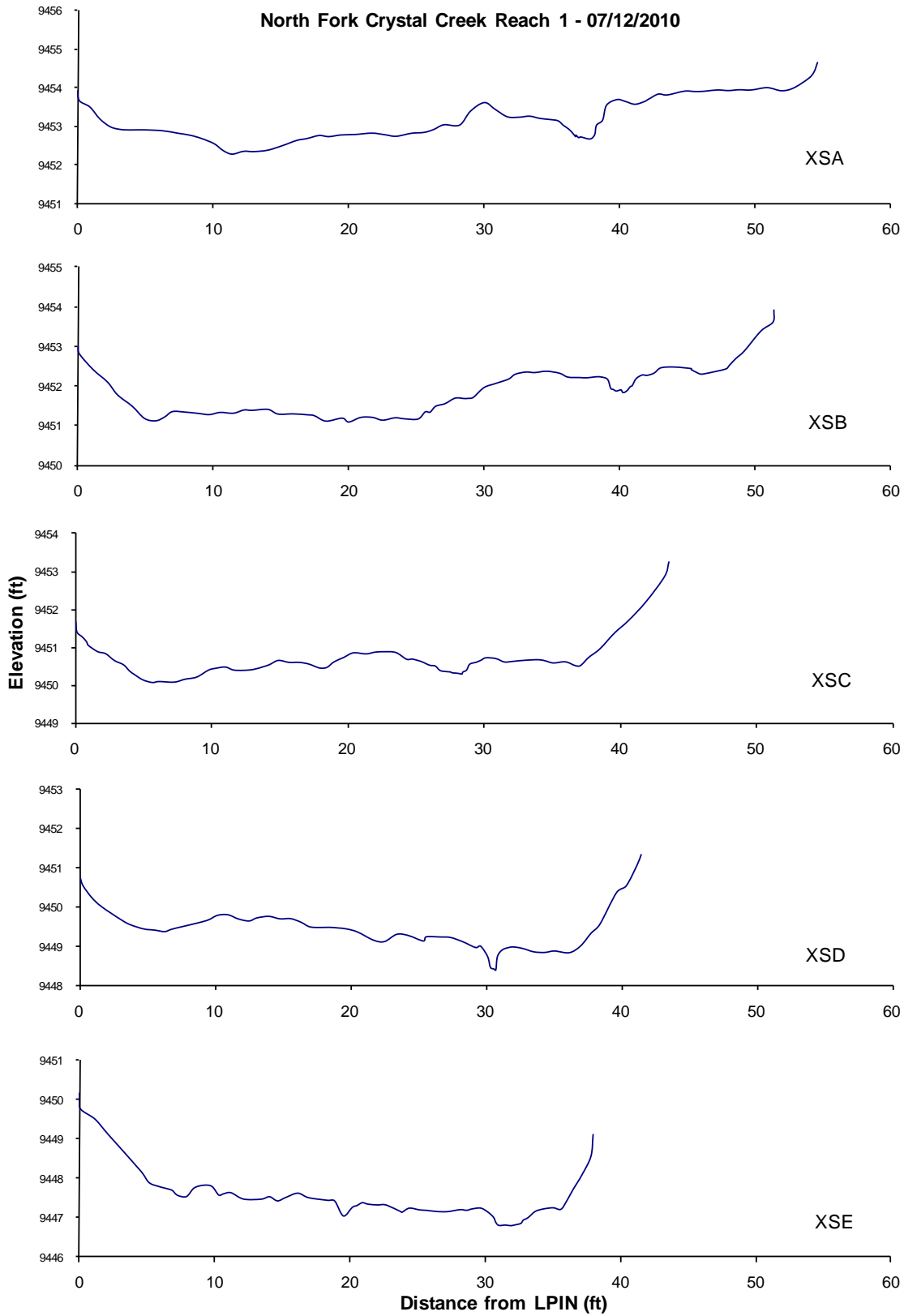


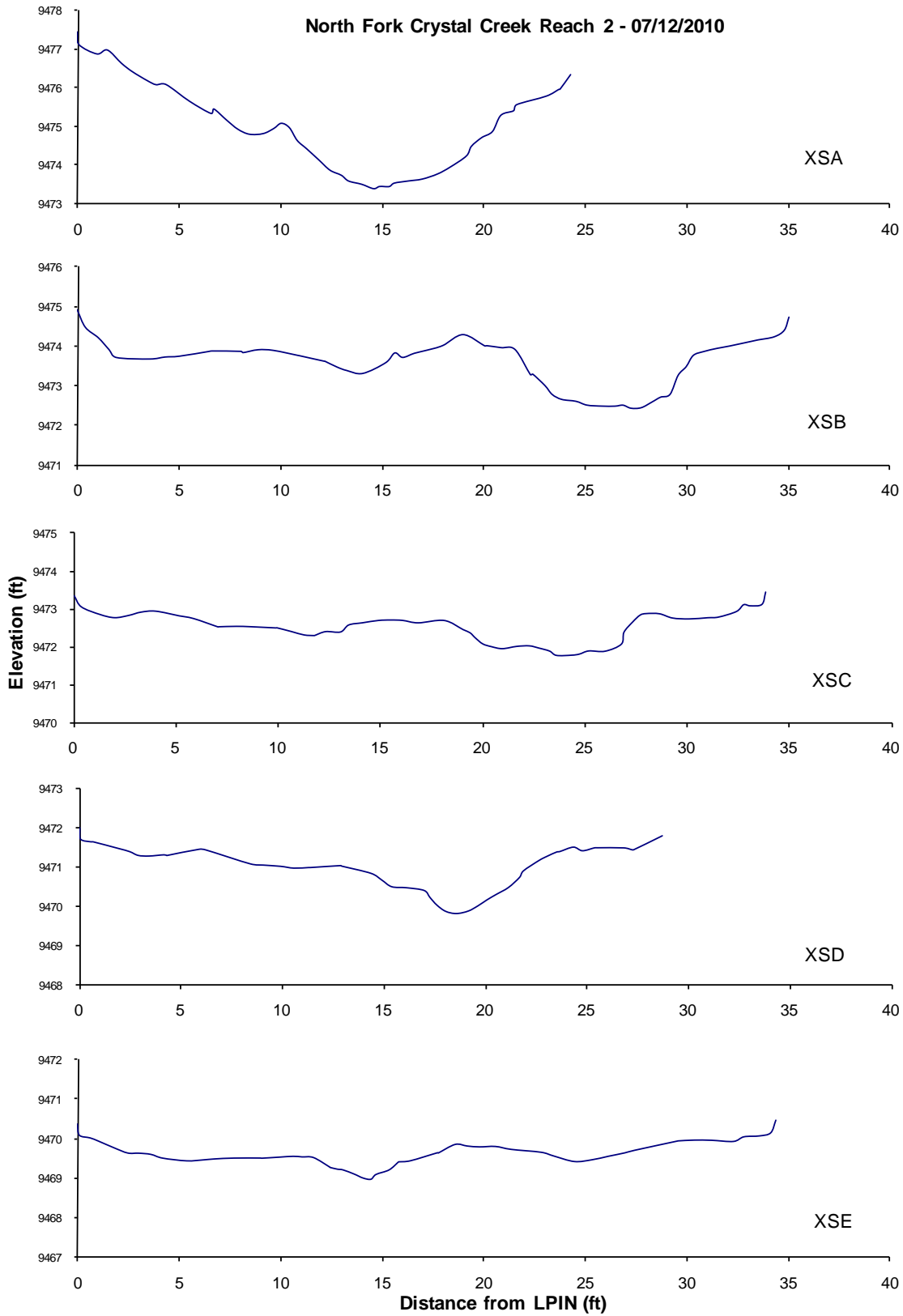




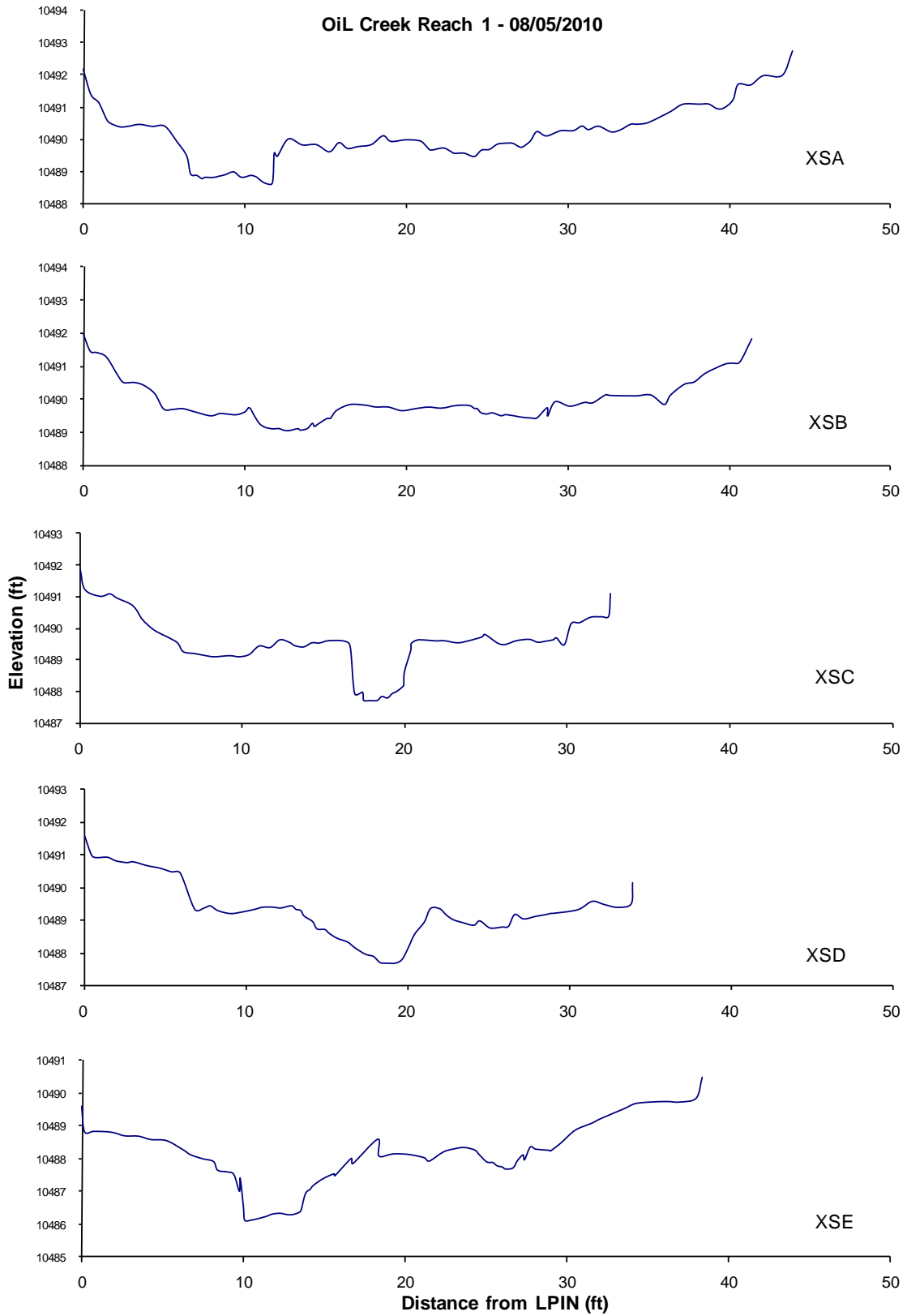


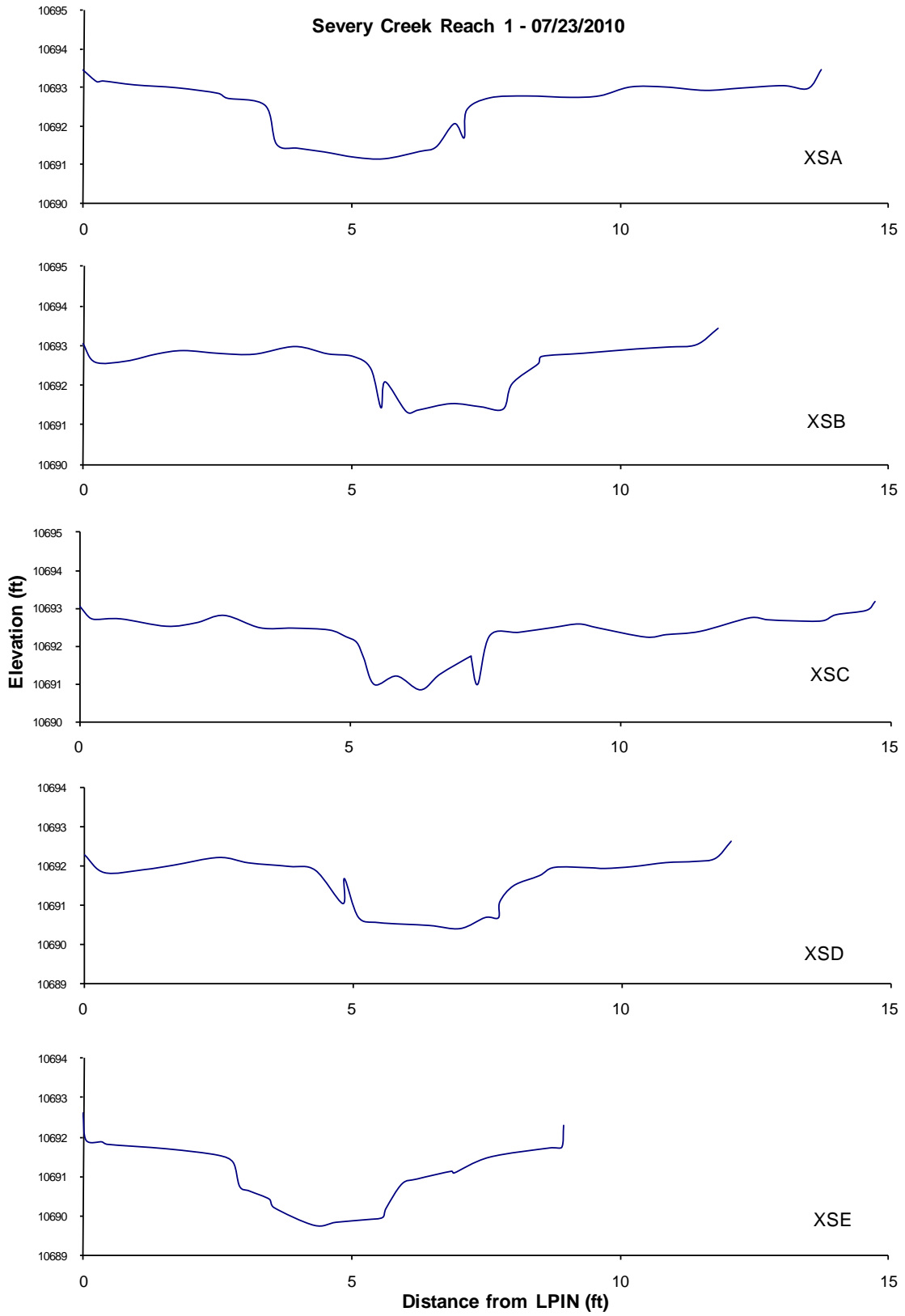


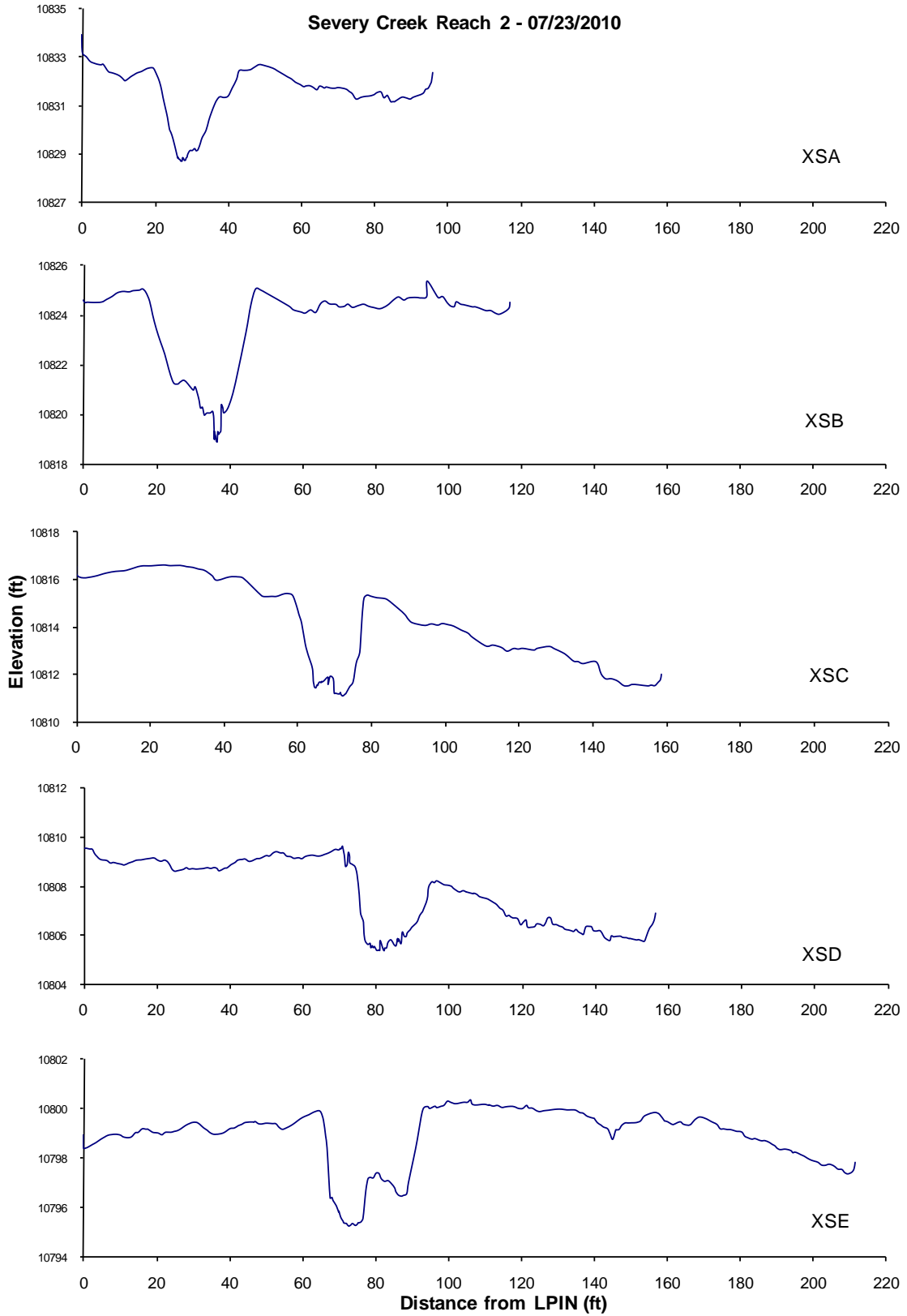


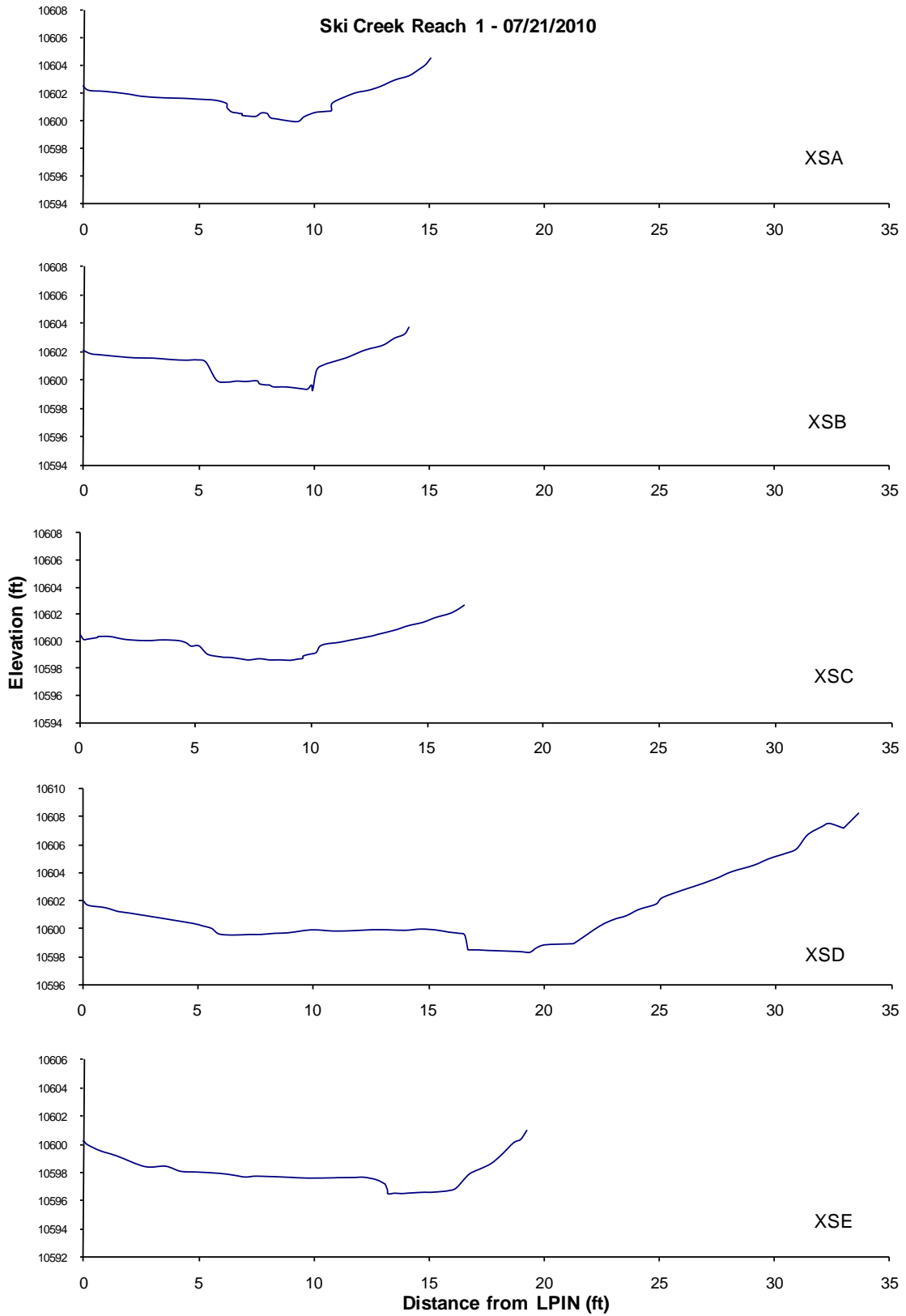


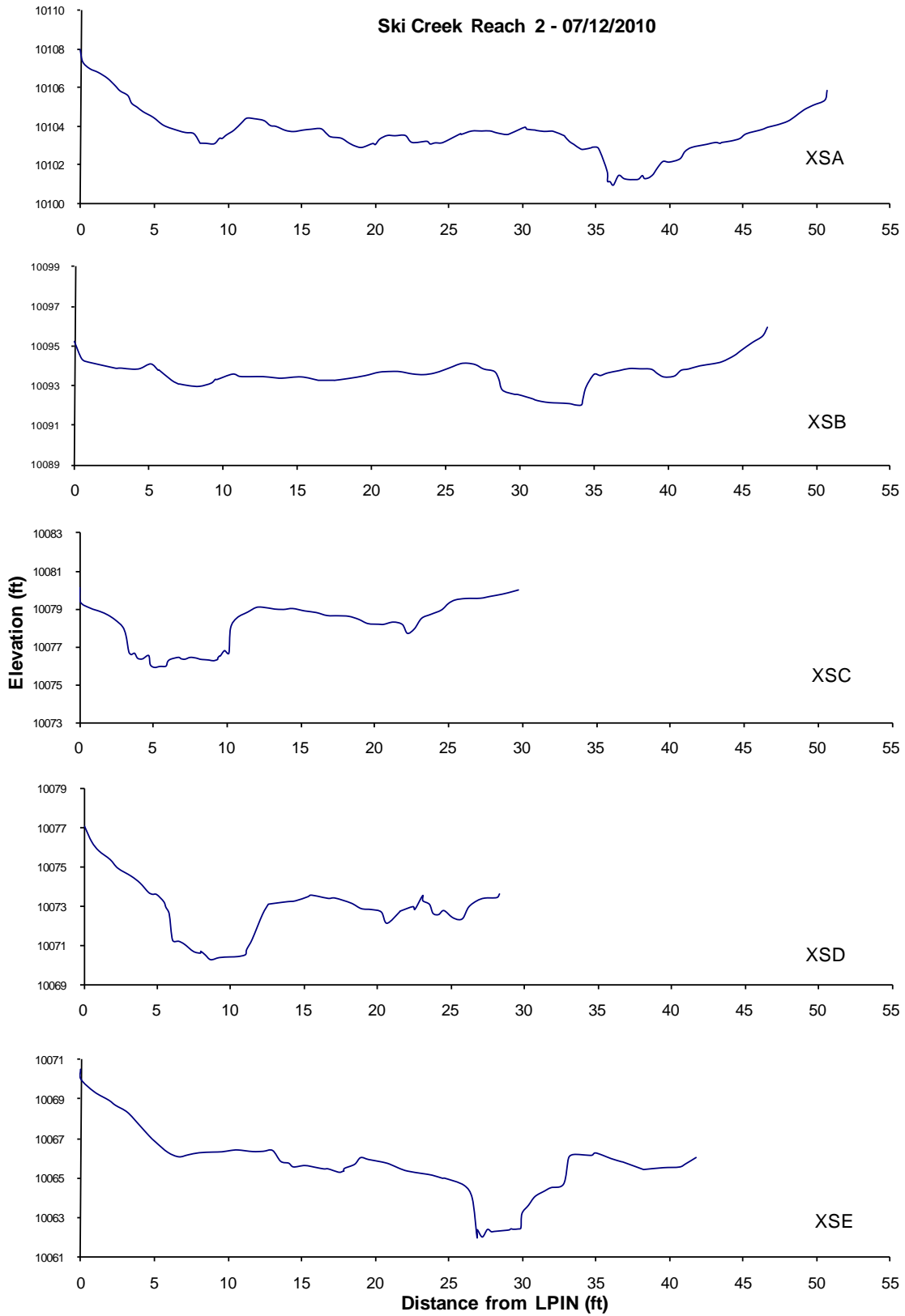


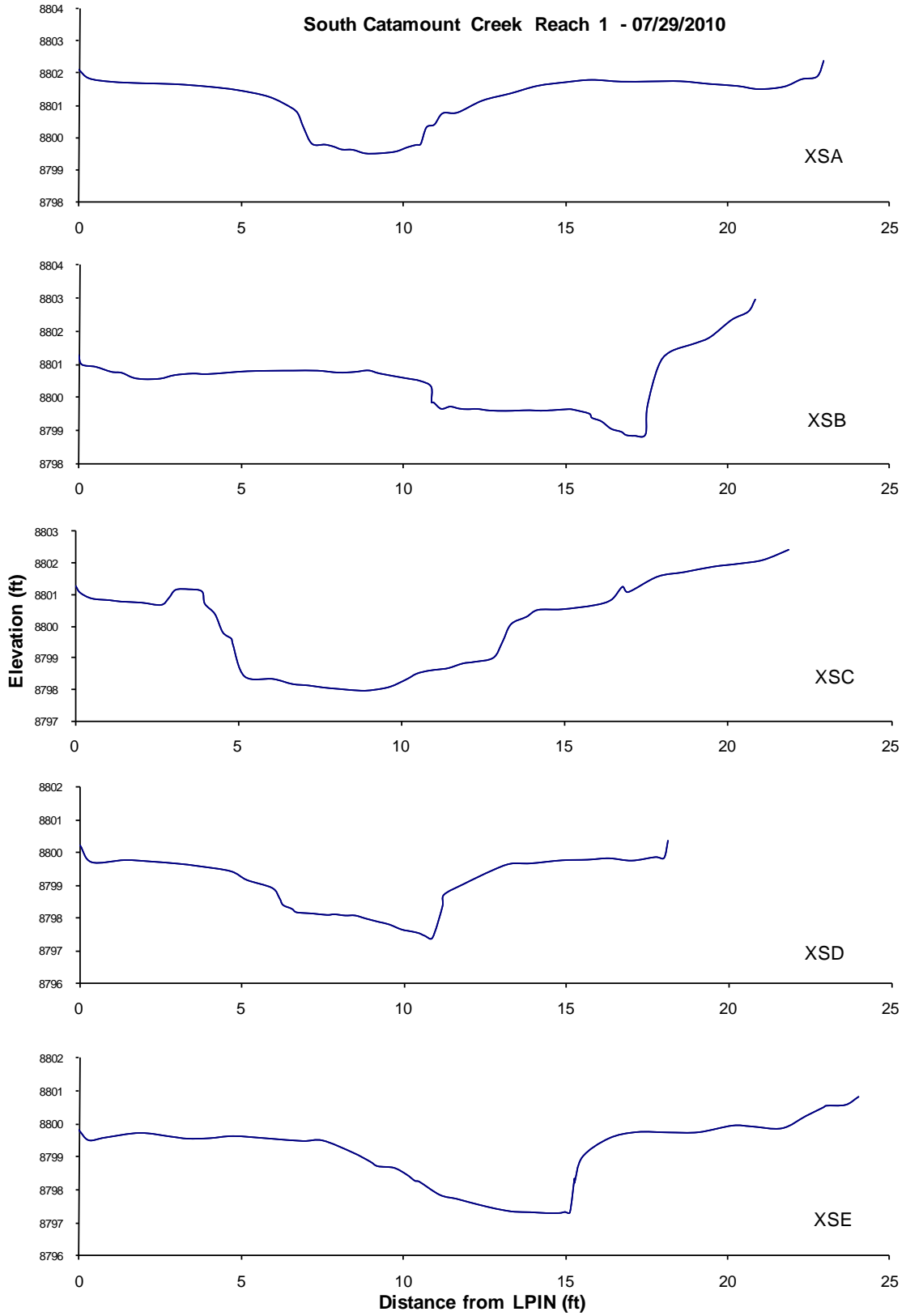


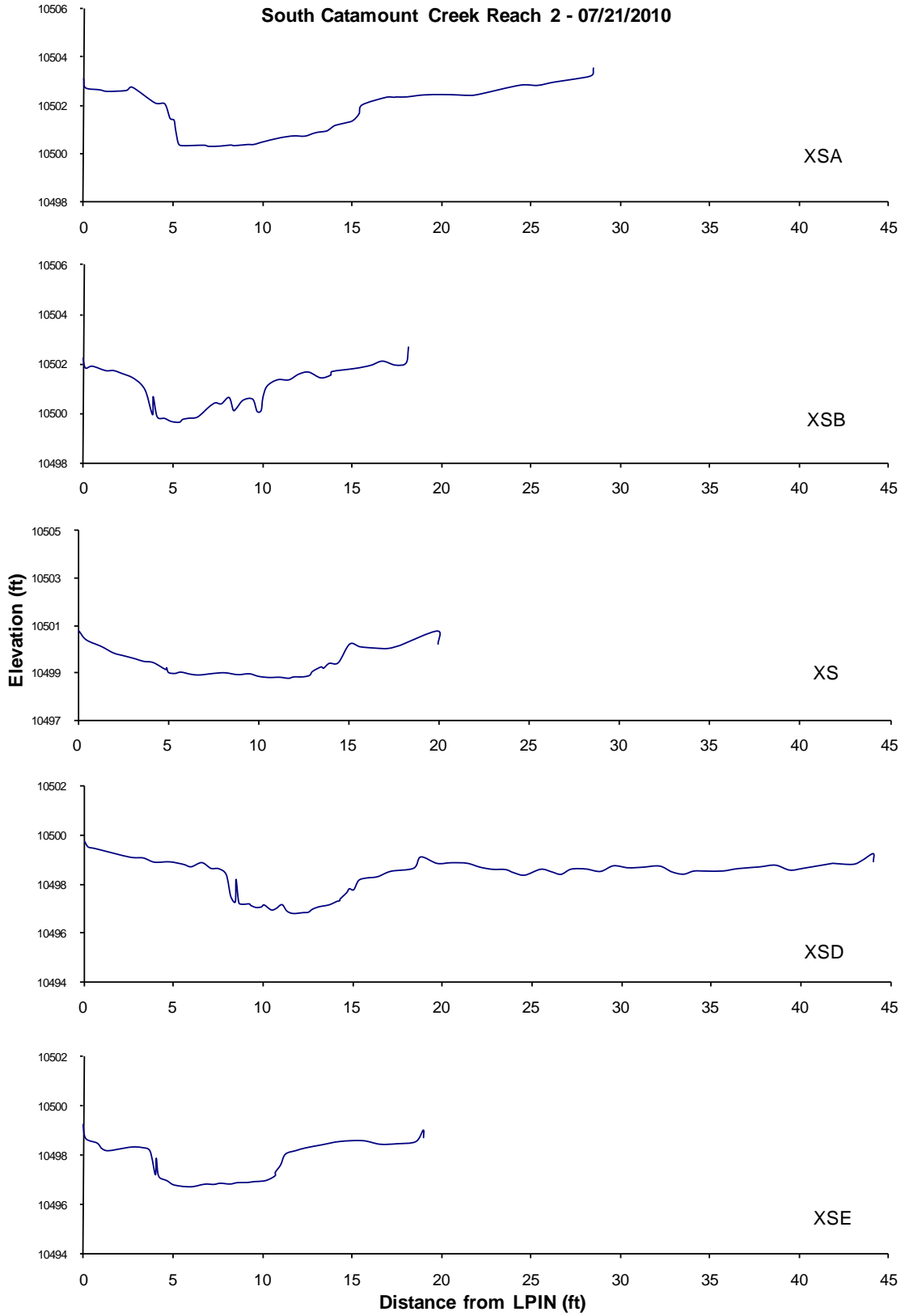


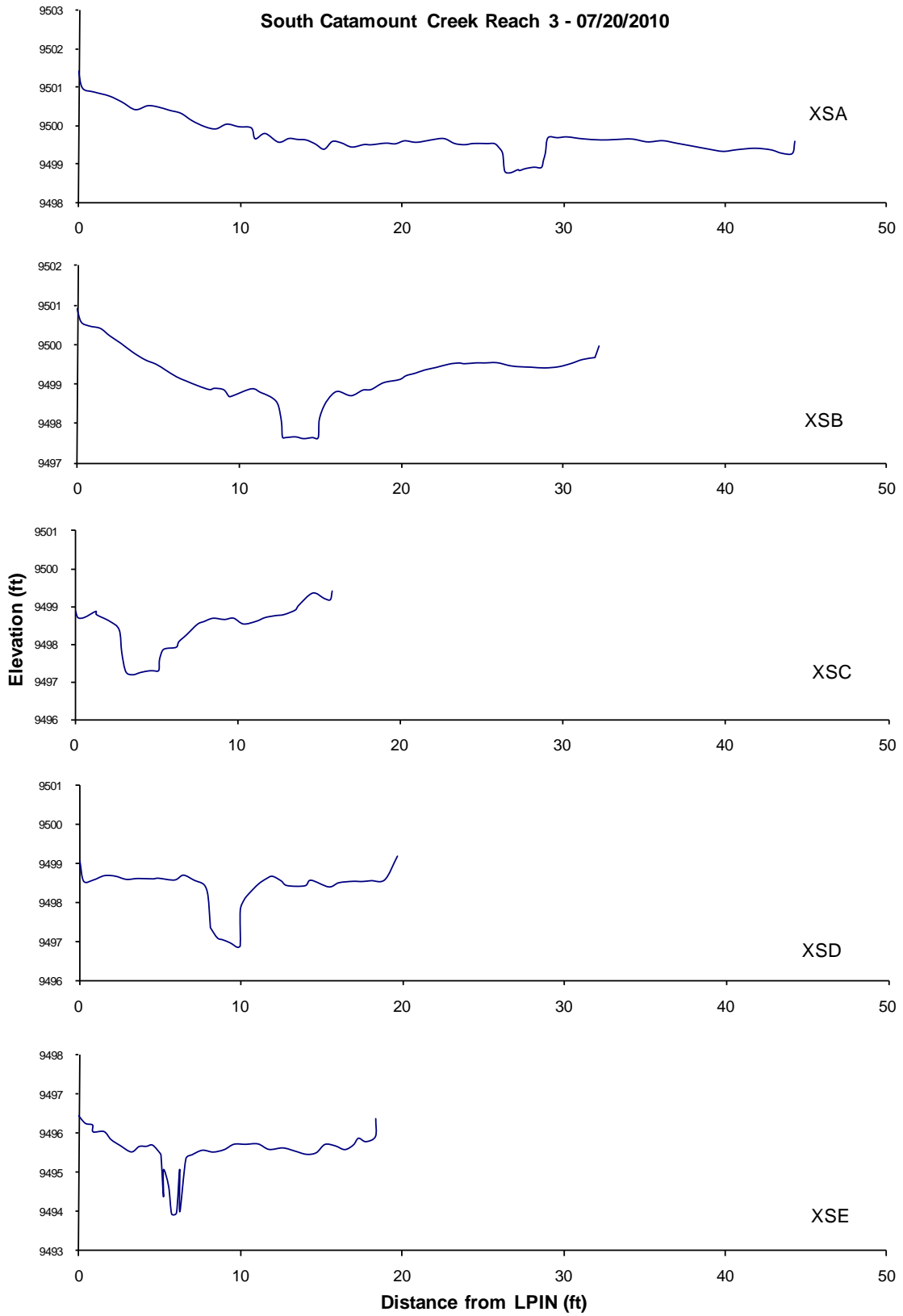




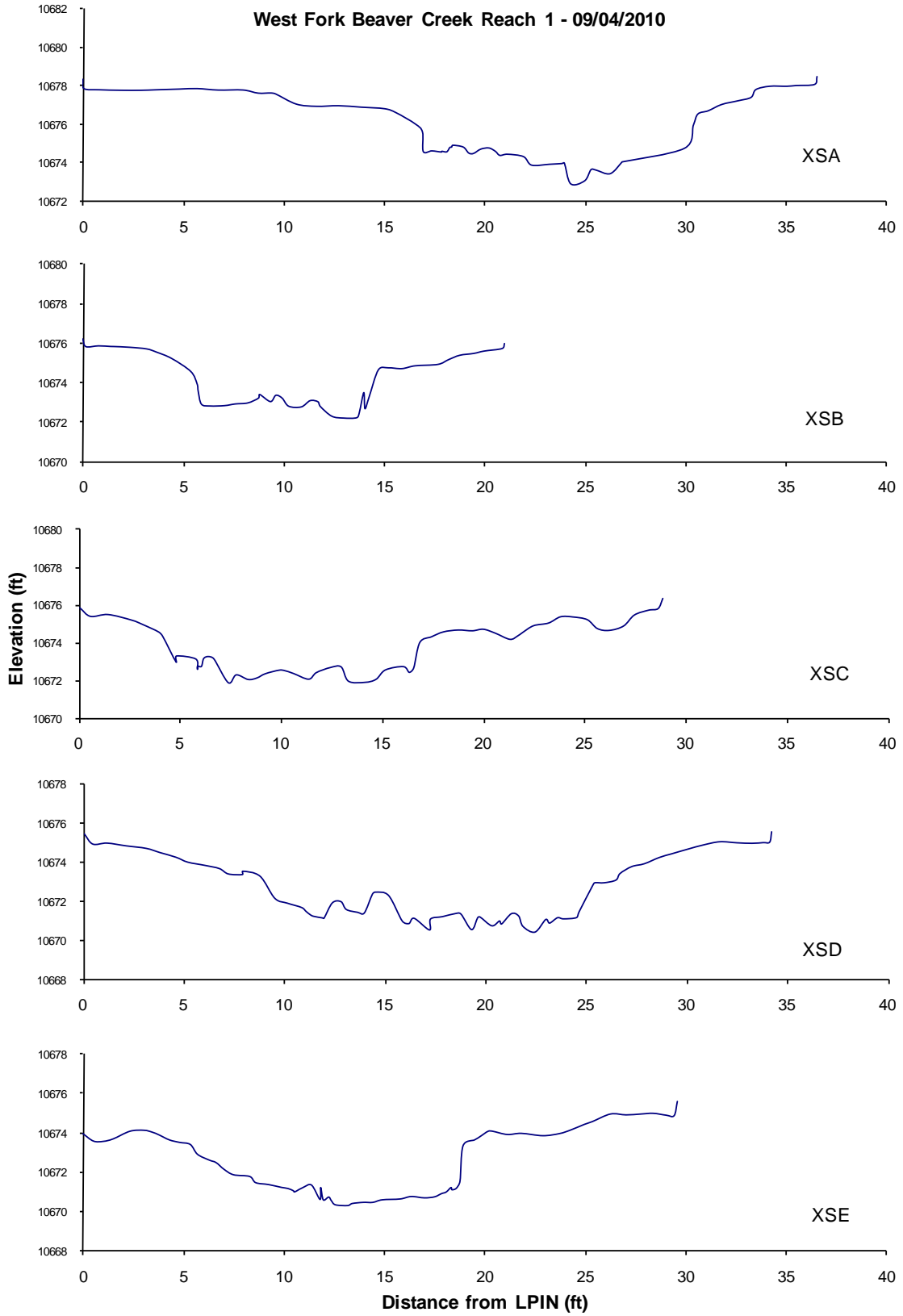


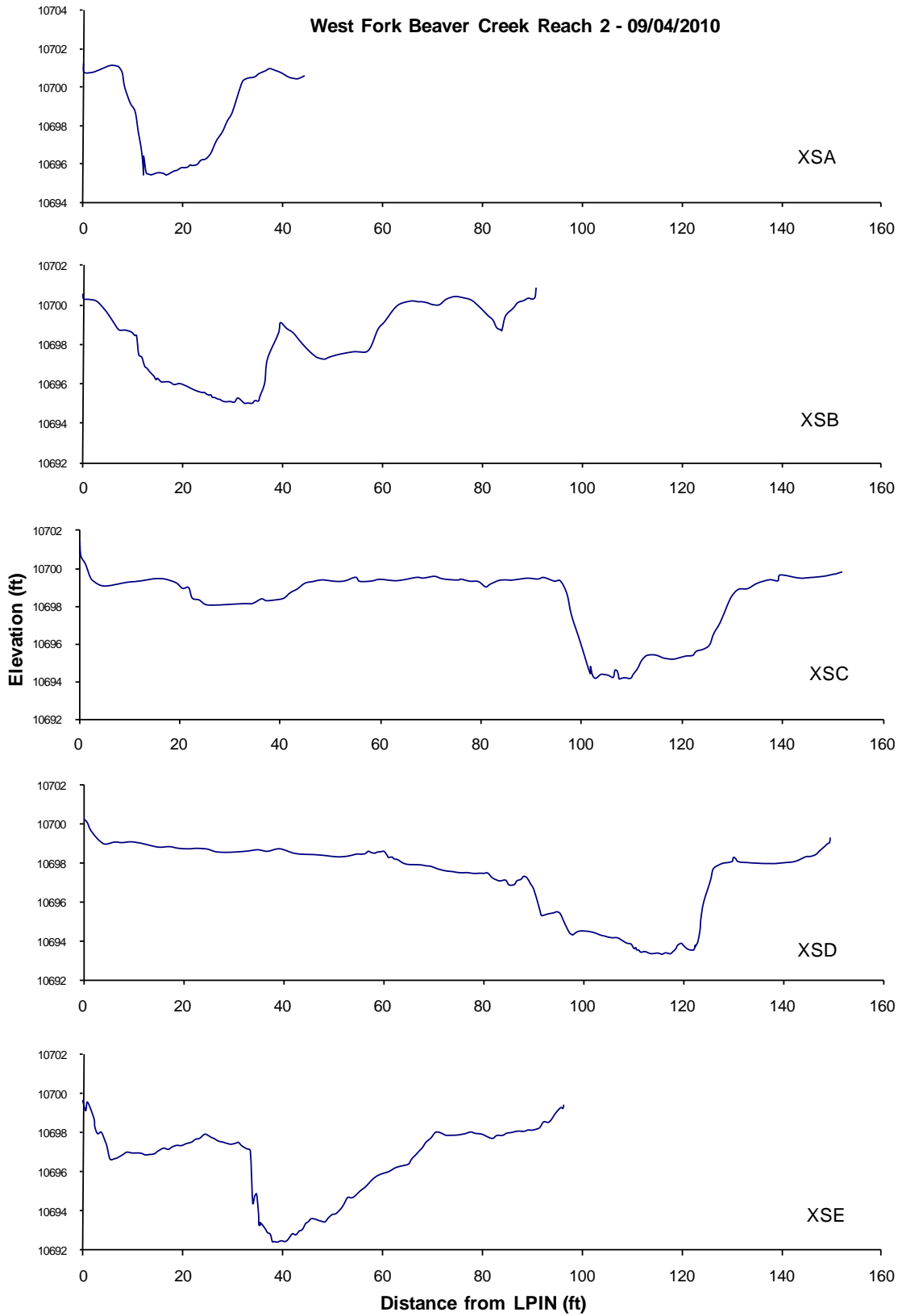












# Appendix N

## Stream Pebble Count

### Particle Size Distribution and Graphs

2010

### Summary of Stream Channel Particle Size Distribution from Pebble Counts on Pikes Peak, 2010

			Particle Size Distribution–Pebble Counts, 2010					
Site Name	ID	Date	D15	D35	D50	D84	D95	D100
Boehmer Creek Reach 1	BHMR1	9/25/2010	1.160	3.503	6.043	16.662	75.269	191.0
Boehmer Creek Reach 2	BHMR2	9/25/2010	1.900	7.118	11.590	69.641	144.556	325.0
East Fork Beaver Creek Reach 1	EBVR1	9/26/2010	2.269	6.000	7.903	17.400	48.000	285.0
East Fork Beaver Creek Reach 2	EBVR2	9/26/2010	1.361	3.924	6.146	13.271	24.780	90.0
Glen Cove Reach 1 †	GLEN1	7/20/2010	2.434	7.750	10.779	23.785	129.450	350.0
North Catamount Creek Reach 1	NCAT1	7/13/2010	1.219	4.377	6.949	16.000	25.289	41.0
North Catamount Creek Reach 2	NCAT2	7/13/2010	2.443	4.956	6.662	13.082	19.438	27.0
North Fork Crystal Creek Reach 1	NCRY1	7/12/2010	1.521	4.222	7.466	16.365	23.731	50.0
North Fork Crystal Creek Reach 2	NCRY2	7/12/2010	0.645	2.774	5.141	11.338	15.830	24.0
