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Looking forward, looking back : monitoring the Tassajara Creek Restoration Project

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Looking Forward, Looking Back: Monitoring the Tassajara Creek Restoration Project

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Abstract

Project monitoring has become a subject of increasing importance within the river restoration field. This study was completed as a post-construction evaluation of a restoration project completed in 1999 along a one-mile reach of Tassajara Creek near Dublin, California. Several objectives guided the design and implementation of the project, including that of protecting existing native trees and providing improved water quality. However, the main goal of the project was to stop incision on the channel, which, over the last century, had produced a deeply incised channel. A monitoring plan for this reach of Tassajara Creek, contained in an initial postproject evaluation completed in 2001, was implemented to evaluate the incision occurring on the creek. That same report found evidence that the creek had continued to incise since the project's construction despite the restoration efforts. However, our study found that the project reach shows little or no evidence of incision, except for a few localized areas at the downstream end of the project reach. Although no evidence of incision was found, other evidence of deviations from the original restoration plan objectives were discovered. Our site work found several potential threats to the success of this project, including damage to existing native trees and a debris jam with the potential to degrade water quality in the creek. To account for these findings, and an appended monitoring plan was drafted so that the success of the project in meeting these additional objectives may be evaluated in the future. Because the study period for this project began only two years ago it is difficult to draw conclusions about the success of this project. Therefore, we recommend that project monitoring be continued in accordance with our monitoring plan so that the success of this restoration project can continue to be evaluated.

Introduction

The Tassajara Creek watershed is located just inland of the San Francisco Bay, approximately 25 miles southeast of Oakland, California (Figure 1). The creek itself flows from its headwaters on the south side of Mount Diablo in southern Contra Costa County to its confluence with the Arroyo de Laguna in northern Alameda County. It drains an area of approximately 23.2 square miles above I-580 in Dublin, California (Hudzik and Truitt, 2001) (Figure 2).

In the early 1990s, the City of Dublin initiated a plan to incorporate and develop the area adjacent to Tassajara Creek north of I-580. Under this plan, 645 acres of land surrounding the creek were to be developed for residential and commercial use (Hudzik and Truitt, 2001). To ensure that these new developments were protected from the flood waters of the creek, Brian Kangas Foulk Engineers (BKF) was retained to produce a general drainage and flood control plan for the creek in 1995.

As development plans moved along, there was a desire to do more with Tassajara Creek than to simply control its flood waters. The idea was to restore the portion of the creek within the development area and incorporate it as a linear park that would provide area residents with numerous recreational opportunities. As a result, Sycamore Associates, in cooperation with Balance Hydrologics and dk Associates, developed a restoration plan in 1996 for a 1-mile reach of Tassajara Creek between I-580 and just north of Gleason Avenue (Figure 3). The restoration goals, as outlined by the 1996 plan, included the following:

- Provide a natural open channel capable of providing for storm water conveyance and sediment loads, channel crossing, maintenance access, and the natural scour and meandering of the creek.
- Provide new and maintain existing riparian habitat for wildlife.

- Protect any existing native trees or other native vegetation within the stream corridor.
- Replace exotic vegetation with native vegetation.
- Provide water quality that meets best management practices and other standards.
- Provide safe public access and visibility of the stream corridor.

Concerns regarding the stability of Tassajara Creek were raised within the 1996 plan, and later that year G. Mathias Kondolf and Graham Matthews of the University of California, Berkeley, were retained to assess the stability of the creek within the project reach. Their analysis of historical topographic maps and aerial photographs revealed that the stream had not drastically changed course during the approximately 150 years of record. However, they did find that incision (the pronounced down-cutting of a stream or river channel) was a problem within the creek and a continuing threat to the stability of the creek. The incision most likely began sometime in the 19th century due to intensive livestock grazing on the surrounding lands (Hudzik and Truitt, 2001). The cattle grazing decreased the vegetation cover along the stream banks and reduced the quantity of runoff that infiltrated the soil before reaching the creek. This increased runoff caused greater stream flows, which, in turn, caused higher shear stresses on the stream bed and facilitated the erosion of the channel and its banks. As time went on, this process built upon itself and eventually created a deeply incised channel within the project reach (Lave, 2002).

Evidence of this deeply incised channel was documented in field surveys completed in 1996 and 1997 by Kondolf and Matthews in their investigation into the stability of the creek. Additional evidence of the extensive incision along Tassajara Creek was provided by broken fragments of the concrete that once lined the channel. From the early 1940s to the early 1950s, a United States naval base and hospital occupied most of the land surrounding the creek within the project reach. Sometime during this period, the U.S. Navy lined most of the channel with concrete

(Lave, 2002). Subsequently, the powerful erosive forces in the creek caused the concrete to fail and remnants of the concrete lining were found as much as six feet above the elevation of the current channel bed (Kondolf and Matthews, 1997).

The work of Kondolf and Matthews provided the incentive for the construction of the restoration project. To combat the channel incision and bring stability to Tassajara Creek, design drawings were produced that met the goals and objectives outlined in the 1996 plan and, in 1999, Alameda County implemented the restoration project on the 1-mile stretch of Tassajara Creek.

The restoration project divided the project reach into two smaller reaches. Reach one, located from I-580 upstream to the Dublin Boulevard bridge, was completely reconstructed. A meandering, low-flow channel was set inside a larger trapezoidal channel designed to carry the 100-year flow (Sycamore Associates, et al., 1996). The stretch of Tassajara Creek from the Dublin Boulevard bridge upstream to slightly beyond the Gleason Avenue bridge was designated as reach two. Within this reach, most of the channel was left intact from the level of the thalweg up to the level of the 15-year flood. Above the level of the 15-year flood, however, the channel was pulled back into a broad floodplain terrace capable of carrying the 100-year flood (Sycamore Associates, et al., 1996). To combat incision and prevent it from spreading upstream, five grade control structures were placed across the creek at various points within the project reach. Additionally, the restoration plans identified several old-growth oak trees located on the channel slopes within the project reach and designated them for preservation. In some areas, new low-flow channels were created to bypass and protect the centuries-old oak trees. The channel slopes and floodplain were re-vegetated with native plants and public trails were built along the tops of the outer stream banks (BKF, 1995).

In fall of 2001, Cathy Hudzik and Jocelyn Truitt of the University of California, Berkeley, conducted a post-project appraisal of the Tassajara Creek restoration project and found evidence of continued incision along the project reach. Because the restoration project was meant to stop incision, a monitoring plan was created to evaluate the changes in channel form over time and to ensure that the goals of the restoration project are met (Hudzik and Truitt, 2001). The monitoring plan suggested the implementation of eight cross-section surveys and a long-profile survey within the project reach (Figure 4). The cross-sections were surveyed by Hudzik and Truitt in 2001 and, the following year, Rebecca Lave, also of the University of California, Berkeley, completed the long-profile survey which tied into the Hudzik and Truitt cross-sections. These surveys were compared with design and pre-construction data to estimate the amount of incision that had occurred in the project reach.

Based on the history of the creek and the past studies mentioned above, two primary objectives of our study were delineated. The first objective was to monitor changes in channel morphology since the project's completion in 1999 in accordance with the monitoring plan created by Hudzik and Truitt (2001) (Figure 5). The second objective was to expand and improve the monitoring plan to encompass several additional restoration objectives stated in the 1996 restoration plan and ease the implementation of future project monitoring.

Methods

Monitoring Changes in Channel Morphology

To monitor and document how the channel morphology of Tassajara Creek has changed since 1999, we followed the monitoring plan completed by Hudzik and Truitt (2001) (Figure 5) who established eight transects in the project reach. We completed long-profile and cross-section surveys within the project reach and took photographs that we compared with existing post-restoration photographs.

We re-surveyed four of the eight transects established by Hudzik and Truitt (2001) using an automatic level, a 25-foot rod, and a 300-foot tape for stationing, recording elevations at all slope breaks and at some intermediate points along stretches of constant grade. We established elevations relative to mean sea level (MSL) using transect benchmarks established by Hudzik and Truitt during their 2001 field work. These benchmarks were tied into a benchmark of known elevation located on the southwest corner of the Dublin Boulevard bridge (Hudzik and Truitt, 2001) (Figure 6). The other four Hudzik and Truitt transects were surveyed in March 2003 by Rebecca Lave (R. Lave, University of California, personal communication, 2003). The data from Lave's cross-section surveys were collected and added to our data.