Oil Creek Reach 1 ∞	OILC1	8/5/2010						
South Catamount Creek Reach 1	SCAT1	7/29/2010	0.871	5.454	8.308	25.421	58.148	191.0
South Catamount Creek Reach 2	SCAT2	7/21/2010	2.071	5.942	8.427	22.311	48.000	315.0
South Catamount Creek Reach 3	SCAT3	7/20/2010	1.414	6.265	8.597	18.700	31.093	200.0
Ski Creek Reach 1	SKIC1	7/21/2010	1.287	4.823	8.619	21.302	55.426	275.0
Ski Creek Reach 2	SKIC2	7/12/2010	1.516	7.831	14.587	40.539	90.836	165.0
Severy Creek Reach 1	SVRY1	7/23/2010	0.110	2.097	4.147	11.485	24.000	198.0
Severy Creek Reach 2	SVRY2	7/23/2010	2.274	8.000	13.637	79.078	161.374	370.0
West Fork Beaver Creek Reach 1	WBVR1	9/4/2010	3.840	7.158	9.666	33.202	192.000	800.0
West Fork Beaver Creek Reach 2	WBVR2	9/4/2010	2.000	4.966	6.852	17.352	32.000	85.0
† Only 275 pebbles collected for pebble count on Glen Cove Creek Reach 1.								
∞ Pebble count not completed on Oil Creek Reach 1 due to lightening storm.								

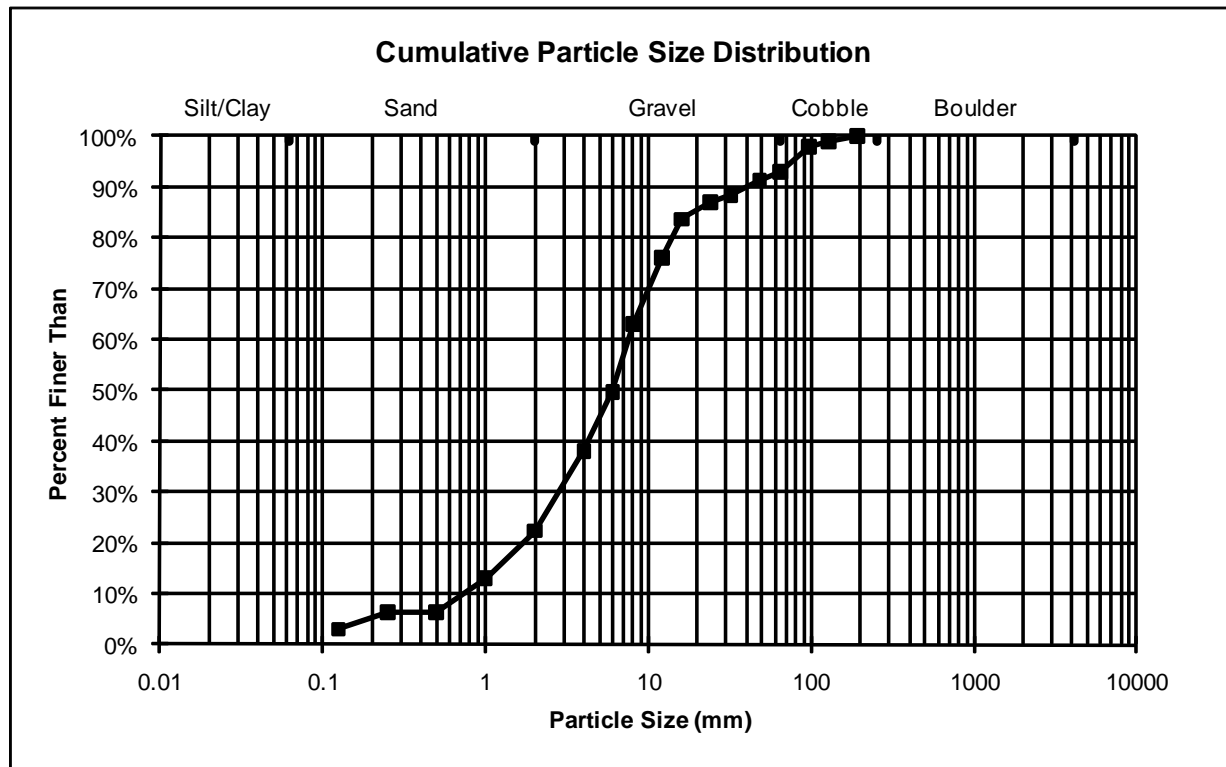
**Pebble Count Worksheet**

**COMMENTS:** ERO Reach

Particle Size (mm)	# in Size Class	% of Total	% Finer Than
<0.062	9	3.0%	
0.062 - 0.125	0	0.0%	3%
0.125 - 0.25	10	3.3%	6%
0.25 - .5	0	0.0%	6%
0.5 - 1.0	20	6.7%	13%
1 - 2	28	9.3%	22%
2 - 4	47	15.7%	38%
4 - 6	35	11.7%	50%
6 - 8	40	13.3%	63%
8 - 12	39	13.0%	76%
12 - 16	23	7.7%	84%
16 - 24	10	3.3%	87%
24 - 32	4	1.3%	88%
32 - 48	9	3.0%	91%
48 - 64	5	1.7%	93%
64 - 96	15	5.0%	98%
96 - 128	3	1.0%	99%
128 - 192	3	1.0%	100%
192 - 256			
256 - 384			
384 - 512			
512 - 1024			
1024 - 2048			
2044 - 4096			
<b>Total</b>	<b>300.00</b>		

**STREAM NAME:** Pike's Peak Highway - Boehmer Creek Reach 1  
**ID NUMBER:** BHMR1  
**DATE:** 9/25/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	1.160	3.503	6.043	16.662	75.269	191.0



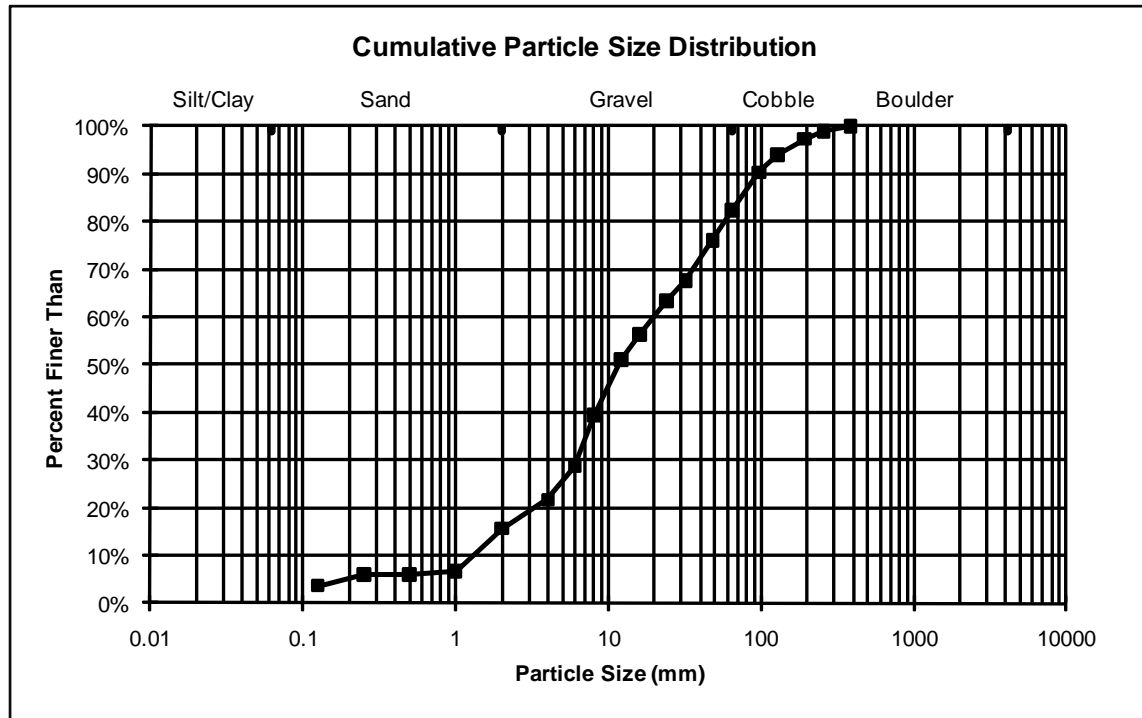
**Pebble Count Worksheet**

**COMMENTS:** Second reach 500 ft upstream of ERO Reach

Particle Size (mm)	# in Size Class	% of Total	% Finer Than
<0.062	11	3.7%	
0.062 - 0.125	0	0.0%	4%
0.125 - 0.25	7	2.3%	6%
0.25 - .5	0	0.0%	6%
0.5 - 1.0	2	0.7%	7%
1 - 2	27	9.0%	16%
2 - 4	18	6.0%	22%
4 - 6	21	7.0%	29%
6 - 8	32	10.7%	39%
8 - 12	35	11.7%	51%
12 - 16	16	5.3%	56%
16 - 24	21	7.0%	63%
24 - 32	13	4.3%	68%
32 - 48	25	8.3%	76%
48 - 64	19	6.3%	82%
64 - 96	24	8.0%	90%
96 - 128	11	3.7%	94%
128 - 192	10	3.3%	97%
192 - 256	5	1.7%	99%
256 - 384	3	1.0%	100%
384 - 512			
512 - 1024			
1024 - 2048			
2044 - 4096			
<b>Total</b>	<b>300.00</b>		

**STREAM NAME:** Pike's Peak Highway - Boehmer Creek Reach 2  
**ID NUMBER:** BHMR2  
**DATE:** 9/25/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	1.900	7.118	11.590	69.641	144.556	325.0



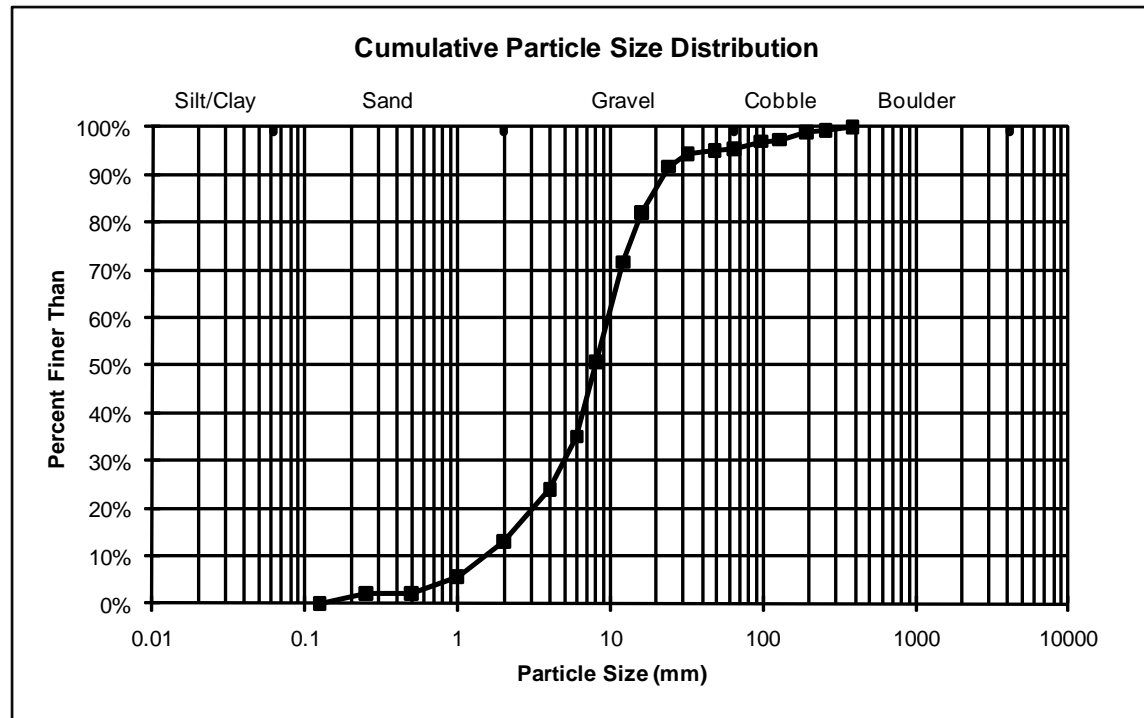
**Pebble Count Worksheet**

**COMMENTS:** ERO Reach

Particle Size (mm)	# in Size Class	% of Total	% Finer Than
<0.062	0	0.0%	
0.062 - 0.125	0	0.0%	0%
0.125 - 0.25	6	2.0%	2%
0.25 - .5	0	0.0%	2%
0.5 - 1.0	11	3.7%	6%
1 - 2	22	7.3%	13%
2 - 4	33	11.0%	24%
4 - 6	33	11.0%	35%
6 - 8	47	15.7%	51%
8 - 12	63	21.0%	72%
12 - 16	31	10.3%	82%
16 - 24	29	9.7%	92%
24 - 32	8	2.7%	94%
32 - 48	2	0.7%	95%
48 - 64	1	0.3%	95%
64 - 96	5	1.7%	97%
96 - 128	1	0.3%	97%
128 - 192	5	1.7%	99%
192 - 256	1	0.3%	99%
256 - 384	2	0.7%	100%
384 - 512			
512 - 1024			
1024 - 2048			
2044 - 4096			
<b>Total</b>	<b>300.00</b>		

**STREAM NAME:** East Fork Beaver Creek Reach 1  
**ID NUMBER:** EBVR1  
**DATE:** 9/26/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	2.269	6.000	7.903	17.400	48.000	285.0



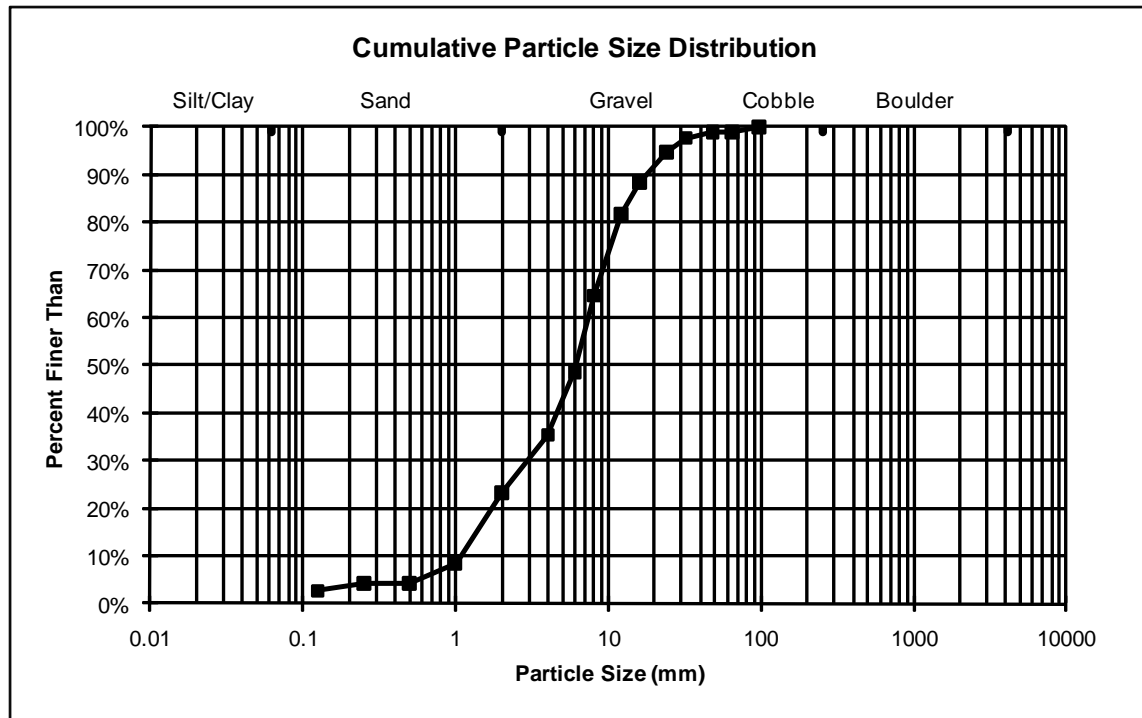
**Pebble Count Worksheet**

**COMMENTS:** Second reach 500 ft of ERO Reach

Particle Size (mm)	# in Size Class	% of Total	% Finer Than
<0.062	8	2.7%	
0.062 - 0.125	0	0.0%	3%
0.125 - 0.25	5	1.7%	4%
0.25 - .5	0	0.0%	4%
0.5 - 1.0	12	4.0%	8%
1 - 2	45	15.0%	23%
2 - 4	36	12.0%	35%
4 - 6	40	13.3%	49%
6 - 8	48	16.0%	65%
8 - 12	51	17.0%	82%
12 - 16	20	6.7%	88%
16 - 24	19	6.3%	95%
24 - 32	9	3.0%	98%
32 - 48	4	1.3%	99%
48 - 64	0	0.0%	99%
64 - 96	3	1.0%	100%
96 - 128			
128 - 192			
192 - 256			
256 - 384			
384 - 512			
512 - 1024			
1024 - 2048			
2044 - 4096			
<b>Total</b>	<b>300.00</b>		

**STREAM NAME:** Pike's Peak Highway - East Fork Beaver Creek Reach 2  
**ID NUMBER:** EBVR2  
**DATE:** 9/26/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	1.361	3.924	6.146	13.271	24.780	90.0





**Pebble Count Worksheet**

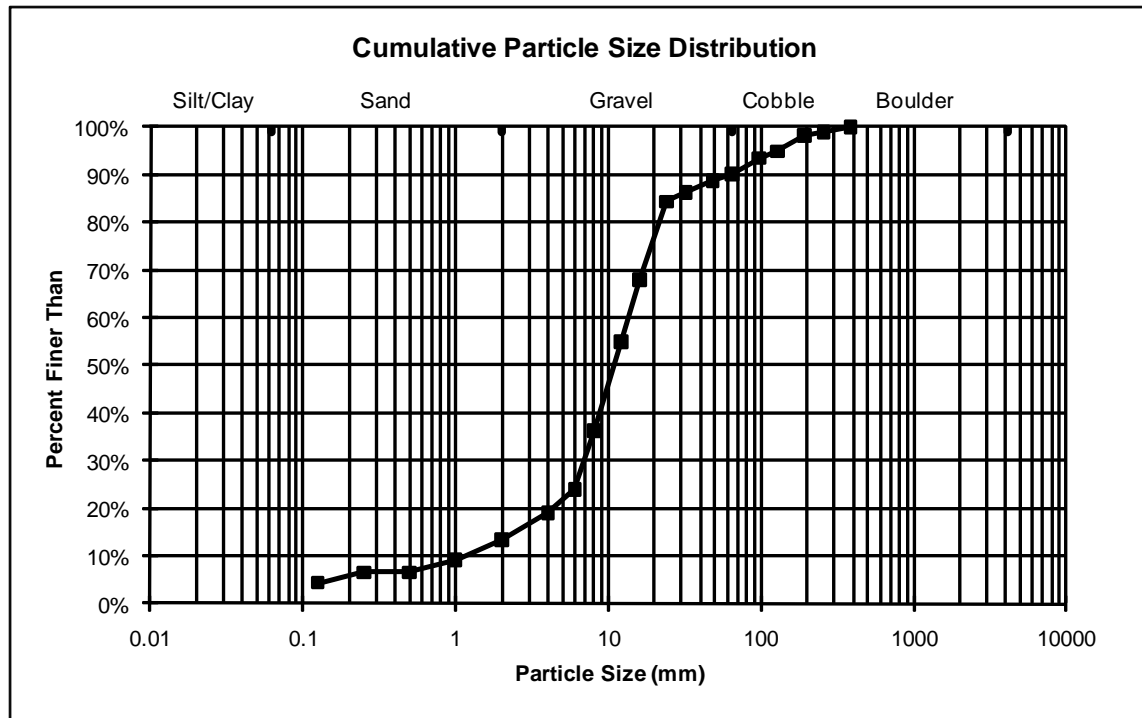
Particle Size (mm)	# in Size Class	% of Total	% Finer Than
<0.062	12	4.4%	
0.062 - 0.125	0	0.0%	4%
0.125 - 0.25	6	2.2%	7%
0.25 - .5	0	0.0%	7%
0.5 - 1.0	7	2.5%	9%
1 - 2	12	4.4%	13%
2 - 4	15	5.5%	19%
4 - 6	14	5.1%	24%
6 - 8	34	12.4%	36%
8 - 12	51	18.5%	55%
12 - 16	36	13.1%	68%
16 - 24	45	16.4%	84%
24 - 32	5	1.8%	86%
32 - 48	7	2.5%	89%
48 - 64	4	1.5%	90%
64 - 96	9	3.3%	93%
96 - 128	4	1.5%	95%
128 - 192	9	3.3%	98%
192 - 256	2	0.7%	99%
256 - 384	3	1.1%	100%
384 - 512			
512 - 1024			
1024 - 2048			
2044 - 4096			
<b>Total</b>	<b>275.00</b>		

**COMMENTS:**

Reach established upstream from confluence with South Catamount Creek because of the transbasin diversion installed in Ski Creek

**STREAM NAME:** Pike's Peak Highway - Glen Cove Creek Reach 1  
**ID NUMBER:** GLEN1  
**DATE:** 7/20/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	2.434	7.750	10.779	23.785	129.450	350.0



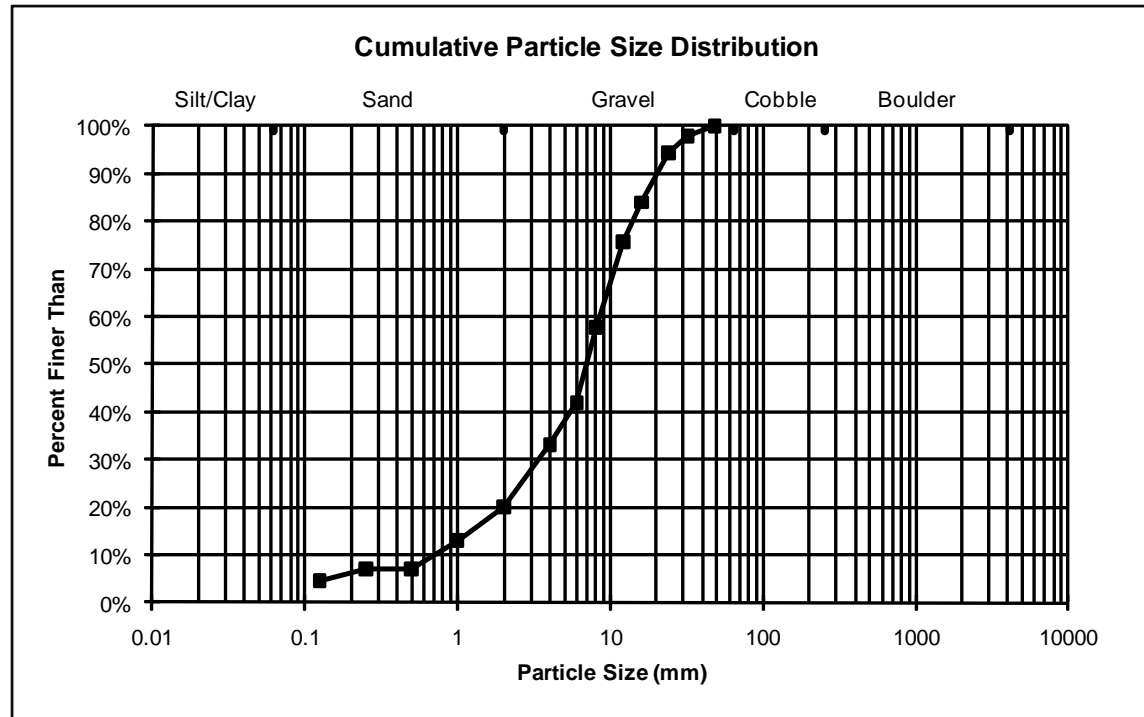
**Pebble Count Worksheet**

**COMMENTS:** ERO Study Site

Particle Size (mm)	# in Size Class	% of Total	% Finer Than
<0.062	14	4.7%	
0.062 - 0.125	0	0.0%	5%
0.125 - 0.25	7	2.3%	7%
0.25 - .5	0	0.0%	7%
0.5 - 1.0	18	6.0%	13%
1 - 2	21	7.0%	20%
2 - 4	39	13.0%	33%
4 - 6	27	9.0%	42%
6 - 8	47	15.7%	58%
8 - 12	54	18.0%	76%
12 - 16	25	8.3%	84%
16 - 24	31	10.3%	94%
24 - 32	11	3.7%	98%
32 - 48	6	2.0%	100%
48 - 64			
64 - 96			
96 - 128			
128 - 192			
192 - 256			
256 - 384			
384 - 512			
512 - 1024			
1024 - 2048			
2044 - 4096			
<b>Total</b>	<b>300.00</b>		

**STREAM NAME:** Pike's Peak Highway - North Catamount Creek Reach 1  
**ID NUMBER:** NCAT1  
**DATE:** 7/13/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	1.219	4.377	6.949	16.000	25.289	41.0



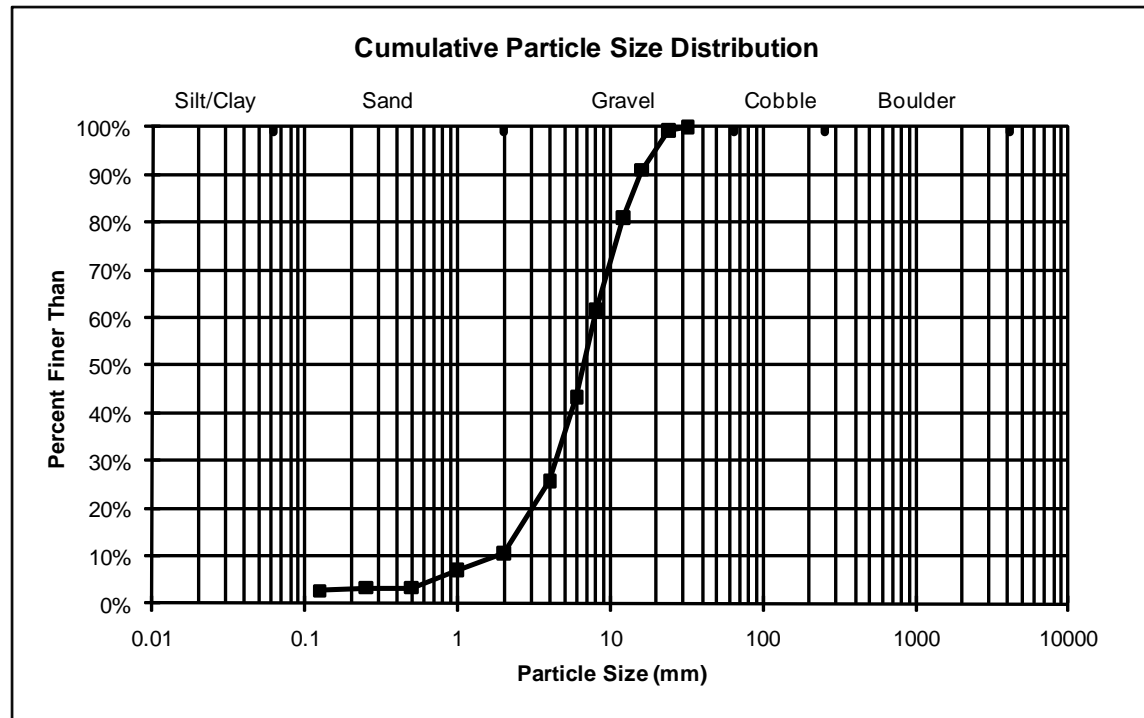
**Pebble Count Worksheet**

**COMMENTS:** Second reach 0.5 miles upstream from ERO Study Site

Particle Size (mm)	# in Size Class	% of Total	% Finer Than
<0.062	8	2.7%	
0.062 - 0.125	0	0.0%	3%
0.125 - 0.25	2	0.7%	3%
0.25 - .5	0	0.0%	3%
0.5 - 1.0	11	3.7%	7%
1 - 2	11	3.7%	11%
2 - 4	45	15.0%	26%
4 - 6	53	17.7%	43%
6 - 8	55	18.3%	62%
8 - 12	58	19.3%	81%
12 - 16	30	10.0%	91%
16 - 24	25	8.3%	99%
24 - 32	2	0.7%	100%
32 - 48			
48 - 64			
64 - 96			
96 - 128			
128 - 192			
192 - 256			
256 - 384			
384 - 512			
512 - 1024			
1024 - 2048			
2044 - 4096			
<b>Total</b>	<b>300.00</b>		

**STREAM NAME:** Pike's Peak Highway - North Catamount Creek Reach 2  
**ID NUMBER:** NCAT2  
**DATE:** 7/13/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	2.443	4.956	6.662	13.082	19.438	27.0



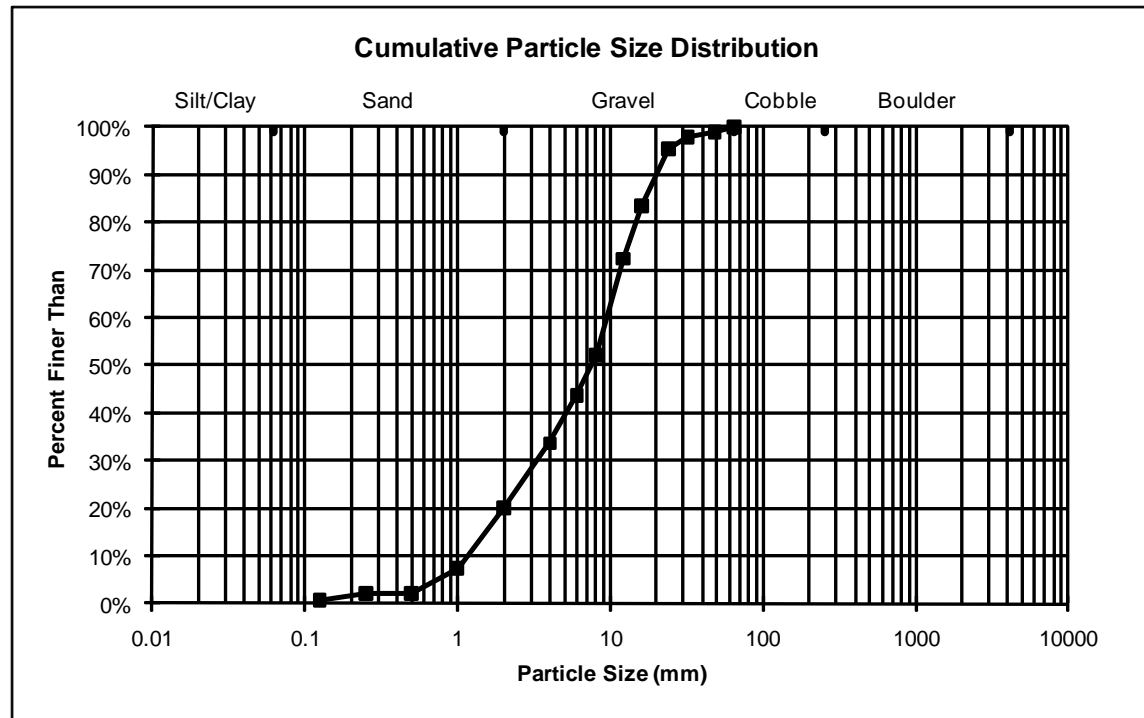
**Pebble Count Worksheet**

**COMMENTS:** ERO Study Site

Particle Size (mm)	# in Size Class	% of Total	% Finer Than
<0.062	2	0.7%	
0.062 - 0.125	0	0.0%	1%
0.125 - 0.25	4	1.3%	2%
0.25 - .5	0	0.0%	2%
0.5 - 1.0	16	5.3%	7%
1 - 2	38	12.7%	20%
2 - 4	41	13.7%	34%
4 - 6	30	10.0%	44%
6 - 8	25	8.3%	52%
8 - 12	61	20.3%	72%
12 - 16	33	11.0%	83%
16 - 24	36	12.0%	95%
24 - 32	8	2.7%	98%
32 - 48	3	1.0%	99%
48 - 64	3	1.0%	100%
64 - 96			
96 - 128			
128 - 192			
192 - 256			
256 - 384			
384 - 512			
512 - 1024			
1024 - 2048			
2044 - 4096			
<b>Total</b>	<b>300.00</b>		