We plotted our cross-sections against the design and 2001 cross-sections contained in the report by Hudzik and Truitt (2001) by aligning the stationing with respect to the transect benchmark on the river left. The design cross-sections were available only in graphical form, so we had to recreate the data by reading the data points off of the graphs. The graphs were marked in ten-foot station intervals and one-foot elevation intervals, so the location of each point required some interpolation. This method likely resulted in an error of +/- 0.1 foot in each direction for each data point.

We also completed a long-profile survey of the creek's thalweg between the Dublin Boulevard bridge and a footbridge/grade control structure located between the Central Parkway bridge and the Gleason Avenue bridge (Figure 4). Using the same surveying equipment utilized for the cross-sectional survey, we recorded elevations at all slope breaks, at some intermediate points along stretches of constant grade, and at the upstream, downstream, and deepest (or shallowest) points of pools (or sediment bars). Elevations relative to MSL were established by tying into the Dublin Boulevard bridge benchmark (Figure 6). The portion of the channel between the

footbridge/grade control structure and the Gleason Avenue bridge was surveyed by Lave in March of 2003 (R. Lave, University of California, personal communication, 2003). These data were collected and added to our long-profile survey data.

Our long-profile survey data were plotted against the 1996, 1997, design, as-built, and 2002 data contained in the report by Lave (2002) using survey notes to align points at permanent landmarks within the project reach. For example, our 2003 data was aligned with the pre-existing data at several points, including the Central Parkway bridge and the footbridge/grade control structure located between Central Parkway and Gleason Avenue.

To supplement the quantitative evidence of changes in channel form since 1999 with some qualitative evidence, we took photographs looking across each cross-section and visually compared them with photographs of the same views taken by Hudzik and Truitt in 2001.

Expansion and Improvement of Existing Monitoring Plan

We expanded and improved the monitoring plan created by Hudzik and Truitt (2001) to ease future project monitoring and to address several additional restoration objectives outlined in the 1996 plan. Several of the transect benchmark descriptions provided by Hudzik and Truitt in their 2001 report were rather vague and somewhat confusing. To eliminate this confusion, we witnessed the benchmarks of the four upstream-most transects to nearby points. The location of each of these transects and a description of each of the benchmarks and their corresponding witness points was included on a sketch of the project site (Figure 7). To further expand the monitoring plan, we photographed any observed deviations from the project objective outlined in the 1996 plan to provide baseline data for future monitoring. These deviations included damage to the old-growth oak trees located throughout the project reach and evidence of degraded water quality. The locations of the photographed deviations were included on the sketch that identified the transect benchmarks (Figure 7). In addition, an appended monitoring plan, based on the one created by Hudzik and Truitt (2001), was created to encompass these additional restoration objectives.

Results and Discussion

The plots of the cross-sections illustrate how the channel geometry of Tassajara Creek has changed since the restoration project was completed in 1999 (Figures 8-15). It should be noted that design cross-sections were only available for the six-downstream most transects. Therefore, the plots for cross-sections AA' and BB' contain no design data. Additionally, there is a significant alignment error in the plot of cross-section HH' (Figures 15). The 2003 cross-section in this plot does not correspond well with the pre-existing cross-sections, as both elevations and stationing are noticeably different. Because this data was collected by Rebecca Lave, it is difficult to speculate on the source of this discrepancy, although it is likely the result of survey error. As for the cross-sections that do align well, comparison of the 2003 cross-sections to the 2001 cross-sections shows that very little has changed at the transects in the past two years (Figures 8-15). The elevation differences seen in the figures are most readily explained by the fact that we were not able to occupy and survey the exact same cross-sections that Hudzik and Truitt did in 2001.