**STREAM NAME:** Pike's Peak Highway - North Fork Crystal Creek Reach 1  
**ID NUMBER:** NCRY1  
**DATE:** 7/12/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	1.521	4.222	7.466	16.365	23.731	50.0



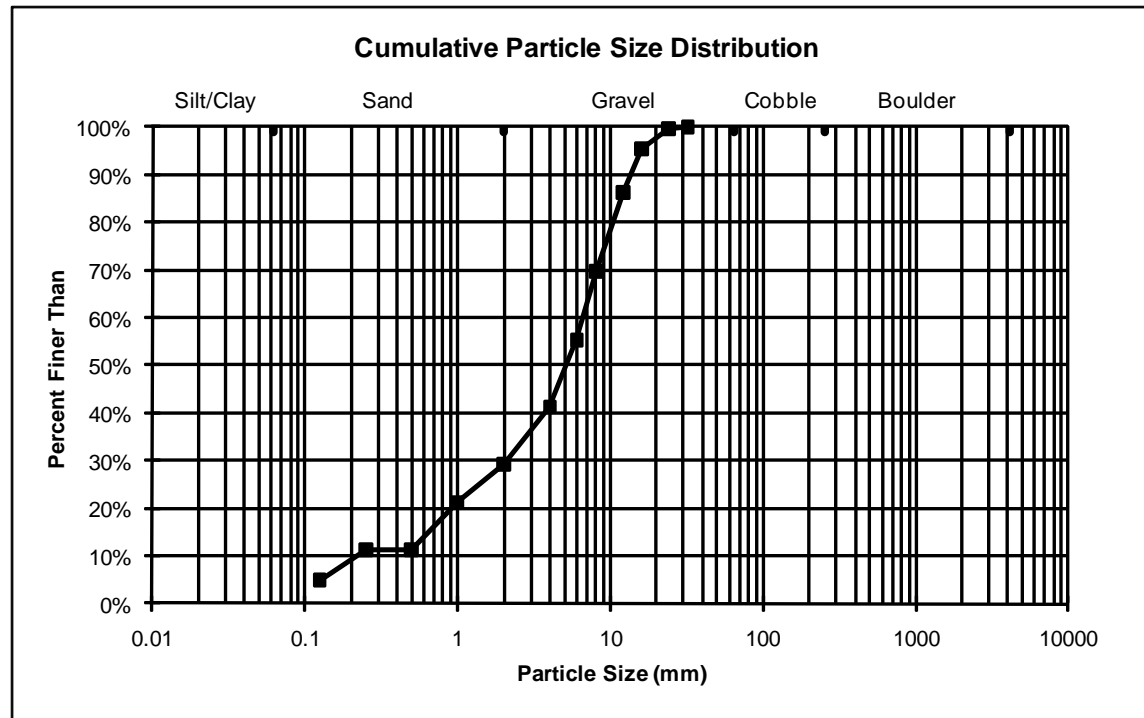
**Pebble Count Worksheet**

**COMMENTS:** Second reach 500 ft upstream from ERO Study Site

Particle Size (mm)	# in Size Class	% of Total	% Finer Than
<0.062	15	5.0%	
0.062 - 0.125	0	0.0%	5%
0.125 - 0.25	19	6.3%	11%
0.25 - .5	0	0.0%	11%
0.5 - 1.0	30	10.0%	21%
1 - 2	24	8.0%	29%
2 - 4	36	12.0%	41%
4 - 6	42	14.0%	55%
6 - 8	43	14.3%	70%
8 - 12	50	16.7%	86%
12 - 16	27	9.0%	95%
16 - 24	13	4.3%	100%
24 - 32	1	0.3%	100%
32 - 48			
48 - 64			
64 - 96			
96 - 128			
128 - 192			
192 - 256			
256 - 384			
384 - 512			
512 - 1024			
1024 - 2048			
2044 - 4096			
<b>Total</b>	<b>300.00</b>		

**STREAM NAME:** Pike's Peak Highway - North Fork Crystal Creek Reach 2  
**ID NUMBER:** NCRY2  
**DATE:** 7/12/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.645	2.774	5.141	11.338	15.830	24.0



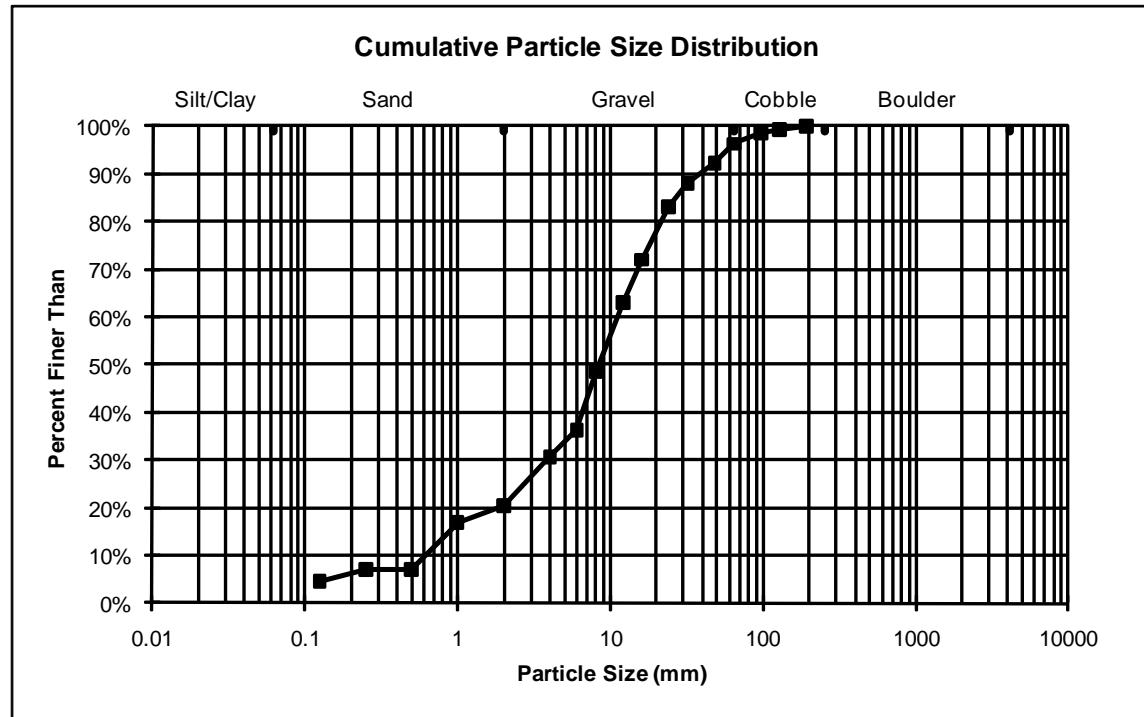
**Pebble Count Worksheet**

**COMMENTS:** ERO Study Site

Particle Size (mm)	# in Size Class	% of Total	% Finer Than
<0.062	14	4.7%	
0.062 - 0.125	0	0.0%	5%
0.125 - 0.25	7	2.3%	7%
0.25 - .5	0	0.0%	7%
0.5 - 1.0	30	10.0%	17%
1 - 2	10	3.3%	20%
2 - 4	31	10.3%	31%
4 - 6	17	5.7%	36%
6 - 8	37	12.3%	49%
8 - 12	43	14.3%	63%
12 - 16	27	9.0%	72%
16 - 24	33	11.0%	83%
24 - 32	15	5.0%	88%
32 - 48	13	4.3%	92%
48 - 64	12	4.0%	96%
64 - 96	7	2.3%	99%
96 - 128	2	0.7%	99%
128 - 192	2	0.7%	100%
192 - 256			
256 - 384			
384 - 512			
512 - 1024			
1024 - 2048			
2044 - 4096			
<b>Total</b>	<b>300.00</b>		

**STREAM NAME:** Pike's Peak Highway - South Catamount Creek Reach 1  
**ID NUMBER:** SCAT1  
**DATE:** 7/29/2010  
**CREW:** VonLoh, Winkler

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.871	5.454	8.308	25.421	58.148	191.0



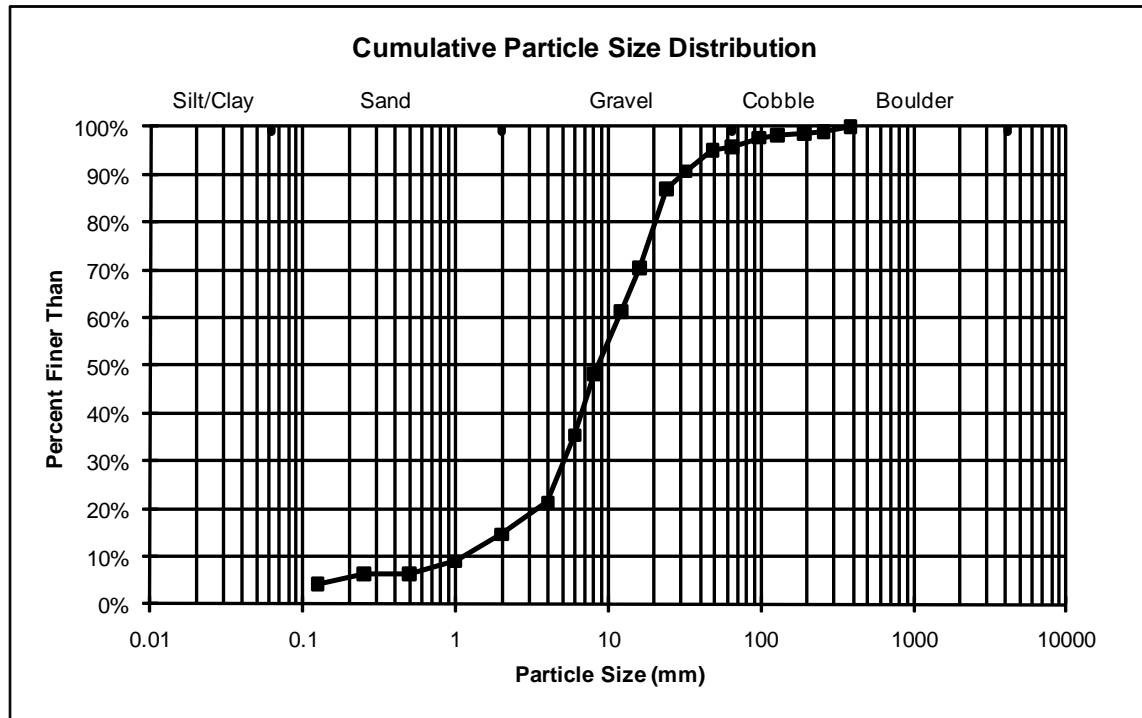
**Pebble Count Worksheet**

Particle Size (mm)	# in Size Class	% of Total	% Finer Than
<0.062	13	4.3%	
0.062 - 0.125	0	0.0%	4%
0.125 - 0.25	6	2.0%	6%
0.25 - .5	0	0.0%	6%
0.5 - 1.0	8	2.7%	9%
1 - 2	17	5.7%	15%
2 - 4	20	6.7%	21%
4 - 6	42	14.0%	35%
6 - 8	39	13.0%	48%
8 - 12	39	13.0%	61%
12 - 16	27	9.0%	70%
16 - 24	50	16.7%	87%
24 - 32	11	3.7%	91%
32 - 48	13	4.3%	95%
48 - 64	2	0.7%	96%
64 - 96	6	2.0%	98%
96 - 128	2	0.7%	98%
128 - 192	1	0.3%	99%
192 - 256	1	0.3%	99%
256 - 384	3	1.0%	100%
384 - 512			
512 - 1024			
1024 - 2048			
2044 - 4096			
<b>Total</b>	<b>300.00</b>		

**COMMENTS:** Second reach 500 ft upstream from ERO Study Site

**STREAM NAME:** Pike's Peak Highway - South Catamount Creek Reach 2  
**ID NUMBER:** SCAT2  
**DATE:** 7/21/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	2.071	5.942	8.427	22.311	48.000	315.0



**Pebble Count Worksheet**

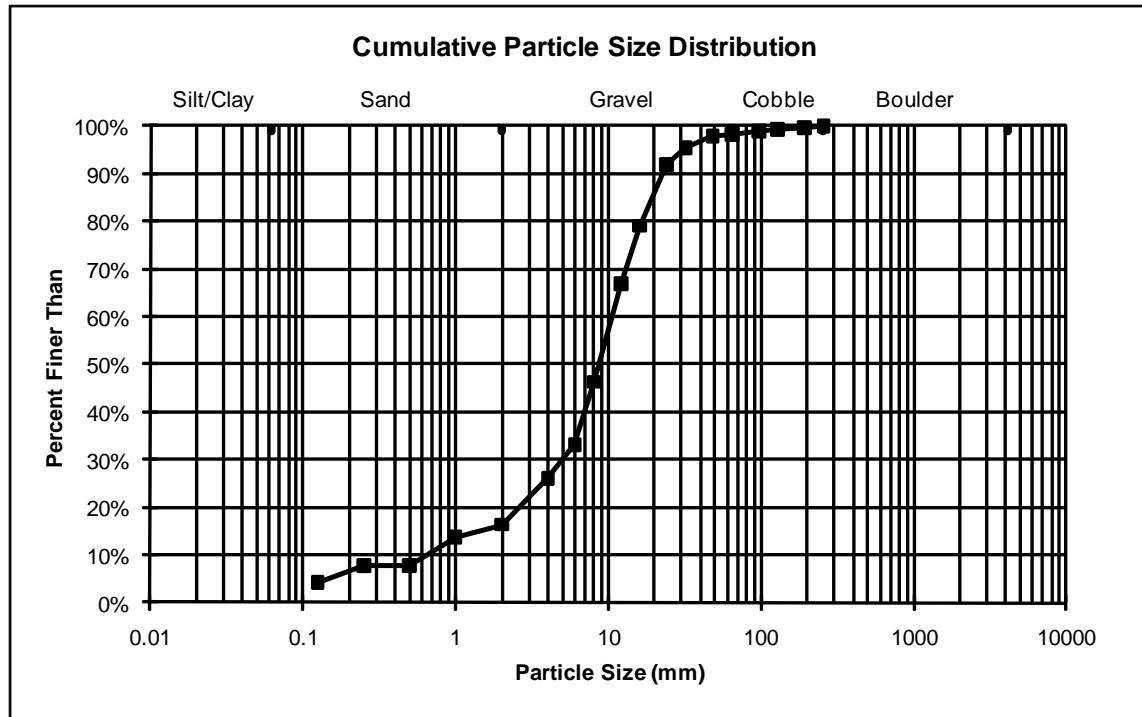
Particle Size (mm)	# in Size Class	% of Total	% Finer Than
<0.062	13	4.3%	
0.062 - 0.125	0	0.0%	4%
0.125 - 0.25	10	3.3%	8%
0.25 - .5	0	0.0%	8%
0.5 - 1.0	18	6.0%	14%
1 - 2	8	2.7%	16%
2 - 4	29	9.7%	26%
4 - 6	21	7.0%	33%
6 - 8	40	13.3%	46%
8 - 12	62	20.7%	67%
12 - 16	36	12.0%	79%
16 - 24	39	13.0%	92%
24 - 32	10	3.3%	95%
32 - 48	8	2.7%	98%
48 - 64	1	0.3%	98%
64 - 96	2	0.7%	99%
96 - 128	1	0.3%	99%
128 - 192	1	0.3%	100%
192 - 256	1	0.3%	100%
256 - 384			
384 - 512			
512 - 1024			
1024 - 2048			
2044 - 4096			
<b>Total</b>	<b>300.00</b>		

**COMMENTS:**

Reach established upstream from confluence with Glen Cove Creek because of the transbasin diversion installed in Ski Creek

**STREAM NAME:** Pike's Peak Highway - South Catamount Creek Reach 3  
**ID NUMBER:** SCAT3  
**DATE:** 7/20/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	1.414	6.265	8.597	18.700	31.093	200.0





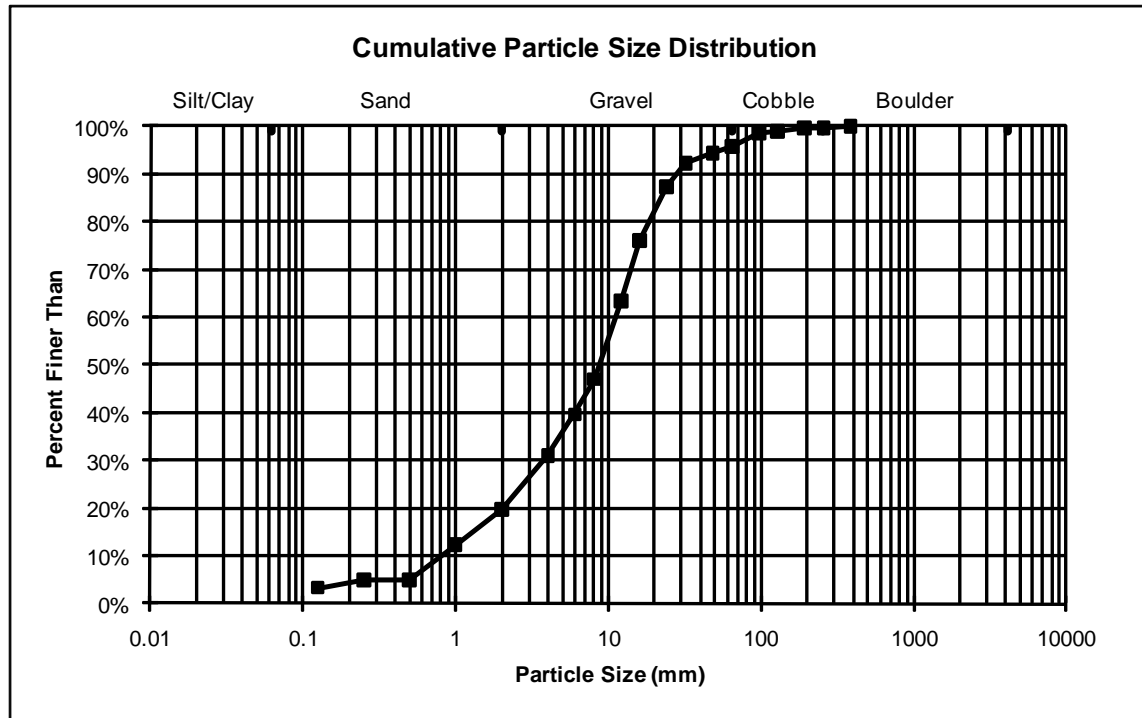
**Pebble Count Worksheet**

Particle Size (mm)	# in Size Class	% of Total	% Finer Than
<0.062	10	3.3%	
0.062 - 0.125	0	0.0%	3%
0.125 - 0.25	5	1.7%	5%
0.25 - .5	0	0.0%	5%
0.5 - 1.0	22	7.3%	12%
1 - 2	22	7.3%	20%
2 - 4	34	11.3%	31%
4 - 6	26	8.7%	40%
6 - 8	22	7.3%	47%
8 - 12	49	16.3%	63%
12 - 16	38	12.7%	76%
16 - 24	34	11.3%	87%
24 - 32	15	5.0%	92%
32 - 48	6	2.0%	94%
48 - 64	4	1.3%	96%
64 - 96	9	3.0%	99%
96 - 128	1	0.3%	99%
128 - 192	2	0.7%	100%
192 - 256	0	0.0%	100%
256 - 384	1	0.3%	100%
384 - 512			
512 - 1024			
1024 - 2048			
2044 - 4096			
<b>Total</b>	<b>300.00</b>		

**COMMENTS:** About 0.2 miles upstream form ERO Study Site

**STREAM NAME:** Pike's Peak Highway - Ski Creek Reach 1  
**ID NUMBER:** SKIC1  
**DATE:** 7/21/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	1.287	4.823	8.619	21.302	55.426	275.0



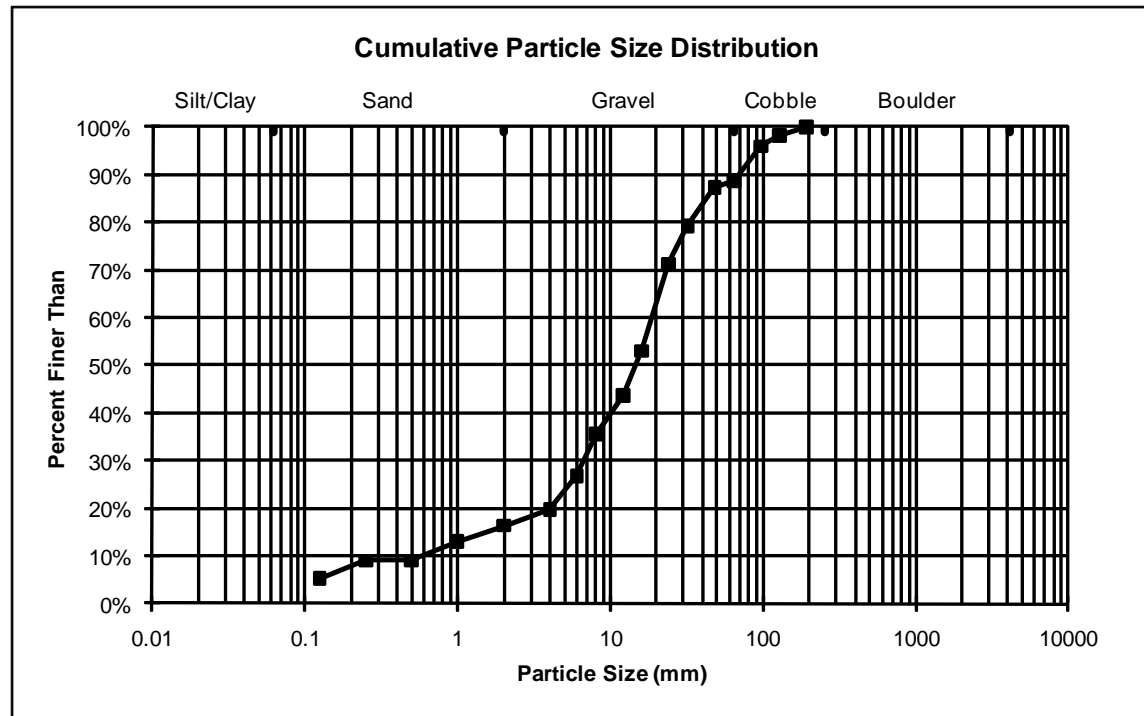
**Pebble Count Worksheet**

**COMMENTS:** Second reach near mile marker 10 on Pike's Peak Highway

Particle Size (mm)	# in Size Class	% of Total	% Finer Than
<0.062	16	5.3%	
0.062 - 0.125	0	0.0%	5%
0.125 - 0.25	11	3.7%	9%
0.25 - .5	0	0.0%	9%
0.5 - 1.0	12	4.0%	13%
1 - 2	10	3.3%	16%
2 - 4	10	3.3%	20%
4 - 6	21	7.0%	27%
6 - 8	27	9.0%	36%
8 - 12	24	8.0%	44%
12 - 16	28	9.3%	53%
16 - 24	55	18.3%	71%
24 - 32	24	8.0%	79%
32 - 48	24	8.0%	87%
48 - 64	4	1.3%	89%
64 - 96	22	7.3%	96%
96 - 128	7	2.3%	98%
128 - 192	5	1.7%	100%
192 - 256			
256 - 384			
384 - 512			
512 - 1024			
1024 - 2048			
2044 - 4096			
<b>Total</b>	<b>300.00</b>		

**STREAM NAME:** Pike's Peak Highway - Ski Creek Reach 2  
**ID NUMBER:** SKIC2  
**DATE:** 7/12/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	1.516	7.831	14.587	40.539	90.836	165.0