In their 2001 paper, Hudzik and Truitt reported that they had found sufficient evidence of continuing incision in Tassajara Creek within the project reach. However, our results show that little or no incision has occurred since that time. Additionally, we found that incision may not have actually been occurring in 2001, as Hudzik and Truitt had suggested. They pointed to the comparison of their cross-section survey data to the pre-existing data as definite evidence that incision was occurring in the project reach. Indeed, when compared to the pre-existing cross-section, the cross-sections surveyed by Hudzik and Truitt in 2001 reveal some significant

elevation differences that would lead one to believe that incision was taking place. However, the pre-existing cross-section data were not as-built information, as Hudzik and Truitt had suggested, but were, in fact, the design plans (Lave, 2002). Furthermore, these design plans were not tied to specific locations along the channel, but were generalized for sizeable portions of the project reach. It is important to note that construction of these types of projects is rarely performed to the precision called for in the design plans. Thus, it is not uncommon for post-construction were performed to the precision called for by the design plans, the fact that the designs were generalized for sizeable portions of the project reach makes the comparison of the 2001 Hudzik and Truitt cross-sections and the design cross-sections rather difficult. These findings provide a reasonable alternative explanation for the elevation differences found in the work done by Hudzik and Truitt (2001). Therefore, we believe that the elevation differences between the 2001 cross-sections and the design cross-section and not by continuing incision within the project reach, as Hudzik and Truitt had suggested.

In contrast to the cross-section comparisons, the comparison of our long-profile data to the existing long-profile data shows a bed profile that has changed noticeably through the years (Figure 16). Our long-profiles align fairly well with the pre-existing data. However, there are a couple of descrepancies that need to be explained. First, the fact that our long-profile extended slightly farther than the 2002 long-profile in each of the surveyed reaches can be explained by the fact that it we were not able occupy and survey the exact same points that Lave did in 2002. Likely, the 300-foot tape used for stationing was placed in a different location and resulted in the slightly longer long-profiles. Second, the long-profile surveyed by Lave in 2003 does not align with the pre-existing data very well at all. This is probably a result of measurement errors during the surveying of this reach (R. Lave, University of California, personal communication, 2003).

In her 2002 report, Lave found evidence of several localized cases of continuing incision on the long-profile. These areas of incision were located mainly between the Central Parkway bridge and the Dublin Boulevard bridge. Our data shows evidence of the persistence of these areas of incision, but it appears that the incision has remained localized and that it is not traveling upstream nor increasing in magnitude. However, our long-profile data does reveal some significant incision since 2002 upstream of this area, near the vicinity of station 1400. The cause of this incision is likely not the instability of the restoration project, but the presence of a large debris jam in the channel (Figure 21). This debris jam is the most likely cause of the creek between station 1100 and 1400. No other significant incision could be delineated from the long-profile data, but as with the cross-section data, small variations in elevation at certain points can be attributed to minor variations in the locations surveyed.

While the comparison of the survey data contributes significant insight into the changes in channel morphology since 1999, the visual comparison of the historical and current photographs (Figures 17-20) did not reveal any meaningful information regarding how the channel has changed. The successful re-vegetation efforts on the site have blocked what have historically been clear views of the channel and the dense vegetation made it impossible to exactly occupy some of the old photograph locations. Because the photographs taken by Hudzik and Truitt in 2001 were only available to us in photocopied form, they did not scan well and very little could be seen in the photographs after they were scanned. For this reason, these photos were not included in this report.

Although we found no evidence that Tassajara Creek is continuing to incise and that the creek appears to be stable, at least at this point in time, our field work did identify several conditions that threaten the stated goals of the restoration project. We observed portions of the root masses of several of the old-growth oak trees that were exposed (Figure 21). Survival of these oak trees is critical to the success of this project, as the demise of the trees would conflict with the previously stated objective of native plant preservation. In their 1997 site investigation, Kondolf and Matthews stated, "While some trees increase bank stability with their root masses, if trees are undercut and fall into the channel, they may divert flow into banks, leading to increased bank erosion" (Kondolf and Matthews, 1997). As the roots of these trees become increasingly exposed, the trees become prone to falling into the stream during high flow events. Therefore, preservation of these trees is also in the best interest of bank stability.

As discussed above, our field work also identified a debris jam caused by large wood in the vicinity of station 1400 (Figure 16). Large wood was also found in other portions of the channel, although it had not caused a jam such as that seen in this area. In addition to the large wood, the jam contained numerous cans, bottles, household debris, and construction waste (Figures 21 and 22). There is the potential that some of this debris, including debris not visible from the surface, may degrade the water quality within the creek, which would conflict with the previously stated objective of improving water quality in the stream.