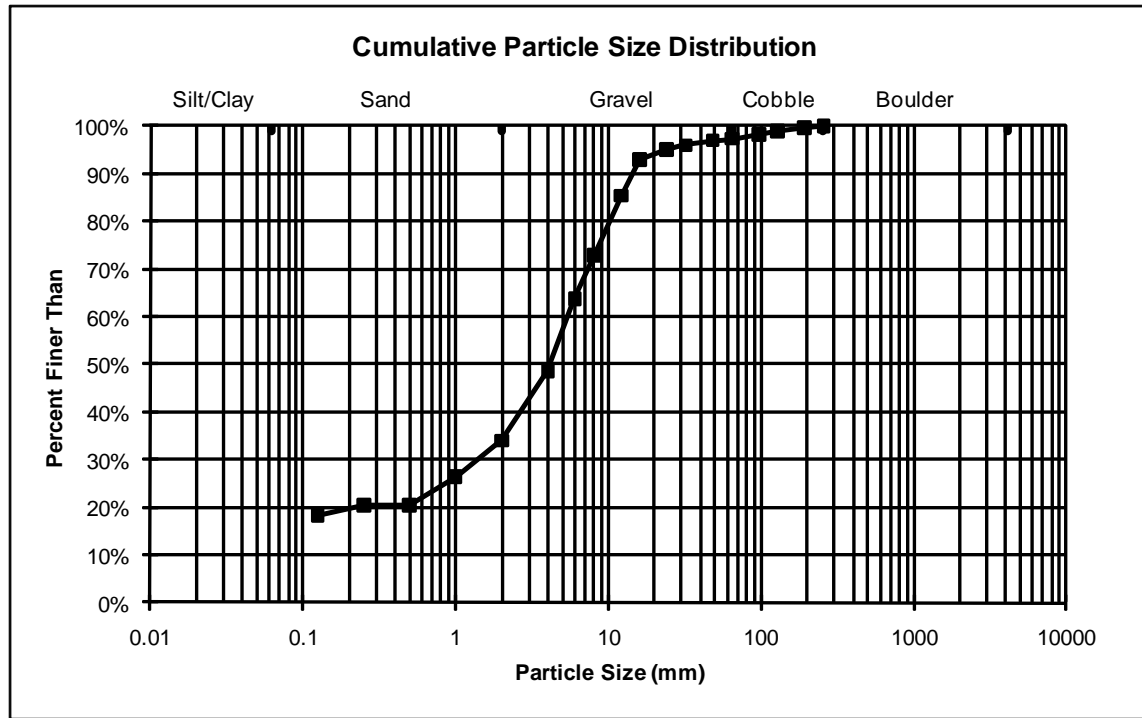
**Pebble Count Worksheet**

**COMMENTS:** ERO Reach

Particle Size (mm)	# in Size Class	% of Total	% Finer Than
<0.062	55	18.3%	
0.062 - 0.125	0	0.0%	18%
0.125 - 0.25	6	2.0%	20%
0.25 - .5	0	0.0%	20%
0.5 - 1.0	18	6.0%	26%
1 - 2	23	7.7%	34%
2 - 4	44	14.7%	49%
4 - 6	45	15.0%	64%
6 - 8	28	9.3%	73%
8 - 12	37	12.3%	85%
12 - 16	23	7.7%	93%
16 - 24	6	2.0%	95%
24 - 32	3	1.0%	96%
32 - 48	3	1.0%	97%
48 - 64	1	0.3%	97%
64 - 96	3	1.0%	98%
96 - 128	2	0.7%	99%
128 - 192	2	0.7%	100%
192 - 256	1	0.3%	100%
256 - 384			
384 - 512			
512 - 1024			
1024 - 2048			
2044 - 4096			
<b>Total</b>	<b>300.00</b>		

**STREAM NAME:** Pike's Peak Highway - Severy Creek Reach 1  
**ID NUMBER:** SVRY1  
**DATE:** 7/23/2010  
**CREW:** Derengowski, VonLoh, Winkler

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.110	2.097	4.147	11.485	24.000	198.0



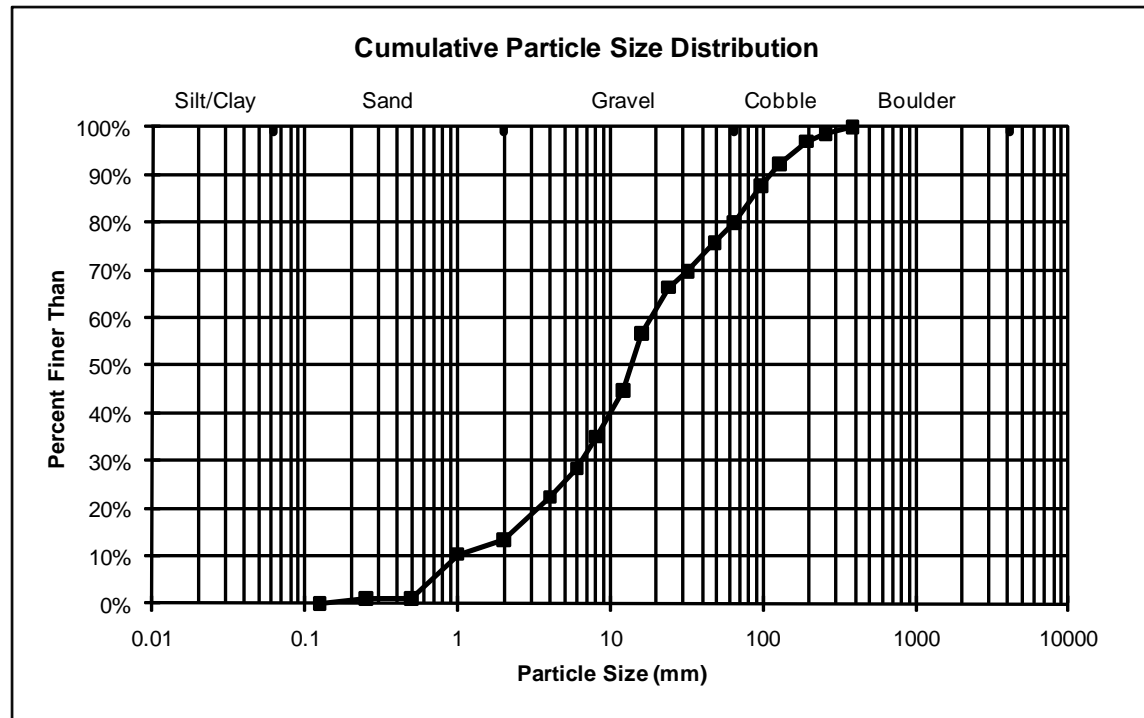
**Pebble Count Worksheet**

**COMMENTS:** Second reach 1000 ft upstream of ERO Reach

Particle Size (mm)	# in Size Class	% of Total	% Finer Than
<0.062	0	0.0%	
0.062 - 0.125	0	0.0%	0%
0.125 - 0.25	3	1.0%	1%
0.25 - .5	0	0.0%	1%
0.5 - 1.0	28	9.3%	10%
1 - 2	9	3.0%	13%
2 - 4	27	9.0%	22%
4 - 6	18	6.0%	28%
6 - 8	20	6.7%	35%
8 - 12	29	9.7%	45%
12 - 16	36	12.0%	57%
16 - 24	29	9.7%	66%
24 - 32	10	3.3%	70%
32 - 48	18	6.0%	76%
48 - 64	13	4.3%	80%
64 - 96	23	7.7%	88%
96 - 128	14	4.7%	92%
128 - 192	14	4.7%	97%
192 - 256	5	1.7%	99%
256 - 384	4	1.3%	100%
384 - 512			
512 - 1024			
1024 - 2048			
2044 - 4096			
<b>Total</b>	<b>300.00</b>		

**STREAM NAME:** Pike's Peak Highway - Severy Creek Reach 2  
**ID NUMBER:** SVRY2  
**DATE:** 7/23/2010  
**CREW:** Derengowski, VonLoh, Winkler

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	2.274	8.000	13.637	79.078	161.374	370.0



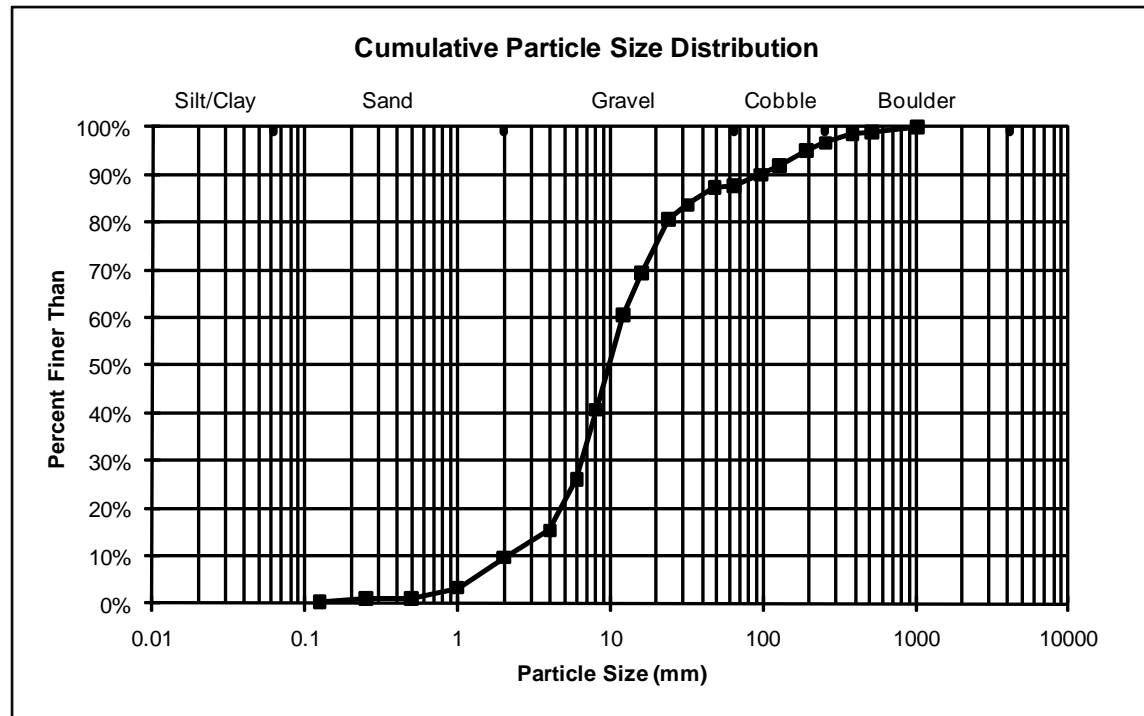
**Pebble Count Worksheet**

**COMMENTS:** ERO Reach

Particle Size (mm)	# in Size Class	% of Total	% Finer Than
<0.062	1	0.3%	
0.062 - 0.125	0	0.0%	0%
0.125 - 0.25	2	0.7%	1%
0.25 - .5	0	0.0%	1%
0.5 - 1.0	7	2.3%	3%
1 - 2	19	6.3%	10%
2 - 4	17	5.7%	15%
4 - 6	32	10.7%	26%
6 - 8	44	14.7%	41%
8 - 12	60	20.0%	61%
12 - 16	26	8.7%	69%
16 - 24	34	11.3%	81%
24 - 32	9	3.0%	84%
32 - 48	11	3.7%	87%
48 - 64	1	0.3%	88%
64 - 96	7	2.3%	90%
96 - 128	6	2.0%	92%
128 - 192	9	3.0%	95%
192 - 256	5	1.7%	97%
256 - 384	6	2.0%	99%
384 - 512	1	0.3%	99%
512 - 1024	3	1.0%	100%
1024 - 2048			
2044 - 4096			
<b>Total</b>	<b>300.00</b>		

**STREAM NAME:** Pike's Peak Highway - West Fork Beaver Creek Reach 1  
**ID NUMBER:** WBVR1  
**DATE:** 9/4/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	3.840	7.158	9.666	33.202	192.000	800.0



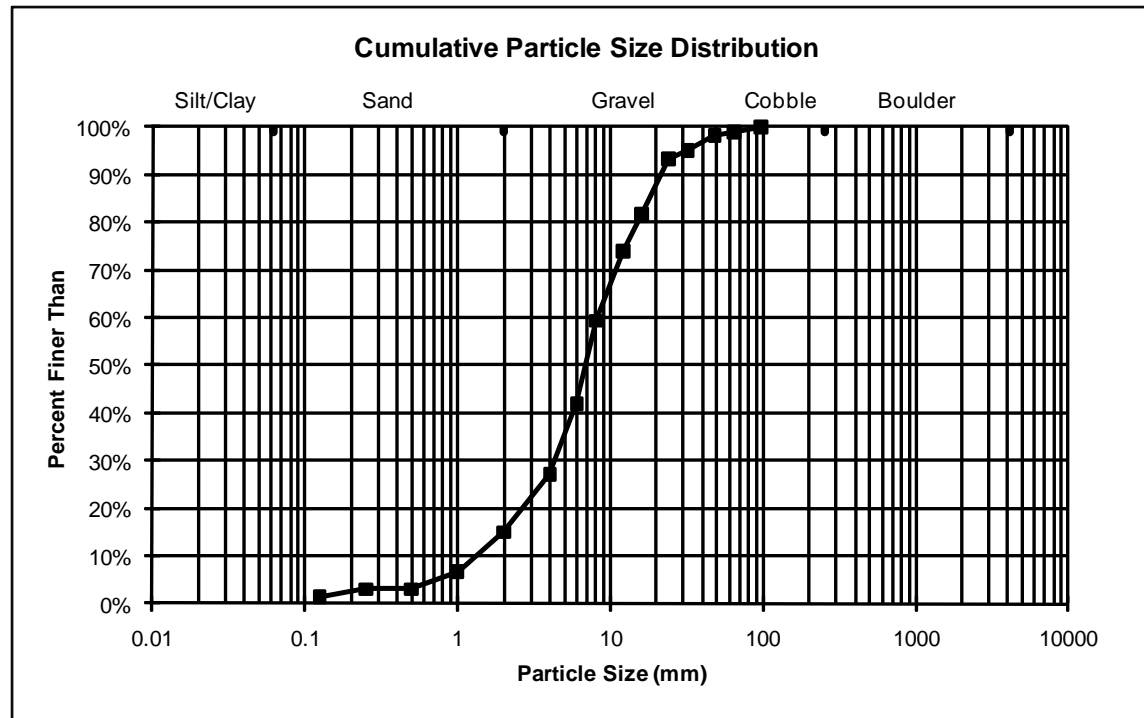
**Pebble Count Worksheet**

**COMMENTS:** Second reach 0.5 miles upstream of ERO Reach

Particle Size (mm)	# in Size Class	% of Total	% Finer Than
<0.062	4	1.3%	
0.062 - 0.125	0	0.0%	1%
0.125 - 0.25	5	1.7%	3%
0.25 - .5	0	0.0%	3%
0.5 - 1.0	11	3.7%	7%
1 - 2	25	8.3%	15%
2 - 4	36	12.0%	27%
4 - 6	45	15.0%	42%
6 - 8	52	17.3%	59%
8 - 12	44	14.7%	74%
12 - 16	23	7.7%	82%
16 - 24	35	11.7%	93%
24 - 32	5	1.7%	95%
32 - 48	10	3.3%	98%
48 - 64	2	0.7%	99%
64 - 96	3	1.0%	100%
96 - 128			
128 - 192			
192 - 256			
256 - 384			
384 - 512			
512 - 1024			
1024 - 2048			
2044 - 4096			
<b>Total</b>	<b>300.00</b>		

**STREAM NAME:** Pike's Peak Highway - West Fork Beaver Creek Reach 2  
**ID NUMBER:** WBVR2  
**DATE:** 9/4/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	2.000	4.966	6.852	17.352	32.000	85.0



# Appendix O

## Stream Bar Sample

### Particle Size Distribution and Graphs

2010

### Summary of Stream Channel Particle Size Distribution from Sieve Analysis of Bar Samples on Pikes Peak, 2010

			Particle Size Distribution–Grab Samples 2010					
Site Name	ID	Date	D15	D35	D50	D84	D95	D100
Boehmer Creek	BHMR1	9/25/2010	0.125	1.190	3.274	24.233	36.714	41.0
Boehmer Creek	BHMR2	9/25/2010	0.666	1.230	1.703	7.469	22.739	27.0
East Fork Beaver Creek	EBVR1	9/26/2010	0.606	2.236	3.639	7.512	10.259	14.0
East Fork Beaver Creek	EBVR2	9/26/2010	0.865	3.676	5.804	10.956	14.938	20.0
Glen Cove Creek	GLEN1	7/20/2010	0.788	1.781	2.781	7.836	12.665	17.0
North Catamount Creek	NCAT1	7/13/2010	2.101	4.559	6.131	10.557	13.347	15.0
North Catamount Creek	NCAT2	7/13/2010	1.890	4.361	6.312	13.465	24.091	28.0
North Fork Crystal Creek	NCRY1	7/12/2010	0.304	1.354	2.551	9.832	23.142	31.0
North Fork Crystal Creek	NCRY2	7/12/2010	0.296	1.182	2.054	6.634	11.303	21.0
Oil Creek	OILC1	8/5/2010	1.052	2.856	4.463	11.857	24.153	30.0
South Catamount Creek	SCAT1	7/29/2010	2.625	4.871	6.586	12.723	16.338	25.0
South Catamount Creek	SCAT2	7/21/2010	0.091	1.168	3.314	10.733	16.425	20.0
South Catamount Creek	SCAT3	7/20/2010	2.244	4.251	5.294	8.556	10.898	15.0
Ski Creek	SKIC1	7/21/2010	0.756	4.204	6.479	13.545	17.878	21.0
Ski Creek	SKIC2	7/12/2010	0.376	2.339	4.958	12.264	17.033	19.0
Severy Creek	SVRY1	7/23/2010	0.422	1.464	2.431	6.826	11.765	18.0
Severy Creek	SVRY2	7/23/2010	1.406	8.525	17.169	45.220	48.454	50.0
West Fork Beaver Creek	WBVR1	9/4/2010	2.014	5.610	7.435	12.594	16.294	20.0
West Fork Beaver Creek	WBVR2	9/4/2010	1.508	3.278	4.750	10.148	37.383	44.0



**Sieve Analysis Worksheet**

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	215.30	21.0%	
0.5	117.30	11.4%	21.0%
1.0	104.00	10.1%	32.5%
2.0	54.70	5.3%	42.6%
2.8	48.00	4.7%	47.9%
4.0	37.90	3.7%	52.6%
5.6	52.90	5.2%	56.3%
8.0	60.80	5.9%	61.5%
11.2	83.70	8.2%	67.4%
16.0	72.30	7.1%	75.6%
22.4	62.80	6.1%	82.6%
32.0	115.00	11.2%	88.8%
41.0	*		100.0%
64.0			-
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1024.70		

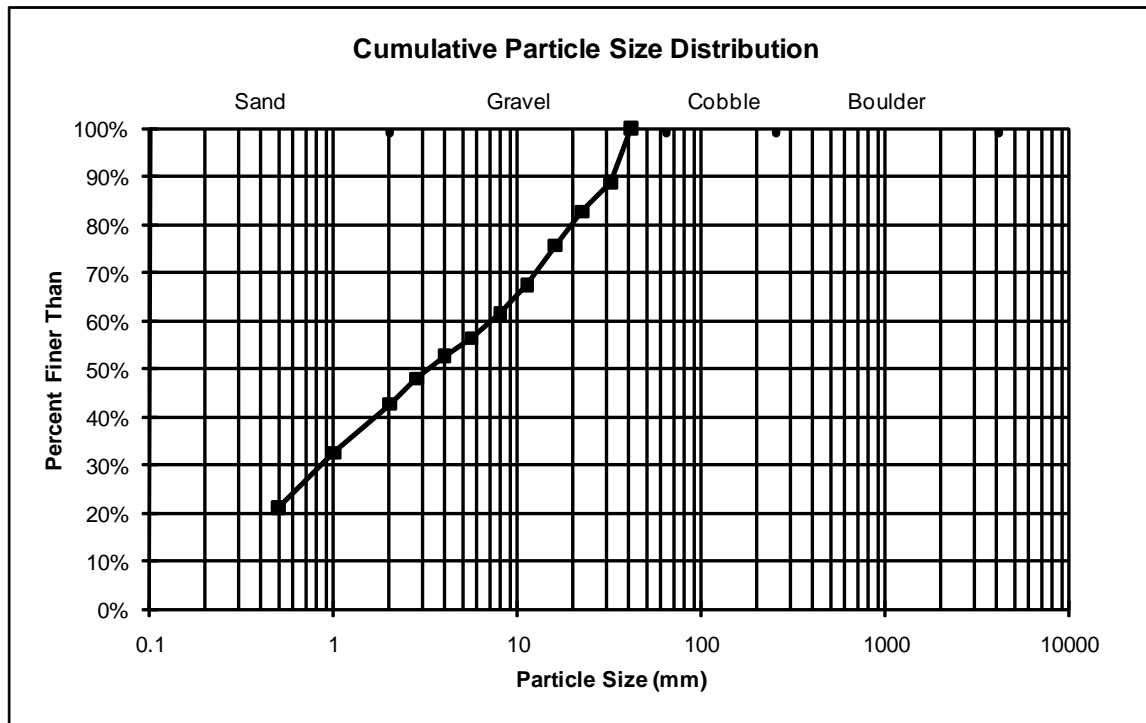
\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:**

Bar Sample taken downstream from Cross Section E

**SITE NAME:** Pike's Peak Highway - Boehmer Creek Reach 1  
**ID NUMBER:** BHMR1  
**DATE:** 9/25/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.125	1.190	3.274	24.233	36.714	41.0



**Sieve Analysis Worksheet**

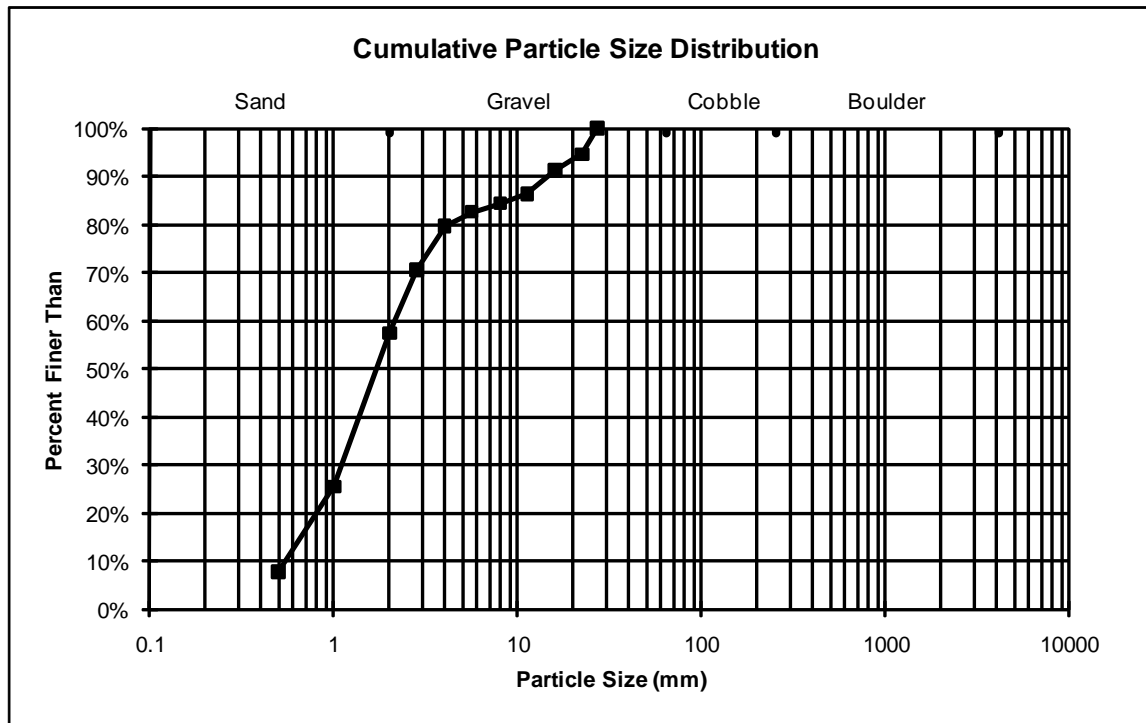
Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	94.80	7.6%	
0.5	221.20	17.8%	7.6%
1.0	396.70	32.0%	25.5%
2.0	164.10	13.2%	57.4%
2.8	111.40	9.0%	70.6%
4.0	37.30	3.0%	79.6%
5.6	21.40	1.7%	82.6%
8.0	26.00	2.1%	84.3%
11.2	59.90	4.8%	86.4%
16.0	41.10	3.3%	91.3%
22.4	67.50	5.4%	94.6%
27.0	*		100.0%
45.0			-
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1241.40		

\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:** Bar Sample taken 18' upstream from Cross Section B

**SITE NAME:** Pike's Peak Highway - Boehmer Creek Reach 2  
**ID NUMBER:** BHMR2  
**DATE:** 9/25/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.666	1.230	1.703	7.469	22.739	27.0



**Sieve Analysis Worksheet**

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	129.10	12.4%	
0.5	95.20	9.2%	12.4%
1.0	107.40	10.4%	21.6%
2.0	94.60	9.1%	32.0%
2.8	125.70	12.1%	41.1%
4.0	173.90	16.8%	53.2%
5.6	176.70	17.0%	70.0%
8.0	112.20	10.8%	87.0%
11.2	22.60	2.2%	97.8%
14.0	*		100.0%
22.4			-
32.0			
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1037.40		

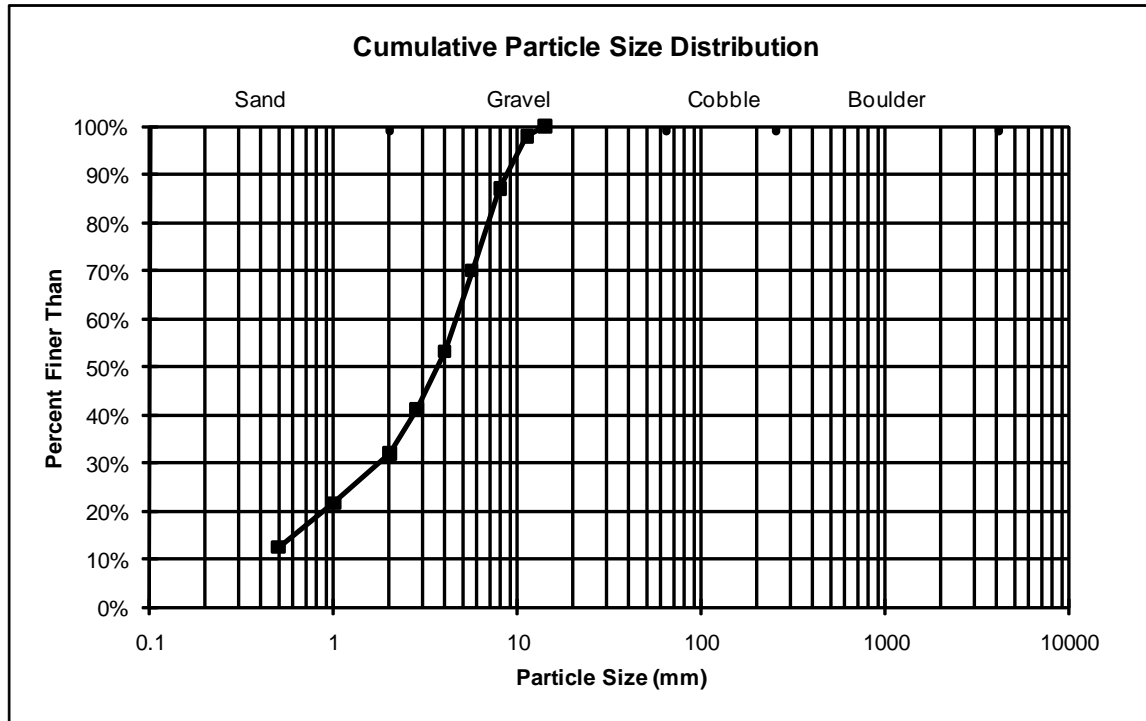
\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:**

Bar Sample taken 2' downstream from Cross Section B right bank

**SITE NAME:** Pike's Peak Highway - East Fork Beaver Creek Reach 1  
**ID NUMBER:** EBVR1  
**DATE:** 9/26/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.606	2.236	3.639	7.512	10.259	14.0



**Sieve Analysis Worksheet**

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	72.40	10.7%	
0.5	36.90	5.5%	10.7%
1.0	46.60	6.9%	16.1%
2.0	37.30	5.5%	23.0%
2.8	57.30	8.5%	28.5%
4.0	76.40	11.3%	37.0%
5.6	115.90	17.1%	48.3%
8.0	134.70	19.9%	65.4%
11.2	81.30	12.0%	85.3%
16.0	18.20	2.7%	97.3%
20.0	*		100.0%
32.0			-
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	677.00		

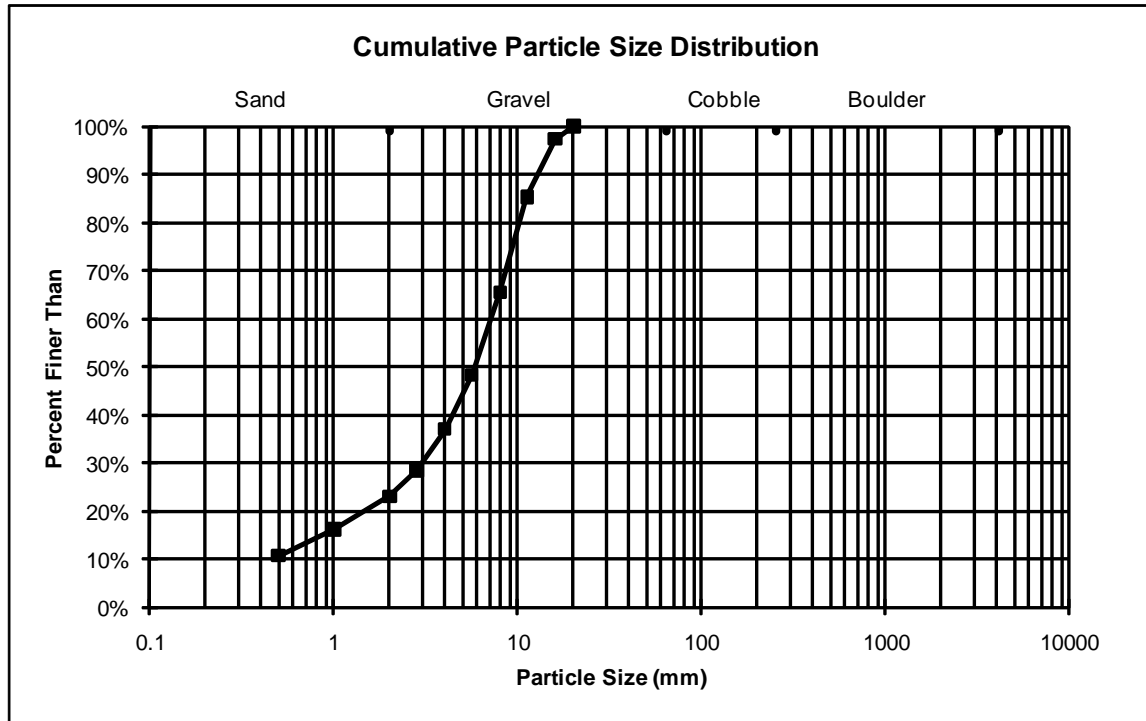
\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:**

Bar Sample taken 6' upstream from Cross Section E

**SITE NAME:** Pike's Peak Highway - East Fork Beaver Creek Reach 2  
**ID NUMBER:** EBVR2  
**DATE:** 9/26/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.865	3.676	5.804	10.956	14.938	20.0



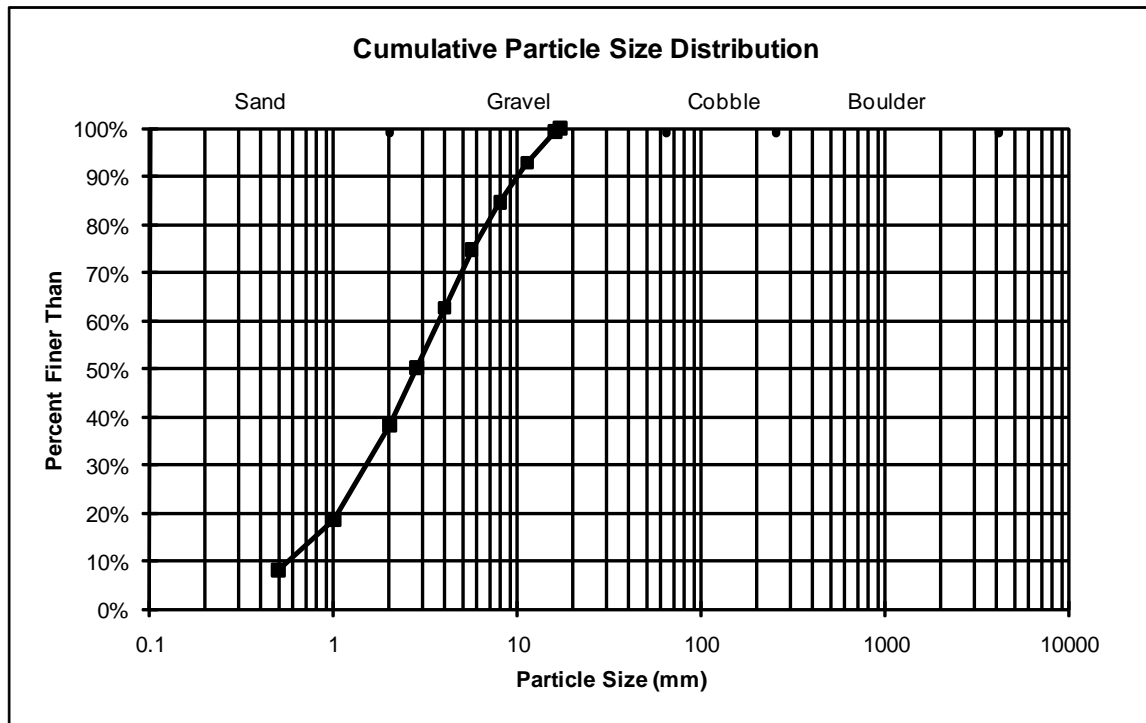
**Sieve Analysis Worksheet**

**COMMENTS:** Bar Sample taken at Cross Section E

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	82.80	8.0%	
0.5	109.30	10.6%	8.0%
1.0	202.30	19.6%	18.6%
2.0	123.20	12.0%	38.3%
2.8	127.80	12.4%	50.2%
4.0	125.60	12.2%	62.6%
5.6	100.20	9.7%	74.8%
8.0	84.30	8.2%	84.6%
11.2	67.30	6.5%	92.7%
16.0	7.40	0.7%	99.3%
17.0	*		100.0%
32.0			-
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1030.20		

**SITE NAME:** Pike's Peak Highway - Glen Cove Creek Reach 1  
**ID NUMBER:** GLEN1  
**DATE:** 7/20/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.788	1.781	2.781	7.836	12.665	17.0



\*Measured value of the largest particle in the sample and not a sieve weight

**Sieve Analysis Worksheet**

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	63.60	5.7%	
0.5	28.30	2.5%	5.7%
1.0	66.40	5.9%	8.2%
2.0	65.40	5.8%	14.1%
2.8	103.90	9.3%	20.0%
4.0	164.90	14.7%	29.3%
5.6	264.30	23.6%	44.0%
8.0	222.40	19.9%	67.6%
11.2	140.00	12.5%	87.5%
15.0	*		100.0%
22.4			-
32.0			
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1119.20		

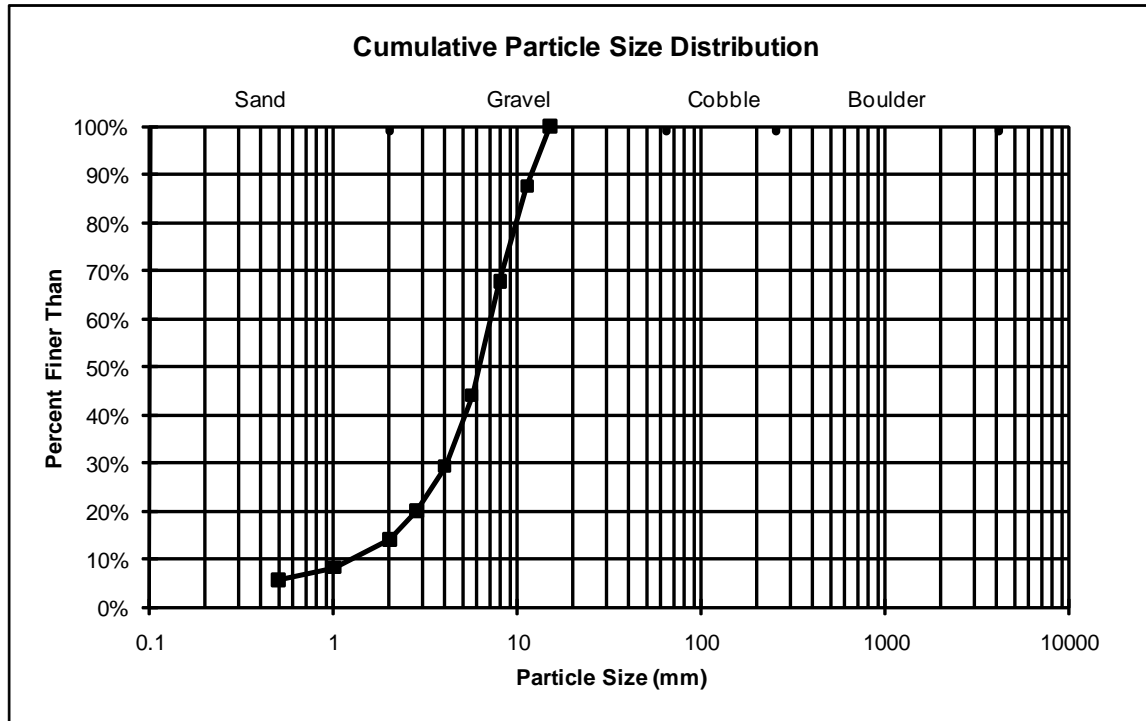
\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:**

Bar Sample taken between Cross Section B and C right bank

**SITE NAME:** Pike's Peak Highway - North Catamount Creek Reach 1  
**ID NUMBER:** NCAT1  
**DATE:** 7/13/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	2.101	4.559	6.131	10.557	13.347	15.0



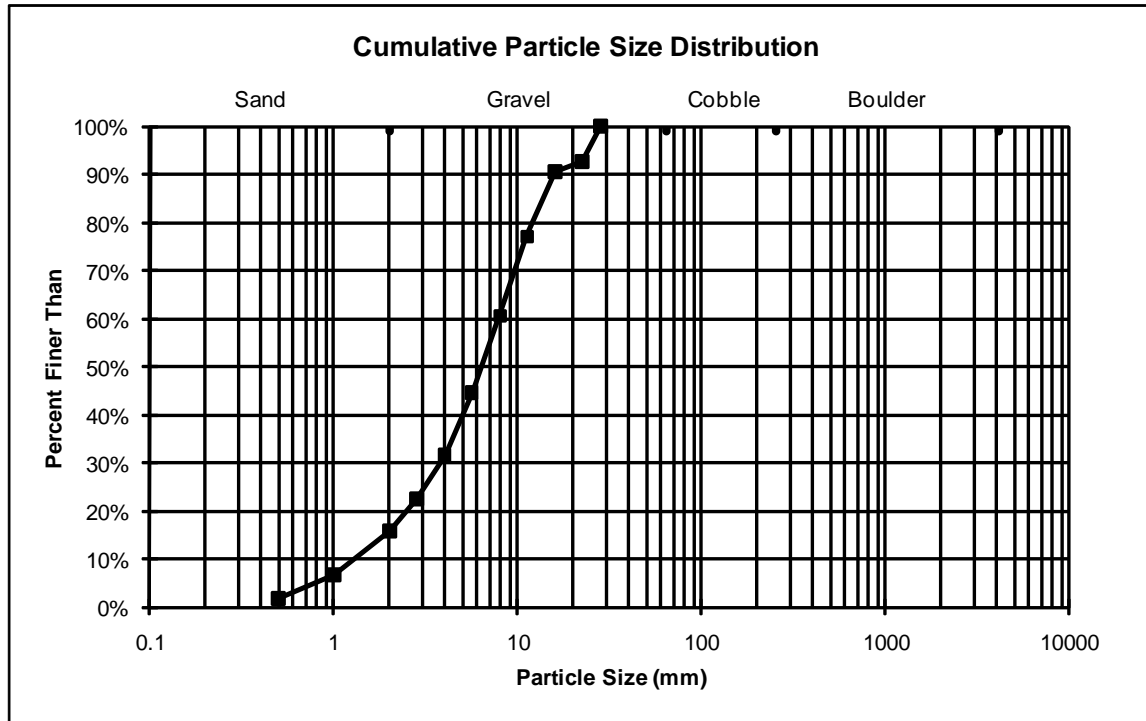
**Sieve Analysis Worksheet**

**COMMENTS:** Bar Sample taken 3' downstream from Cross Section B

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	12.90	1.8%	
0.5	35.40	4.9%	1.8%
1.0	65.60	9.1%	6.7%
2.0	48.20	6.7%	15.7%
2.8	67.00	9.3%	22.4%
4.0	94.10	13.0%	31.7%
5.6	115.20	15.9%	44.7%
8.0	119.10	16.5%	60.6%
11.2	97.60	13.5%	77.0%
16.0	14.90	2.1%	90.5%
22.4	53.70	7.4%	92.6%
28.0	*		100.0%
45.0			-
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	723.70		

**SITE NAME:** Pike's Peak Highway - North Catamount Creek Reach 2  
**ID NUMBER:** NCAT2  
**DATE:** 7/13/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	1.890	4.361	6.312	13.465	24.091	28.0



\*Measured value of the largest particle in the sample and not a sieve weight

**Sieve Analysis Worksheet**

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	134.10	16.7%	
0.5	92.30	11.5%	16.7%
1.0	124.60	15.5%	28.2%
2.0	69.50	8.7%	43.7%
2.8	73.00	9.1%	52.4%
4.0	75.80	9.4%	61.5%
5.6	66.20	8.2%	70.9%
8.0	63.00	7.9%	79.2%
11.2	30.60	3.8%	87.0%
16.0	28.80	3.6%	90.9%
22.4	44.60	5.6%	94.4%
31.0	*		100.0%
45.0			-
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	802.50		

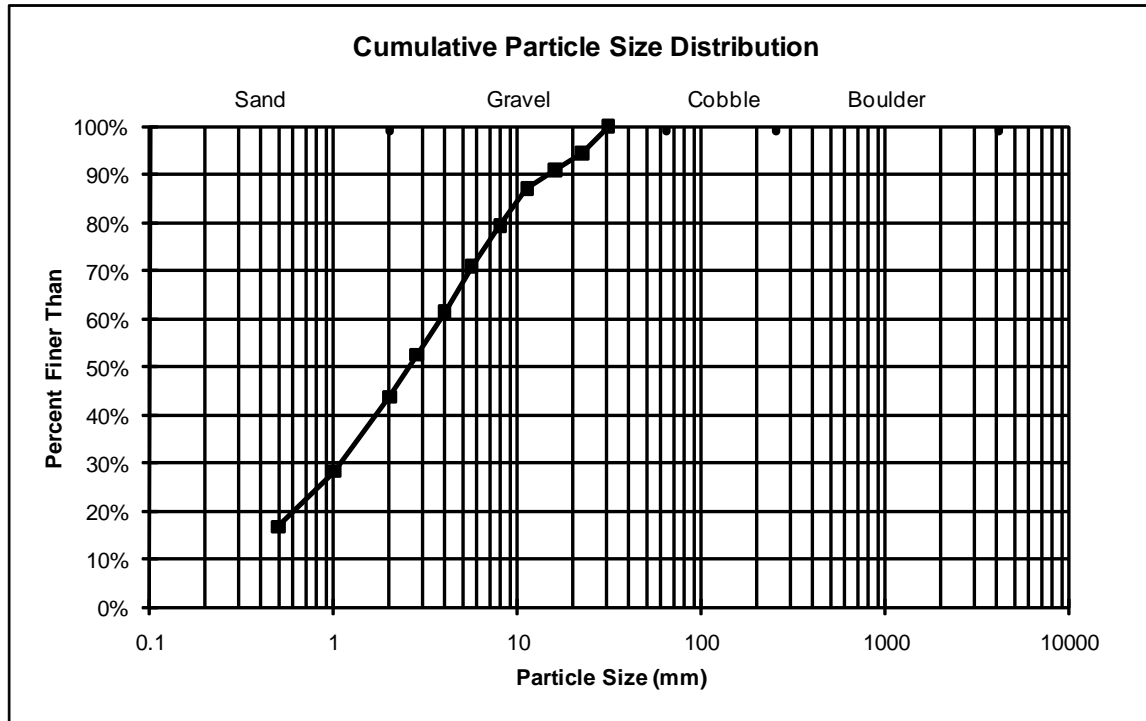
\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:**

Bar Sample taken at Cross Section A left bank

**SITE NAME:** Pike's Peak Highway - North Fork Crystal Creek Reach 1  
**ID NUMBER:** NCRY1  
**DATE:** 7/12/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.304	1.354	2.551	9.832	23.142	31.0





**Sieve Analysis Worksheet**

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	139.70	16.8%	
0.5	113.60	13.7%	16.8%
1.0	155.50	18.7%	30.5%
2.0	83.30	10.0%	49.2%
2.8	89.10	10.7%	59.2%
4.0	80.20	9.7%	70.0%
5.6	76.80	9.2%	79.6%
8.0	50.30	6.1%	88.9%
11.2	29.70	3.6%	94.9%
16.0	12.60	1.5%	98.5%
21.0	*		100.0%
32.0			-
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	830.80		

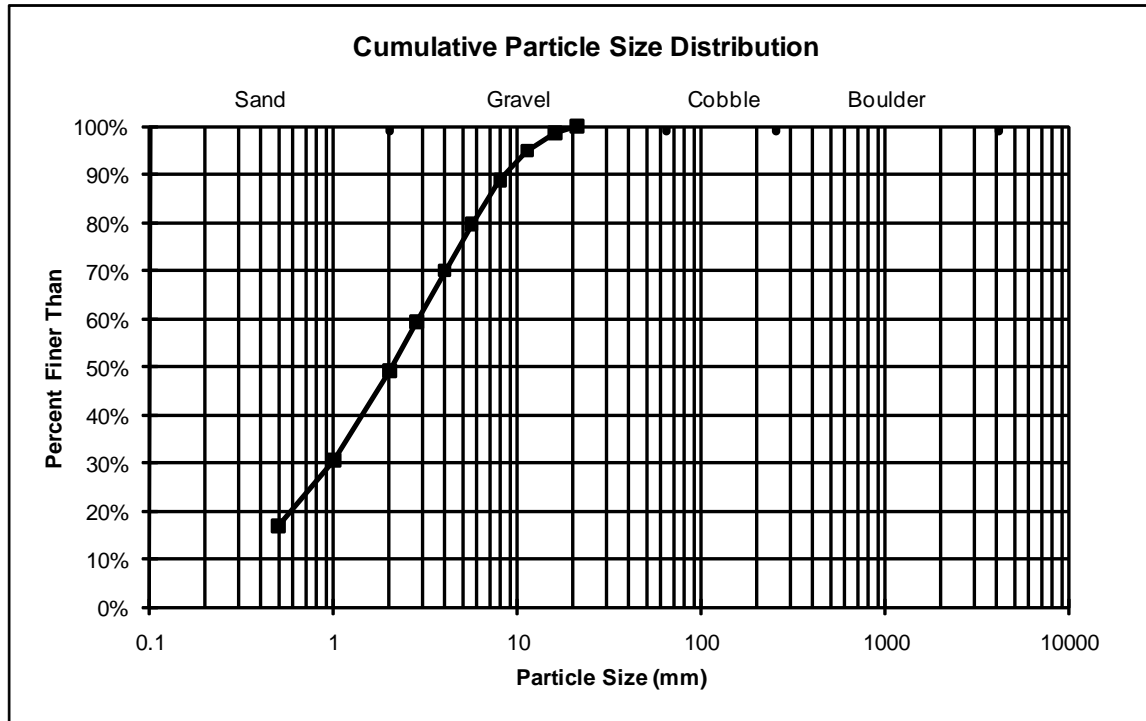
\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:**

Bar Sample taken upstream from Cross Section E

**SITE NAME:** Pike's Peak Highway - North Fork Crystal Creek Reach 2  
**ID NUMBER:** NCRY2  
**DATE:** 7/12/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.296	1.182	2.054	6.634	11.303	21.0



**Sieve Analysis Worksheet**

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	52.30	5.4%	
0.5	84.20	8.7%	5.4%
1.0	118.10	12.2%	14.1%
2.0	78.10	8.1%	26.3%
2.8	108.20	11.2%	34.4%
4.0	131.70	13.6%	45.6%
5.6	129.40	13.4%	59.2%
8.0	99.40	10.3%	72.6%
11.2	71.20	7.4%	82.8%
16.0	29.80	3.1%	90.2%
22.4	65.20	6.7%	93.3%
30.0	*		100.0%
45.0			-
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	967.60		

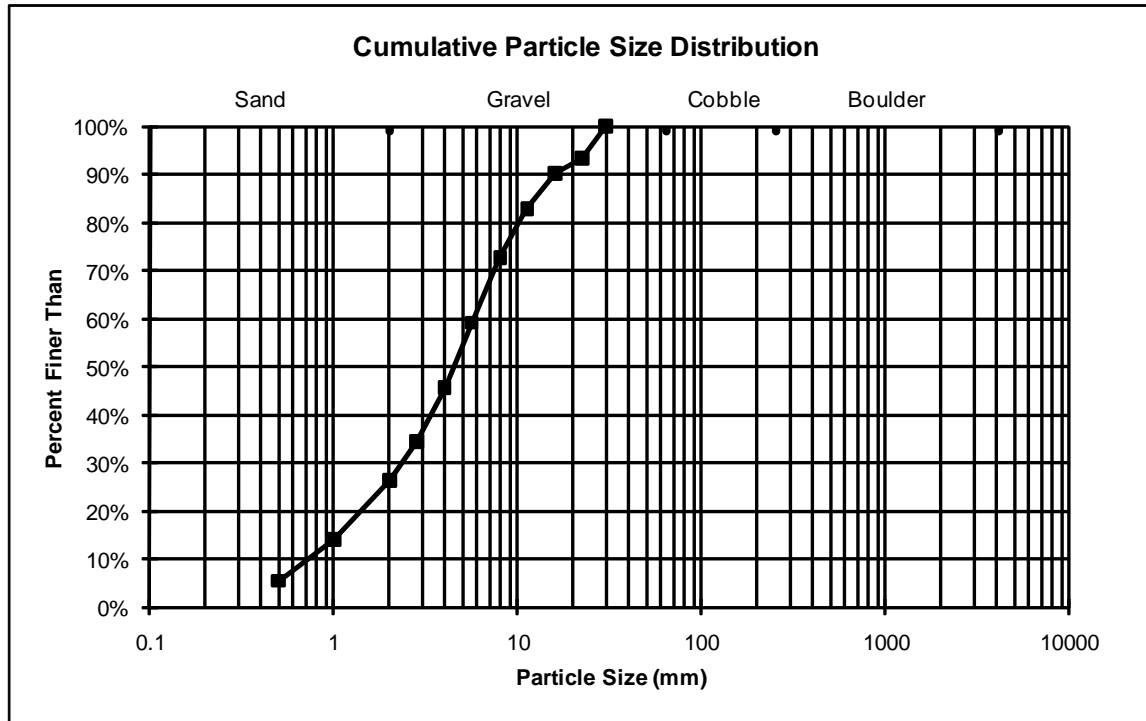
\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:**

Bar Sample taken 4" downstream from Cross Section A right bank

**SITE NAME:** Pike's Peak Highway - Oil Creek Reach 1  
**ID NUMBER:** OILC1  
**DATE:** 8/5/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	1.052	2.856	4.463	11.857	24.153	30.0



**Sieve Analysis Worksheet**

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	30.40	3.2%	
0.5	21.80	2.3%	3.2%
1.0	45.40	4.9%	5.6%
2.0	52.90	5.7%	10.4%
2.8	92.90	9.9%	16.1%
4.0	143.60	15.3%	26.0%
5.6	177.70	19.0%	41.4%
8.0	165.20	17.7%	60.4%
11.2	156.70	16.7%	78.0%
16.0	35.70	3.8%	94.8%
22.4	13.30	1.4%	98.6%
25.0	*		100.0%
45.0			-
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	935.60		