Conclusions and Recommendations

The 2001 post-project appraisal of the Tassajara Creek restoration project completed by Hudzik and Truitt found significant incision within the low flow channel. Our results, however, show little evidence to support the conclusion that the creek is continuing to incise and show that the creek may not have actually been incising in 2001. Measurement error and slight variations in the location of surveyed points may have skewed our results, but it is possible that the incision control measures included during the project construction have worked and that Tassajara Creek has adjusted to its new configuration. However, it is also possible that Tassajara Creek has not experienced a rainfall event large enough to produce bed shear forces great enough to create significant incision during the past few years. Therefore, it is difficult to speak about the success of this restoration project in stopping the incision at this point in time. With a wet rainy season and corresponding high flow events, we may once again see significant incision in the project reach. Therefore, it is recommended that monitoring of channel form in the Tassajara Creek restoration project be continued.

The monitoring should not only continue to track changes in channel morphology, as proposed in the original monitoring plan by Hudzik and Truitt (2001), but should also track the additional objectives highlighted in our appended monitoring plan (Figure 23). This is due to the fact that our field work revealed several potential threats to the success of the Tassajara Creek restoration project. The exposed oak tree roots have the potential to undermine the survival of these trees as well as the stability of the channel banks. It is recommended that these trees be monitored in subsequent studies of Tassajara Creek. It may even be appropriate for a professional arborist to assess the current health of these trees and provide measures to save them and maintain channel bank stability. The debris jam consisting of numerous solid waste items has the potential to degrade water quality in the creek. It is recommended that the debris jam should be monitored during future studies of the restoration project. If it persists, it should assessed by an engineer to determine the hydraulic effects of removing debris from the jam. After this assessment has been completed, it is recommended that all material with the potential to degrade water quality be removed.

References

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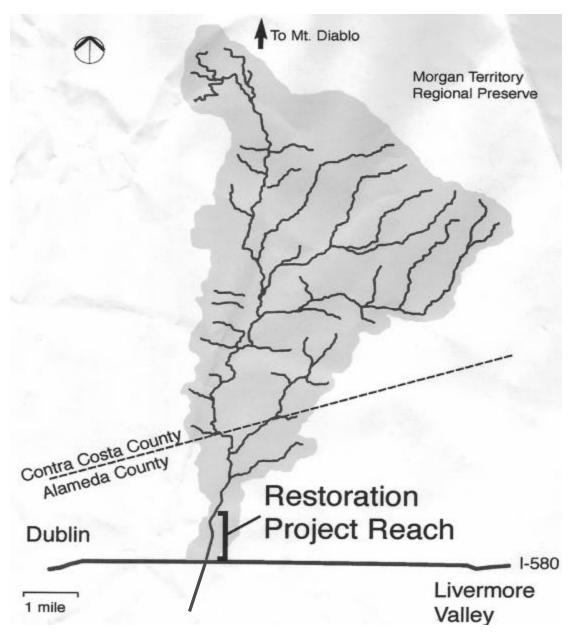
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Figure 22	Photos of Potential Threats and Overview
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Figure 1.