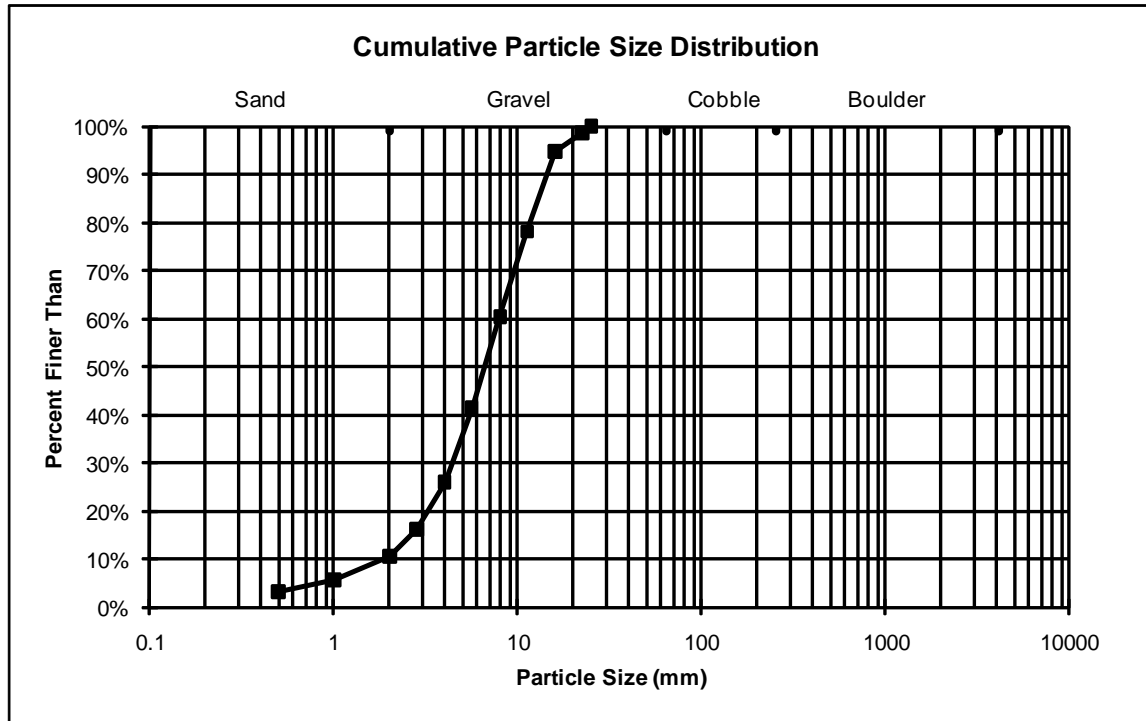
\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:**

Bar Sample taken 3' upstream from Cross Section B

**SITE NAME:** Pike's Peak Highway - Boehmer Creek Reach 1  
**ID NUMBER:** SCAT1  
**DATE:** 7/29/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	2.625	4.871	6.586	12.723	16.338	25.0



**Sieve Analysis Worksheet**

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	196.70	23.1%	
0.5	84.90	10.0%	23.1%
1.0	74.70	8.8%	33.0%
2.0	42.70	5.0%	41.8%
2.8	57.60	6.8%	46.8%
4.0	78.30	9.2%	53.6%
5.6	98.40	11.5%	62.8%
8.0	94.70	11.1%	74.3%
11.2	76.10	8.9%	85.4%
16.0	48.30	5.7%	94.3%
20.0	*		100.0%
32.0			-
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	852.40		

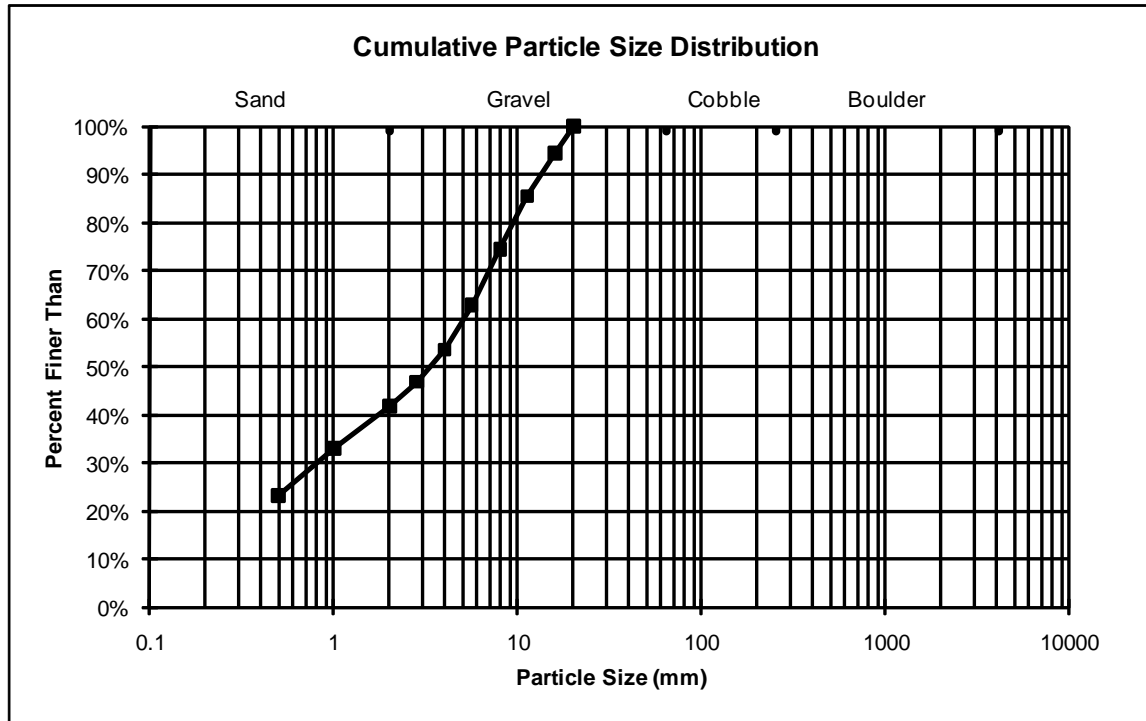
\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:**

Bar Sample taken 10' upstream from Cross Section E left bank

**SITE NAME:** Pike's Peak Highway - South Catamount Creek Reach 2  
**ID NUMBER:** SCAT2  
**DATE:** 7/21/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.091	1.168	3.314	10.733	16.425	20.0



**Sieve Analysis Worksheet**

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	17.00	1.3%	
0.5	35.90	2.8%	1.3%
1.0	104.00	8.1%	4.1%
2.0	105.30	8.2%	12.2%
2.8	134.30	10.4%	20.4%
4.0	295.80	23.0%	30.8%
5.6	348.50	27.1%	53.8%
8.0	196.70	15.3%	80.9%
11.2	48.30	3.8%	96.2%
15.0	*		100.0%
22.4			-
32.0			
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1285.80		

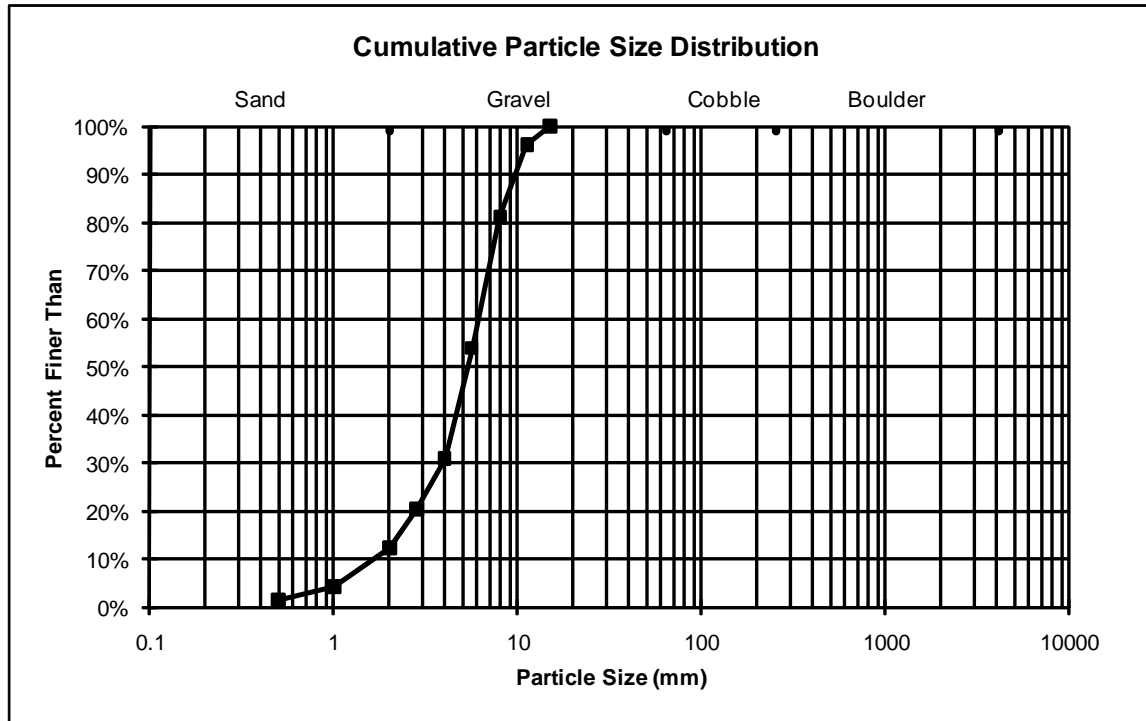
\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:**

Bar Sample taken 10' downstream from Cross Section D right bank

**SITE NAME:** Pike's Peak Highway - South Catamount Creek Reach 3  
**ID NUMBER:** SCAT3  
**DATE:** 7/20/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	2.244	4.251	5.294	8.556	10.898	15.0



**Sieve Analysis Worksheet**

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	134.00	12.4%	
0.5	47.10	4.4%	12.4%
1.0	53.90	5.0%	16.8%
2.0	46.10	4.3%	21.7%
2.8	80.20	7.4%	26.0%
4.0	114.40	10.6%	33.4%
5.6	158.00	14.6%	44.0%
8.0	180.90	16.7%	58.6%
11.2	174.70	16.2%	75.4%
16.0	91.30	8.4%	91.6%
21.0	*		100.0%
32.0			-
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1080.60		

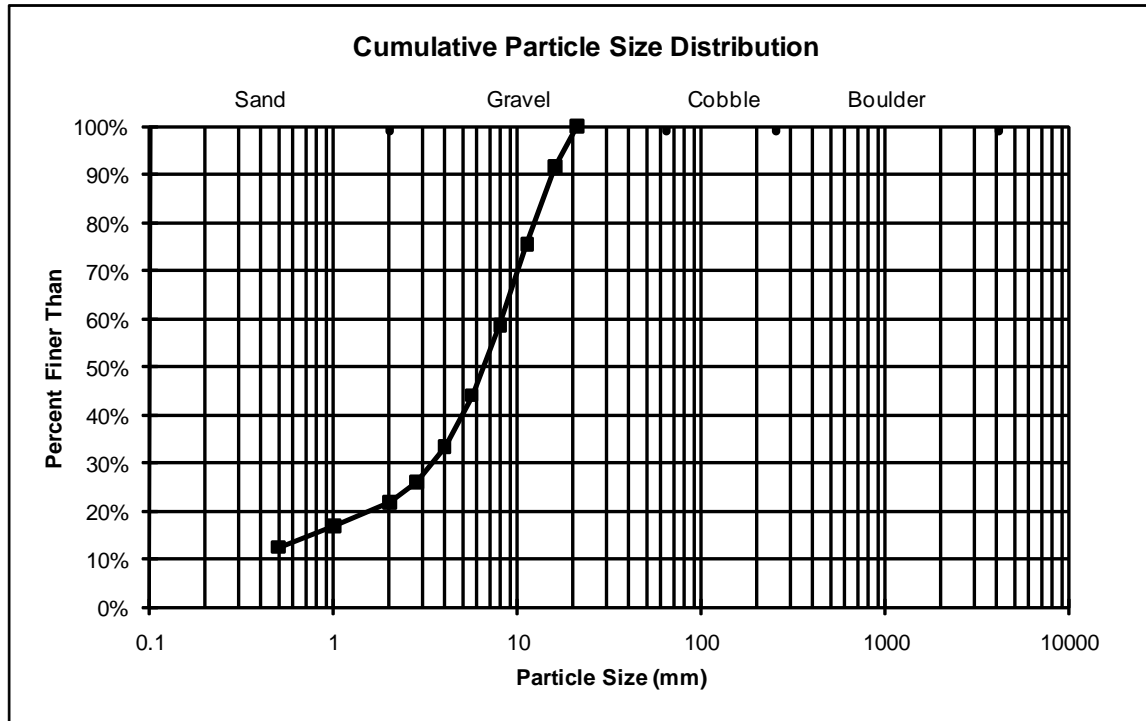
\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:**

Bar Sample taken 10' downstream from Cross Section D

**SITE NAME:** Pike's Peak Highway - Ski Creek Reach 1  
**ID NUMBER:** SKIC1  
**DATE:** 7/21/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.756	4.204	6.479	13.545	17.878	21.0



**Sieve Analysis Worksheet**

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	205.50	15.9%	
0.5	101.70	7.9%	15.9%
1.0	111.80	8.7%	23.8%
2.0	69.70	5.4%	32.5%
2.8	86.10	6.7%	37.9%
4.0	109.90	8.5%	44.6%
5.6	151.70	11.8%	53.1%
8.0	211.30	16.4%	64.8%
11.2	140.80	10.9%	81.2%
16.0	101.40	7.9%	92.1%
19.0	*		100.0%
32.0			-
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	1289.90		

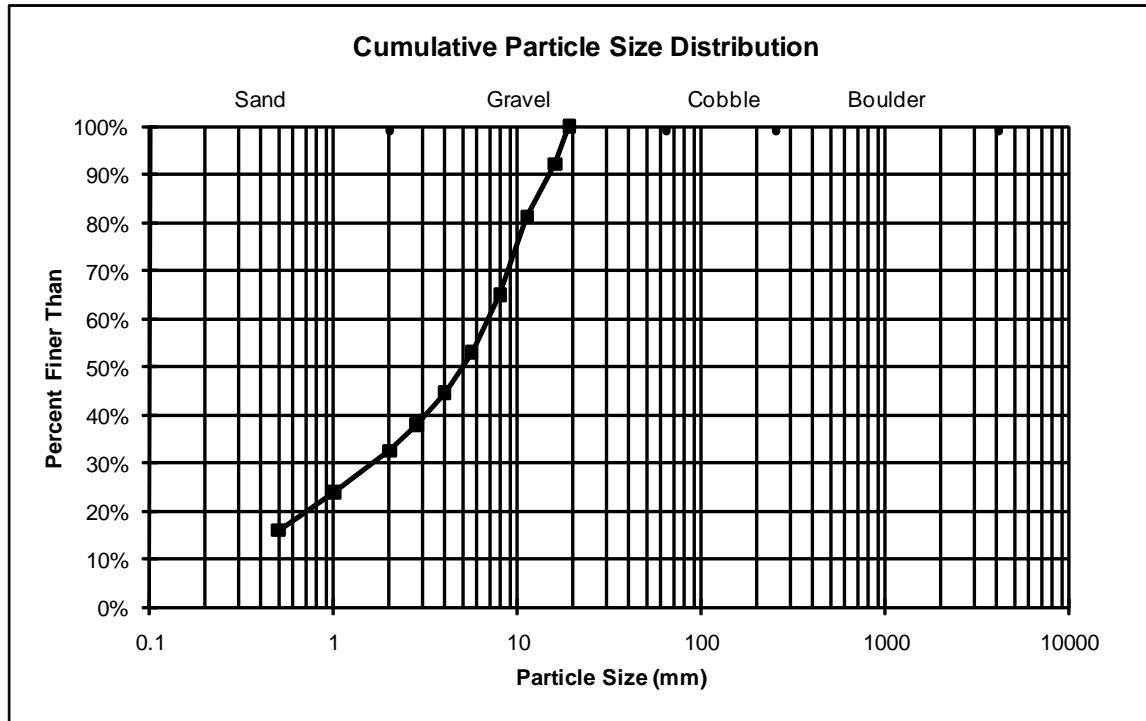
\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:**

Bar Sample taken 6' upstream from Cross Section A left bank

**SITE NAME:** Pike's Peak Highway - Ski Creek Reach 2  
**ID NUMBER:** SKIC2  
**DATE:** 7/12/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.376	2.339	4.958	12.264	17.033	19.0



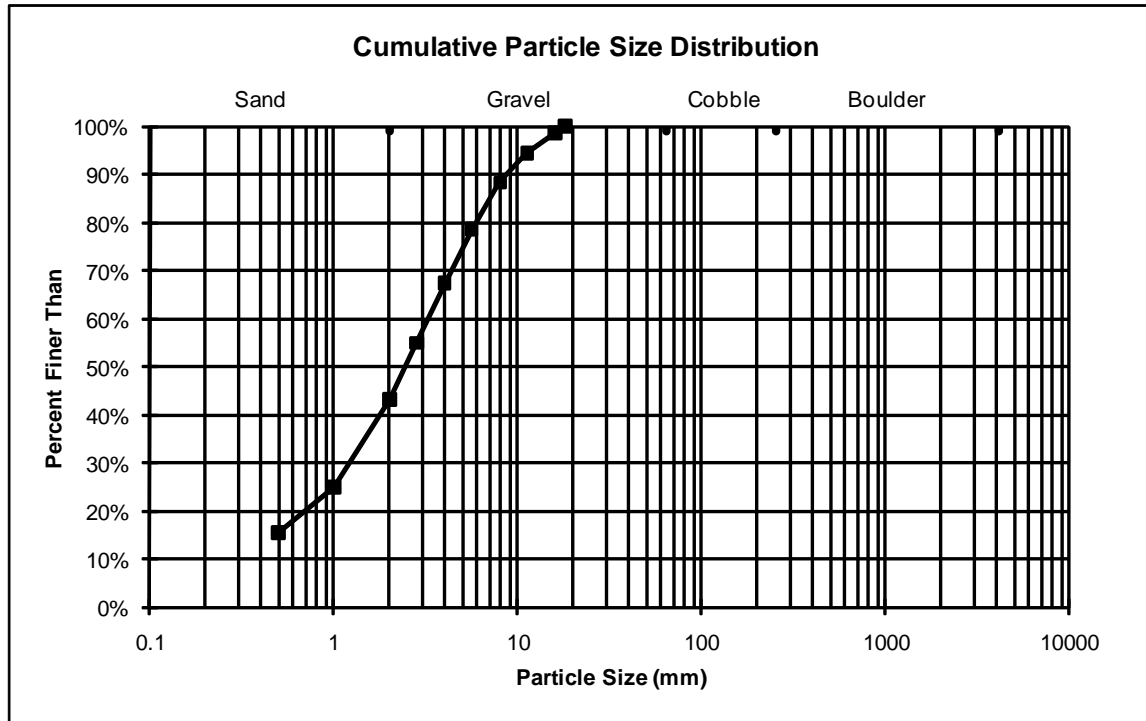
**Sieve Analysis Worksheet**

**COMMENTS:** Bar Sample taken at Cross Section A

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	109.10	15.5%	
0.5	66.50	9.5%	15.5%
1.0	127.40	18.2%	25.0%
2.0	82.60	11.8%	43.2%
2.8	86.40	12.3%	54.9%
4.0	80.20	11.4%	67.3%
5.6	67.20	9.6%	78.7%
8.0	43.20	6.2%	88.3%
11.2	29.80	4.2%	94.4%
16.0	9.40	1.3%	98.7%
18.0	*		100.0%
32.0			-
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	701.80		

**SITE NAME:** Pike's Peak Highway - Severy Creek Reach 1  
**ID NUMBER:** SVRY1  
**DATE:** 7/23/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	0.422	1.464	2.431	6.826	11.765	18.0



\*Measured value of the largest particle in the sample and not a sieve weight



**Sieve Analysis Worksheet**

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	71.30	7.3%	
0.5	46.80	4.8%	7.3%
1.0	56.40	5.8%	12.1%
2.0	30.10	3.1%	18.0%
2.8	38.10	3.9%	21.0%
4.0	41.10	4.2%	25.0%
5.6	44.30	4.6%	29.2%
8.0	64.20	6.6%	33.8%
11.2	76.60	7.9%	40.4%
16.0	81.80	8.4%	48.2%
22.4	57.40	5.9%	56.7%
32.0	200.90	20.7%	62.6%
45.0	163.10	16.8%	83.2%
50.0	*		100.0%
90			-
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	972.10		

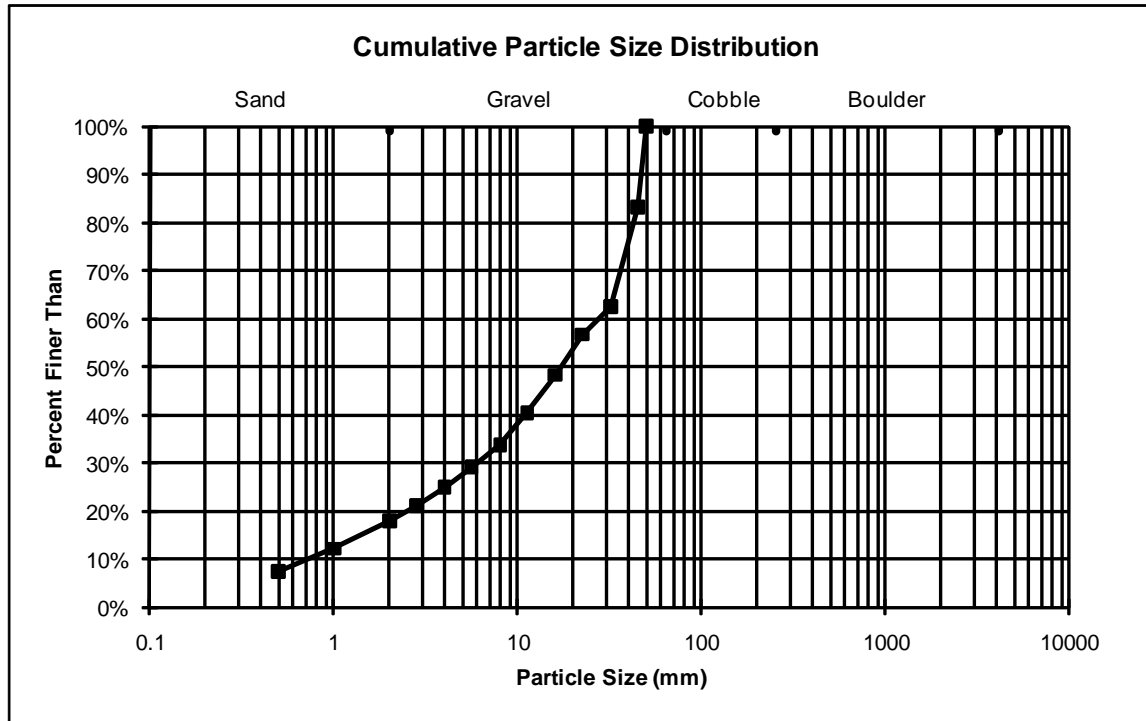
\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:**

Bar Sample taken downstream from Cross Section E

**SITE NAME:** Pike's Peak Highway - Severy Creek Reach 2  
**ID NUMBER:** SVRY2  
**DATE:** 7/23/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	1.406	8.525	17.169	45.220	48.454	50.0



**Sieve Analysis Worksheet**

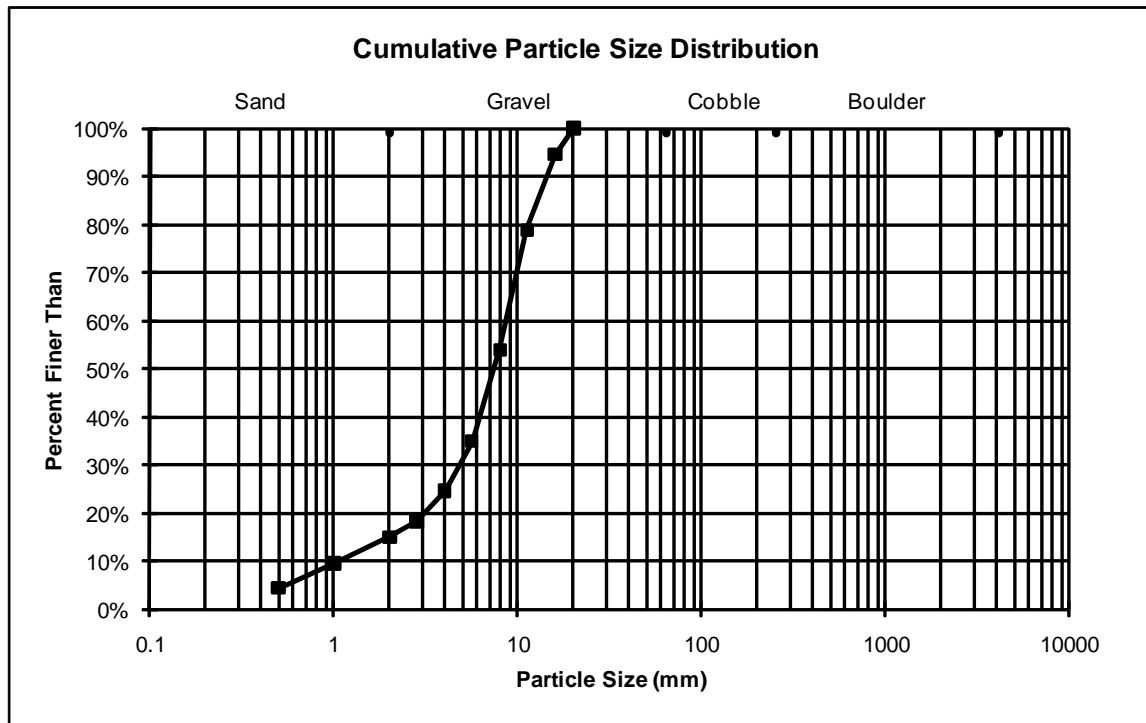
Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	42.80	4.3%	
0.5	49.90	5.1%	4.3%
1.0	54.30	5.5%	9.4%
2.0	32.60	3.3%	14.9%
2.8	61.70	6.3%	18.2%
4.0	102.30	10.4%	24.5%
5.6	187.00	19.0%	34.9%
8.0	245.40	24.9%	53.9%
11.2	154.80	15.7%	78.8%
16.0	53.60	5.4%	94.6%
20.0	*		100.0%
32.0			-
45.0			
64.0			
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	984.40		

\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:** Bar Sample taken between Cross Section D and E

**SITE NAME:** Pike's Peak Highway - West Fork Creek Reach 1  
**ID NUMBER:** WBVR1  
**DATE:** 9/4/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	2.014	5.610	7.435	12.594	16.294	20.0



**Sieve Analysis Worksheet**

Size Finer Than (mm)	Wt. on Sieve	% of Total	% Finer Than
Pan	39.40	4.6%	
0.5	34.90	4.1%	4.6%
1.0	91.00	10.6%	8.7%
2.0	83.80	9.8%	19.3%
2.8	113.10	13.2%	29.1%
4.0	127.40	14.9%	42.4%
5.6	151.50	17.7%	57.3%
8.0	108.60	12.7%	75.0%
11.2	21.40	2.5%	87.7%
16.0	0.00	0.0%	90.2%
22.4	0.00	0.0%	90.2%
32.0	83.50	9.8%	90.2%
44.0	*		100.0%
64.0			-
90			
128			
181			
256			
362			
512			
1024			
2048			
4096			
Total	854.60		

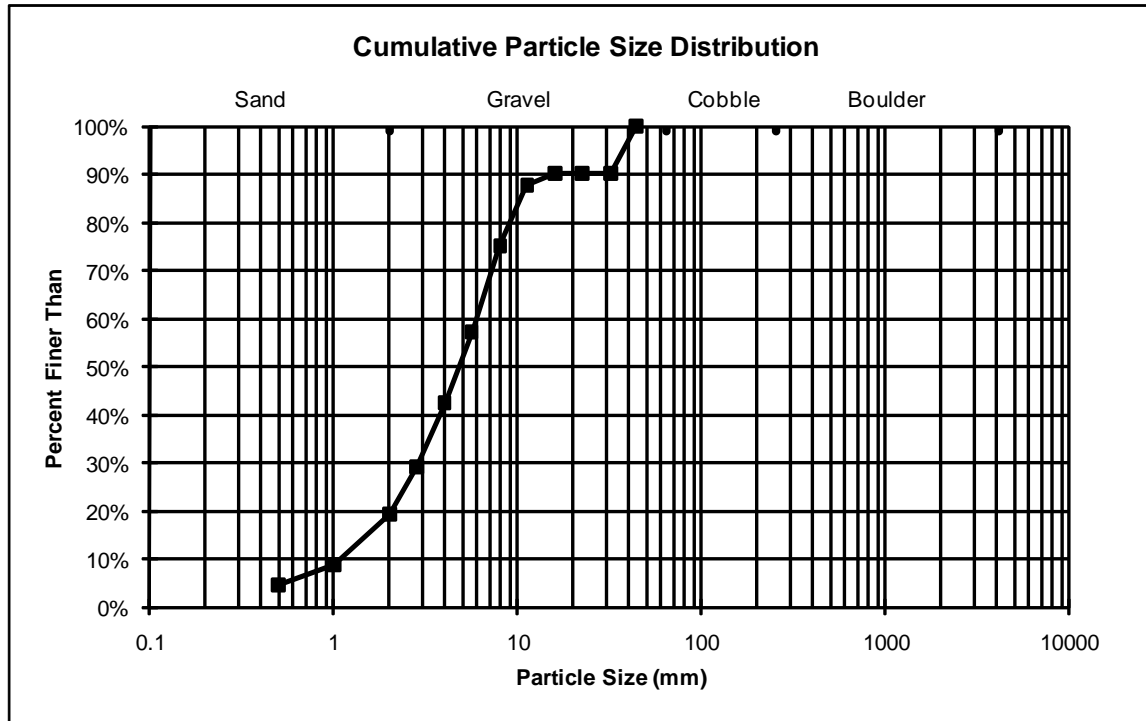
\*Measured value of the largest particle in the sample and not a sieve weight

**COMMENTS:**

Bar Sample taken between Cross Section B and C left bank

**SITE NAME:** Pike's Peak Highway - West Fork Beaver Creek Reach 2  
**ID NUMBER:** WBVR2  
**DATE:** 9/4/2010  
**CREW:** Derengowski, VonLoh

Particle Size Distribution (mm)	D15	D35	D50	D84	D95	Lpart
	1.508	3.278	4.750	10.148	37.383	44.0





# Appendix P

## Riparian Vegetation Summary

2010

### Riparian Vegetation Summary Pikes Peak, 2009

Site ID	Date	Camera	Cross Section and Pin to Pin Distance in Feet	Bar Sample	Bank	Bank Distance from LPIN (ft)	Camera Distance from LPIN (ft)	Percent Cover	Comments
BHMR1	9/25/2010	Olympus Stylus 400	A (24.36)	Downstream from XSE	Left	11.2	14.0	50	moss, sedge, forb
BHMR1		Olympus Stylus 400	A		Right	13.4	10.5	60	grass, sedge, forb
BHMR1		Olympus Stylus 400	B (31.95)		Left	6.5	10.8	40	grass, sedge, forb
BHMR1		Olympus Stylus 400	B		Right	9.9	5.8	70	grass, sedge, forb
BHMR1		Olympus Stylus 400	C (16.81)		Left	8.2	13.0	40	sedge, forb
BHMR1		Olympus Stylus 400	C		Right	11.8	7.5	40	sedge, forb, shrub
BHMR1		Olympus Stylus 400	D (20.28)		Left	7.4	11.0	35	moss, grass, sedge, forb
BHMR1		Olympus Stylus 400	D		Right	11.2	7.0	60	grass, sedge, forb
BHMR1		Olympus Stylus 400	E (34.42)		Left	21.8	27.0	50	grass, sedge, forb
BHMR1		Olympus Stylus 400	E		Right	27.6	22.5	35	sedge
BHMR2	9/25/2010	Olympus Stylus 400	A (25.43)	18' upstream from XSB	Left	6.0	11.0	20	grass, forb
BHMR2		Olympus Stylus 400	A		Right	10.0	6.0	50	grass, sedge, forb
BHMR2		Olympus Stylus 400	B (17.59)		Left	6.9	10.0	20	grass, sedge, forb
BHMR2		Olympus Stylus 400	B		Right	10.0	6.0	20	grass, sedge, forb
BHMR2		Olympus Stylus 400	C (18.46)		Left	6.0	10.0	50	grass, sedge, forb
BHMR2		Olympus Stylus 400	C		Right	9.4	6.0	20	grass, sedge, forb
BHMR2		Olympus Stylus 400	D (30.44)		Left	15.5	19.0	20	grass, sedge, forb
BHMR2		Olympus Stylus 400	D		Right	18.6	15.0	20	grass, sedge
BHMR2		Olympus Stylus 400	E (43.02)		Left	11.0	16.0	35	grass, sedge
BHMR2		Olympus Stylus 400	E		Right	14.7	11.5	60	grass, sedge
EBVR1	9/26/2010	Olympus Stylus 400	A (20.70)	2' downstream from XSB right bank	Left	1.3	5.0	5	shrub

Site ID	Date	Camera	Cross Section and Pin to Pin Distance in Feet	Bar Sample	Bank	Bank Distance from LPIN (ft)	Camera Distance from LPIN (ft)	Percent Cover	Comments
EBVR1		Olympus Stylus 400	A		Right	17.1	13.6	20	moss, grass, sedge, forb
EBVR1		Olympus Stylus 400	B (24.53)		Left	3.0	5.0	40	moss, sedge, shrub
EBVR1		Olympus Stylus 400	B		Right	13.5	9.0	30	sedge, forb, shrub
EBVR1		Olympus Stylus 400	C (29.05)		Left	6.8	11.0	30	sedge, forb, shrub
EBVR1		Olympus Stylus 400	C		Right	17.0	12.0	15	moss, forb, shrub
EBVR1		Olympus Stylus 400	D (12.77)		Left	1.9	6.5	20	sedge, forb, shrub
EBVR1		Olympus Stylus 400	D		Right	10.1	5.0	5	forb
EBVR1		Olympus Stylus 400	E (18.48)		Left	8.3	11.0	20	sedge, forb, shrub
EBVR1		Olympus Stylus 400	E		Right	14.2	10.0	65	moss, shrub
EBVR2	9/26/2010	Olympus Stylus 400	A (37.63)	6' upstream from XSE	Left	14.3	19.0	30	grass, sedge, forb
EBVR2		Olympus Stylus 400	A		Right	20.0	16.0	20	sedge
EBVR2		Olympus Stylus 400	B (21.24)		Left	9.2	15.0	10	grass, sedge
EBVR2		Olympus Stylus 400	B		Right	14.3	11.0	20	grass, sedge
EBVR2		Olympus Stylus 400	C (20.46)		Left	9.2	13.0	30	moss, grass, sedge, forb
EBVR2		Olympus Stylus 400	C		Right	13.4	11.0	10	grass, sedge, forb
EBVR2		Olympus Stylus 400	D (17.45)		Left	7.7	12.5	10	grass, sedge
EBVR2		Olympus Stylus 400	D		Right	13.2	10.0	20	grass, sedge, forb
EBVR2		Olympus Stylus 400	E (19.66)		Left	9.8	14.0	25	grass, sedge, forb
EBVR2		Olympus Stylus 400	E		Right	14.6	11.0	20	sedge, forb
GLEN1	7/20/2010	Olympus Stylus 400	A (20.03)	At XSE right bank	Left	9.0	12.0	10	grass, forb
GLEN1		Olympus Stylus 400	A		Right	13.0	8.5	70	moss, grass, forb, shrub
GLEN1		Olympus Stylus 400	B(16.57)		Left	6.3	9.5	5	grass
GLEN1		Olympus Stylus 400	B		Right	9.0	5.7	45	grass, sedge, forb, shrub
GLEN1		Olympus Stylus 400	C (17.31)		Left	5.9	9.9	15	sedge, shrub
GLEN1		Olympus Stylus 400	C		Right	9.6	6.0	15	sedge, forb

Site ID	Date	Camera	Cross Section and Pin to Pin Distance in Feet	Bar Sample	Bank	Bank Distance from LPIN (ft)	Camera Distance from LPIN (ft)	Percent Cover	Comments
GLEN1		Olympus Stylus 400	D (49.99)		Left	16.8	21.0	0	gravel
GLEN1		Olympus Stylus 400	D		Right	29.0	27.2	5	shrub
GLEN1		Olympus Stylus 400	E (24.29)		Left	8.0	15.5	10	sedge, forb
GLEN1		Olympus Stylus 400	E		Right	19.7	16.0	10	sedge, forb
NCAT1	7/13/2010	Olympus Stylus 400	A (57.53)	XSB <-> XSC right bank	Left	12.0	17.0	15	grass, sedge, forb, shrub
NCAT1		Olympus Stylus 400	A		Right	16.5	12.0	40	sedge, forb
NCAT1		Olympus Stylus 400	B (58.83)		Left	46.0	50.0	35	sedge
NCAT1		Olympus Stylus 400	B		Right	50.5	47.0	25	sedge
NCAT1		Olympus Stylus 400	C (38.85)		Left	16.7	21.5	10	sedge, shrub
NCAT1		Olympus Stylus 400	C		Right	30.3	26.0	10	sedge, forb
NCAT1		Olympus Stylus 400	D (44.77)		Left	26.0	30.0	30	sedge, shrub
NCAT1		Olympus Stylus 400	D		Right	32.5	29.3	35	sedge
NCAT1		Olympus Stylus 400	E (60.78)		Left	42.8	47.0	20	sedge, shrub
NCAT1		Olympus Stylus 400	E		Right	45.5	41.0	15	sedge
NCAT2	7/13/2010	Olympus Stylus 400	A (29.17)	3' downstream from XSB	Left	12.0	16.5	10	grass, sedge, forb
NCAT2		Olympus Stylus 400	A		Right	16.2	12.0	15	grass, sedge, forb, shrub
NCAT2		Olympus Stylus 400	B (40.59)		Left	8.8	13.0	10	grass, sedge, forb
NCAT2		Olympus Stylus 400	B		Right	11.8	8.0	20	grass, sedge, forb, shrub
NCAT2		Olympus Stylus 400	C (42.34)		Left	12.4	17.0	10	grass, sedge, forb
NCAT2		Olympus Stylus 400	C		Right	17.2	11.5	15	grass, sedge, forb
NCAT2		Olympus Stylus 400	D (29.78)		Left	6.0	10.5	20	sedge, forb, shrub
NCAT2		Olympus Stylus 400	D		Right	9.7	5.0	15	grass, sedge, forb
NCAT2		Olympus Stylus 400	E (34.25)		Left	10.0	15.0	15	sedge, shrub
NCAT2		Olympus Stylus 400	E		Right	13.1	2.5	15	grass, sedge
NCRY1	7/12/2010	Olympus Stylus 400	A (54.53)	At XSA left bank	Left	35.5	39.0	5	grass, sedge, forb



Site ID	Date	Camera	Cross Section and Pin to Pin Distance in Feet	Bar Sample	Bank	Bank Distance from LPIN (ft)	Camera Distance from LPIN (ft)	Percent Cover	Comments
NCRY1		Olympus Stylus 400	A		Right	38.8	36.0	5	sedge
NCRY1		Olympus Stylus 400	A		Right	38.8	36.0	5	sedge, forb
NCRY1		Olympus Stylus 400	B (51.31)		Left	39.2	42.0	5	moss, sedge, forb tree
NCRY1		Olympus Stylus 400	B		Right	41.5	38.0	5	grass, sedge, forb
NCRY1		Olympus Stylus 400	C (43.61)		Left	26.7	29.0	15	moss, grass, tree
NCRY1		Olympus Stylus 400	C		Right	28.7	25.0	5	moss, sedge, forb
NCRY1		Olympus Stylus 400	D (41.53)		Left	30.0	32.8	5	grass, sedge
NCRY1		Olympus Stylus 400	D		Right	31.5	29.5	5	grass, sedge
NCRY1		Olympus Stylus 400	E (37.98)		Left	30.0	33.7	5	sedge
NCRY2	7/12/2010	Olympus Stylus 400	A (24.23)	Upstream from XSE	Left	10.5	15.5	5	grass, shrub
NCRY2		Olympus Stylus 400	A		Right	20.6	15.0	5	moss, grass, forb, tree
NCRY2		Olympus Stylus 400	B (35.00)		Left	21.4	25.0	15	moss, grass, shrub
NCRY2		Olympus Stylus 400	B		Right	30.5	26.0	5	grass, forb
NCRY2		Olympus Stylus 400	C (33.82)		Left	19.3	24.0	25	moss, grass, shrub
NCRY2		Olympus Stylus 400	C		Right	27.4	23.0	10	moss, grass, forb
NCRY2		Olympus Stylus 400	D (28.71)		Left	14.5	18.3	15	moss, forb, tree
NCRY2		Olympus Stylus 400	D		Right	22.9	19.3	5	moss, forb
NCRY2		Olympus Stylus 400	E (34.35)		Left	5.3	7.1	5	grass, shrub
NCRY2		Olympus Stylus 400	E		Right	18.4	15.6	75	moss
OILC1	8/5/2010	Olympus Stylus 400	A (43.95)	4' downstream from XSA right bank	Left	5.4	11.0	35	sedge, forb, shrub
OILC1		Olympus Stylus 400	A		Right	12.4	8.0	30	sedge, shrub
OILC1		Olympus Stylus 400	B (41.34)		Left	5.9	12.0	25	sedge, shrub
OILC1		Olympus Stylus 400	B		Right	16.6	6.0	20	sedge, shrub
OILC1		Olympus Stylus 400	C (32.67)		Left	15.7	19.5	20	sedge

Site ID	Date	Camera	Cross Section and Pin to Pin Distance in Feet	Bar Sample	Bank	Bank Distance from LPIN (ft)	Camera Distance from LPIN (ft)	Percent Cover	Comments
OILC1		Olympus Stylus 400	C		Right	22.2	20.7	65	grass, sedge, shrub
OILC1		Olympus Stylus 400	D (33.98)		Left	11.0	12.6	40	grass, sedge, forb, shrub
OILC1		Olympus Stylus 400	D		Right	22.5	21.0	30	grass, sedge, forb, shrub
OILC1		Olympus Stylus 400	E (38.35)		Left	7.0	8.9	15	grass, sedge, forb
OILC1		Olympus Stylus 400	E		Right	18.5	16.7	25	grass, sedge, shrub
SVRY1	7/23/2010	Olympus Stylus 400	A (13.70)	At XSA	Left	2.0	7.0	25	sedge, forb
SVRY1		Olympus Stylus 400	A		Right	7.8	4.0	30	sedge, shrub
SVRY1		Olympus Stylus 400	B (11.83)		Left	5.0	8.0	25	moss, sedge, shrub
SVRY1		Olympus Stylus 400	B		Right	8.9	7.0	20	moss, sedge, shrub
SVRY1		Olympus Stylus 400	C (14.82)		Left	4.9	8.0	15	sedge, forb, shrub
SVRY1		Olympus Stylus 400	C		Right	7.8	5.0	15	sedge, forb, shrub
SVRY1		Olympus Stylus 400	D (12.09)		Left	4.6	8.0	30	sedge, forb, shrub
SVRY1		Olympus Stylus 400	D		Right	8.6	4.0	80	moss, sedge, forb
SVRY1		Olympus Stylus 400	E (9.57)		Left	2.7	7.0	25	sedge, forb, shrub
SVRY1		Olympus Stylus 400	E		Right	6.6	4.0	30	moss, sedge, forb, shrub
SVRY2	7/23/2010	Olympus Stylus 400	A (95.72)	Downstream from XSE	Left	20.2	28.0	0	gravel
SVRY2		Olympus Stylus 400	A		Right	37.0	32.0	0	gravel
SVRY2		Olympus Stylus 400	B (116.96)		Left	32.0	35.0	0	gravel
SVRY2		Olympus Stylus 400	B		Right	47.2	41.0	0	gravel
SVRY2		Olympus Stylus 400	C (158.61)		Left	59.2	65.0	0	gravel
SVRY2		Olympus Stylus 400	C		Right	78.3	73.0	0	gravel
SVRY2		Olympus Stylus 400	D (156.58)		Left	74.8	79.0	0	gravel
SVRY2		Olympus Stylus 400	D		Right	90.1	87.0	0	gravel
SVRY2		Olympus Stylus 400	E (211.52)		Left	66.0	72.0	0	gravel
SVRY2		Olympus Stylus 400	E		Right	78.2	71.0	0	gravel

Site ID	Date	Camera	Cross Section and Pin to Pin Distance in Feet	Bar Sample	Bank	Bank Distance from LPIN (ft)	Camera Distance from LPIN (ft)	Percent Cover	Comments
SKIC1	7/21/2010	Olympus Stylus 400	A (15.04)	10' downstream from XSD	Left	6.2	8.0	15	moss, grass, forb
SKIC1		Olympus Stylus 400	A		Right	11.1	8.5	15	moss, grass, forb
SKIC1		Olympus Stylus 400	B (14.15)		Left	4.9	7.0	5	moss, forb, tree
SKIC1		Olympus Stylus 400	B		Right	10.5	7.5	5	forb, tree
SKIC1		Olympus Stylus 400	C (16.60)		Left	4.1	7.0	15	grass, sedge, forb
SKIC1		Olympus Stylus 400	C		Right	12.1	9.0	5	grass, forb
SKIC1		Olympus Stylus 400	D (33.57)		Left	16.0	19.5	15	moss, grass, sedge, forb
SKIC1		Olympus Stylus 400	D		Right	23.2	19.5	5	sedge, forb, rock
SKIC1		Olympus Stylus 400	E (21.78)		Left	14.5	17.5	30	moss, grass, sedge, forb
SKIC1		Olympus Stylus 400	E		Right	19.2	15.0	25	moss, grass, forb
SKIC2	7/12/2010	Olympus Stylus 400	A (50.70)	6' upstream from XSA left bank	Left	32.8	36.0	15	sedge, forb
SKIC2		Olympus Stylus 400	A		Right	40.7	35.0	20	moss, sedge, forb, tree
SKIC2		Olympus Stylus 400	B (46.73)		Left	29.4	35.5	0	silt, gravel
SKIC2		Olympus Stylus 400	B		Right	35.1	32.5	5	moss, forb, shrub
SKIC2		Olympus Stylus 400	C (29.76)		Left	2.6	6.0	40	moss, sedge, forb, shrub
SKIC2		Olympus Stylus 400	C		Right	10.6	7.0	5	moss, forb
SKIC2		Olympus Stylus 400	D (28.31)		Left	4.3	11.0	10	moss, forb
SKIC2		Olympus Stylus 400	D		Right	12.5	8.0	5	moss
SKIC2		Olympus Stylus 400	E (41.90)		Left	24.9	31.0	15	moss, forb, tree
SKIC2		Olympus Stylus 400	E		Right	31.1	26.0	0	
SCAT1	7/29/2010	Olympus Stylus 400	A (22.96)	3' upstream from XSB	Left	6.4	11.5	10	grass, sedge, forb
SCAT1		Olympus Stylus 400	A		Right	11.7	8.9	80	moss, grass, sedge, forb
SCAT1		Olympus Stylus 400	B (20.83)		Left	10.5	14.0	25	moss, grass, sedge, forb
SCAT1		Olympus Stylus 400	B		Right	18.3	14.0	10	moss, grass, sedge, forb

Site ID	Date	Camera	Cross Section and Pin to Pin Distance in Feet	Bar Sample	Bank	Bank Distance from LPIN (ft)	Camera Distance from LPIN (ft)	Percent Cover	Comments
SCAT1		Olympus Stylus 400	C (21.86)		Left	4.8	10.0	5	grass, forb
SCAT1		Olympus Stylus 400	C		Right	13.7	9.6	5	grass, sedge, forb
SCAT1		Olympus Stylus 400	D (18.12)		Left	5.5	12.0	10	moss, grass, sedge, forb
SCAT1		Olympus Stylus 400	D		Right	11.7	6.0	25	moss, grass, sedge, forb
SCAT1		Olympus Stylus 400	E (24.02)		Left	8.8	16.0	30	moss, grass, sedge, forb
SCAT1		Olympus Stylus 400	E		Right	15.5	10.0	30	moss, grass, sedge, forb
SCAT2	7/21/2010	Olympus Stylus 400	A (28.57)	10' upstream from XSE left bank	Left	3.9	9.0	15	moss, grass
SCAT2		Olympus Stylus 400	A		Right	15.0	9.5	15	moss, forb, tree
SCAT2		Olympus Stylus 400	B (17.05)		Left	3.0	7.0	5	grass, forb
SCAT2		Olympus Stylus 400	B		Right	11.3	7.0	20	moss, grass, forb
SCAT2		Olympus Stylus 400	C (19.81)		Left	2.2	6.0	25	moss, grass, forb
SCAT2		Olympus Stylus 400	C		Right	13.2	9.0	5	moss, forb
SCAT2		Olympus Stylus 400	D (38.50)		Left	7.6	11.0	20	moss, grass, forb
SCAT2		Olympus Stylus 400	D		Right	15.4	12.7	35	moss, grass, forb
SCAT2		Olympus Stylus 400	E (18.95)		Left	3.8	7.0	30	moss, grass, forb
SCAT2		Olympus Stylus 400	E		Right	11.2	8.0	50	moss, grass, forb
SCAT3	7/20/2010	Olympus Stylus 400	A (44.32)	10' downstream from XSD right bank	Left	26.0	29.4	10	sedge
SCAT3		Olympus Stylus 400	A		Right	29.2	25.2	20	grass, sedge, forb
SCAT3		Olympus Stylus 400	B (32.19)		Left	12.1	16.0	5	sedge
SCAT3		Olympus Stylus 400	B		Right	15.5	12.7	25	sedge
SCAT3		Olympus Stylus 400	C (15.79)		Left	3.0	6.8	25	sedge, forb
SCAT3		Olympus Stylus 400	C		Right	6.8	3.1	10	sedge, forb
SCAT3		Olympus Stylus 400	D (19.60)		Left	8.0	11.6	20	sedge
SCAT3		Olympus Stylus 400	D		Right	10.8	8.1	25	sedge

Site ID	Date	Camera	Cross Section and Pin to Pin Distance in Feet	Bar Sample	Bank	Bank Distance from LPIN (ft)	Camera Distance from LPIN (ft)	Percent Cover	Comments
SCAT3		Olympus Stylus 400	E (18.48)		Left	5.1	8.2	25	sedge, forb, shrub
SCAT3		Olympus Stylus 400	E		Right	6.5	3.8	15	sedge, shrub
WBVR1	9/4/2010	Olympus Stylus 400	A (36.64)	XSD <> XSE	Left	15.9	21.0	15	sedge, forb
WBVR1		Olympus Stylus 400	A		Right	31.0	27.0	10	grass, forb
WBVR1		Olympus Stylus 400	B (20.98)		Left	4.3	10.0	35	moss, sedge, forb, shrub
WBVR1		Olympus Stylus 400	B		Right	15.5	11.0	30	moss, sedge, shrub
WBVR1		Olympus Stylus 400	C (28.83)		Left	4.0	9.0	75	moss, sedge, forb, shrub
WBVR1		Olympus Stylus 400	C		Right	17.0	11.0	15	sedge, forb, shrub
WBVR1		Olympus Stylus 400	D (34.18)		Left	9.7	14.0	0	
WBVR1		Olympus Stylus 400	D		Right	25.0	20.0	15	sedge, shrub
WBVR1		Olympus Stylus 400	E (29.56)		Left	6.0	12.0	80	moss, grass, shrub
WBVR1		Olympus Stylus 400	E		Right	20.0	16.0	25	sedge, shrub
WBVR2	9/4/2010	Olympus Stylus 400	A (44.40)	XSB <> XSC left bank	Left	7.5	16.0	10	moss, shrub
WBVR2		Olympus Stylus 400	A		Right	25.0	19.0	0	gravel
WBVR2		Olympus Stylus 400	B (90.60)		Left	14.0	21.0	5	grass
WBVR2		Olympus Stylus 400	B		Right	37.0	31.0	0	gravel
WBVR2		Olympus Stylus 400	C (151.93)		Left	100.5	107.0	0	gravel
WBVR2		Olympus Stylus 400	C		Right	126.0	119.0	10	grass, shrub
WBVR2		Olympus Stylus 400	D (149.43)		Left	97.0	108.0	0	gravel
WBVR2		Olympus Stylus 400	D		Right	124.5	120.0	0	gravel
WBVR2		Olympus Stylus 400	E (96.25).		Left	34.0	39.0	5	shrub
WBVR2		Olympus Stylus 400	E		Right	54.5	43.0	25	grass, forb, shrub