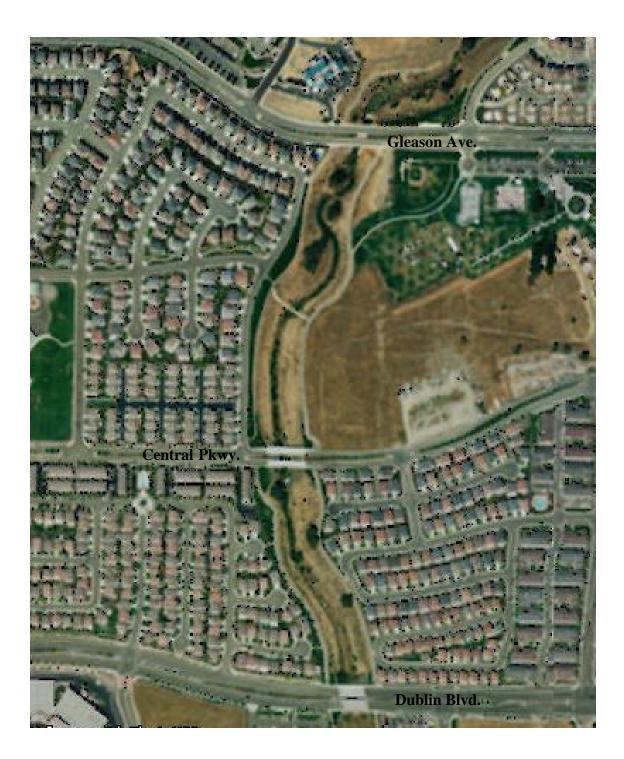


Figure 2.



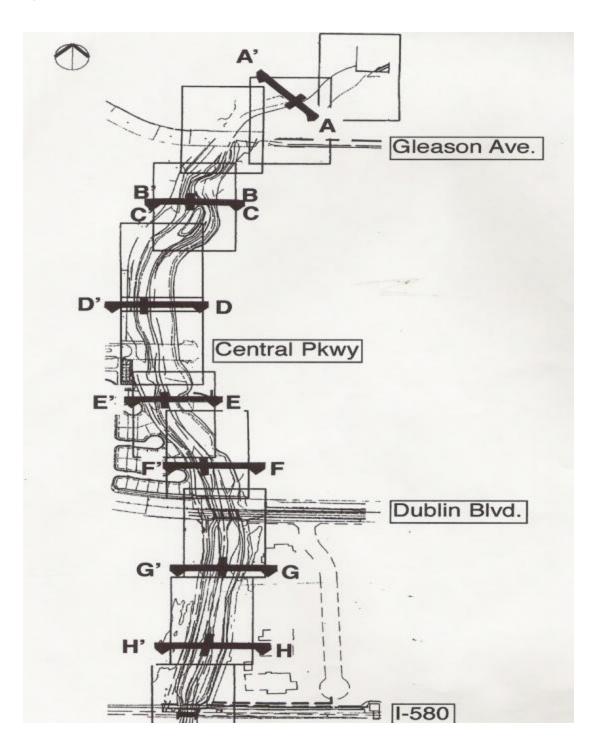
(Hudzik and Truitt, 2001)





(www.GlobeXplorer.com, 2003)

Figure 4.



(Hudzik and Truitt, 2001)

Figure 5.

Recommended Actions: Development of a Monitoring Plan for Channel Morphology in the Tassajara Creek Restoration Project Area.			
Action	Tassajara Creek Monitoring Plan	Completed as part of this paper	
Establish objectives: Set specific goals that will guide the development of a plan	Objective: Evaluate changes in channel form over time.	~	
Establish a database of existing data: Identify data necessary to fulfill objectives	 1996 and 1997 long profile Historical cross sections surveyed in 1995, 1999, and 2000 (not tied to landmarks) Pre-project photos 	~	
Analyze data: Identify and fill gaps in data	Data needed: • Long profile tied in to 2001 cross section locations		
Establish Baseline Data	 Cross sections surveyed in 2001 (tied to replicable landmarks) Photos documenting cross section locations 	~	
Establish Sampling and Data Protocols: Replicability will ensure that data are comparable over time	Quantitative • Survey cross sections in the same pre-established locations • Plot survey data against pre-existing cross sections to identify any changes in channel form	-	
	 <u>Qualitative</u> Take photographs of the channel at each cross section Compare photographs to pre-existing images to identify any noticeable changes in channel form 	~	
Determine frequency of Collection	 Monitoring should be completed at least once per year, as well as after significant floods 	~	
Develop implementation plan	 Identify agency or organization and staff person responsible for overseeing monitoring and providing assistance Create a regular schedule for monitoring Identify people responsible for field monitoring. The surveying methods used for this paper are relatively simple. Monitoring objectives could be met by volunteers with minimal training, provided they have access to equipment. 		

(Hudzik and Truitt, 2001)



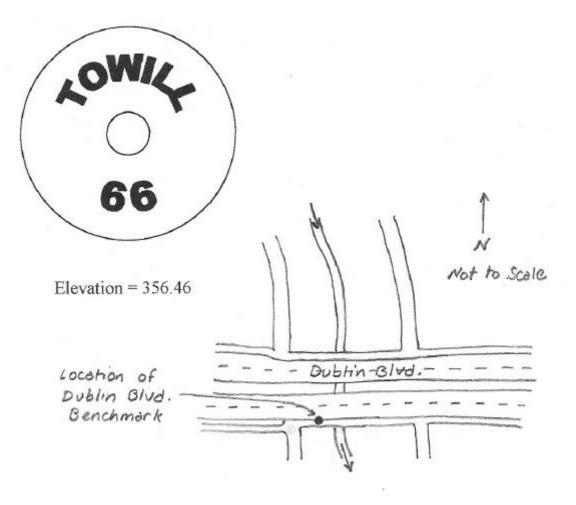


Figure 7.

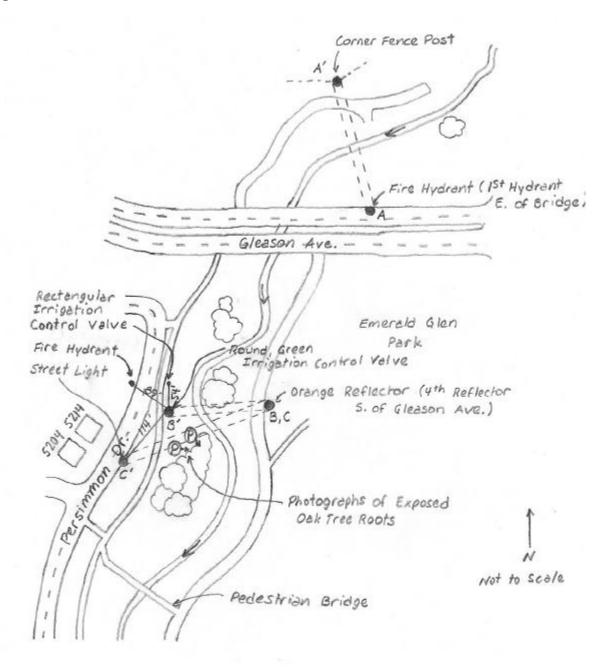
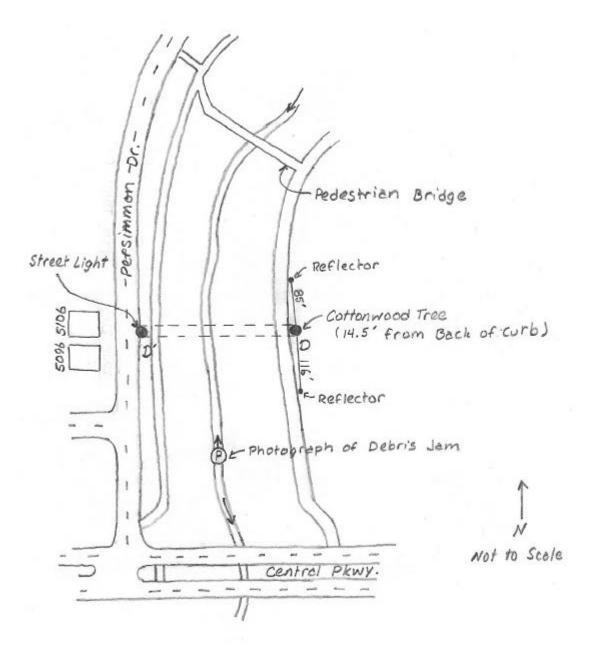
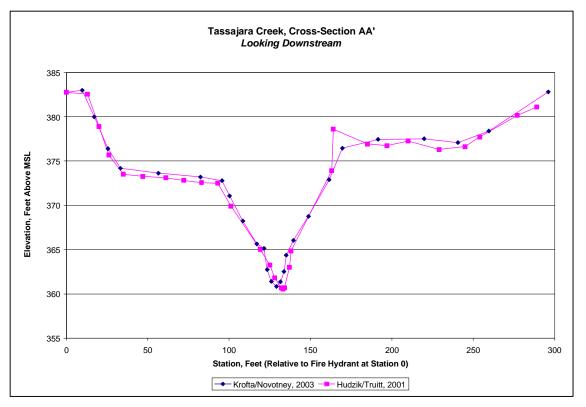


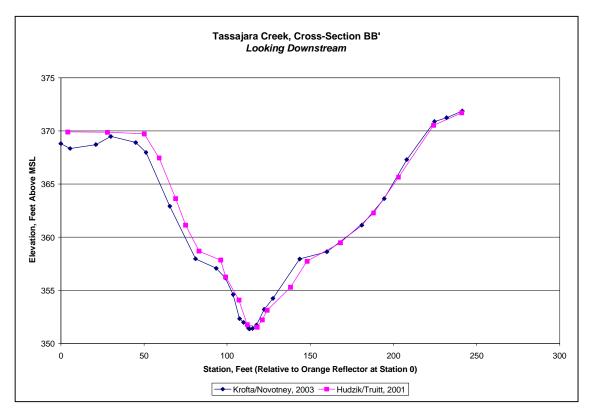
Figure 7 (Continued).



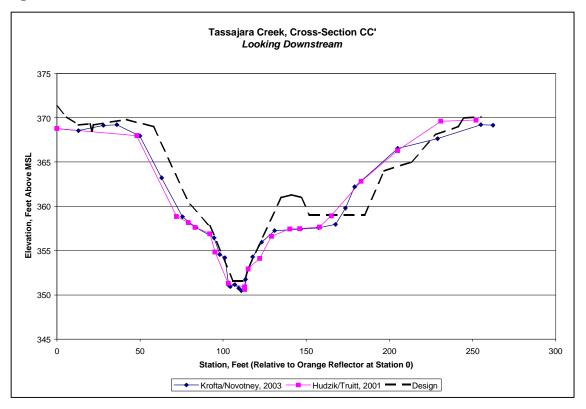




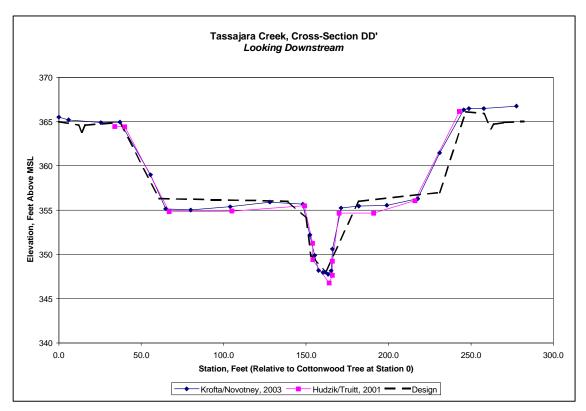




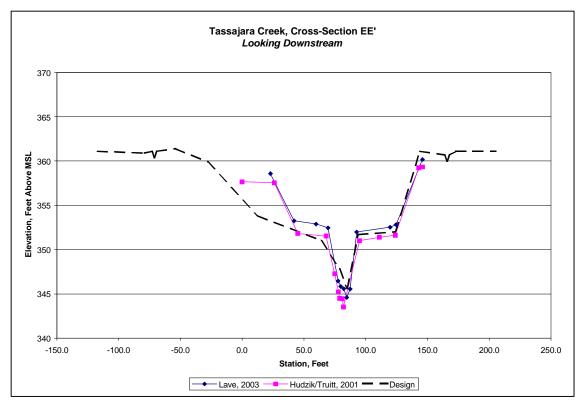




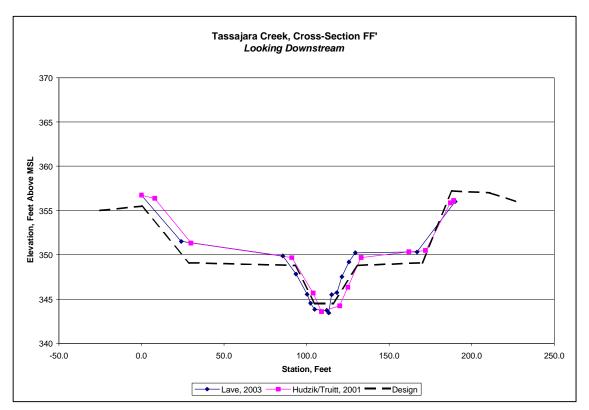














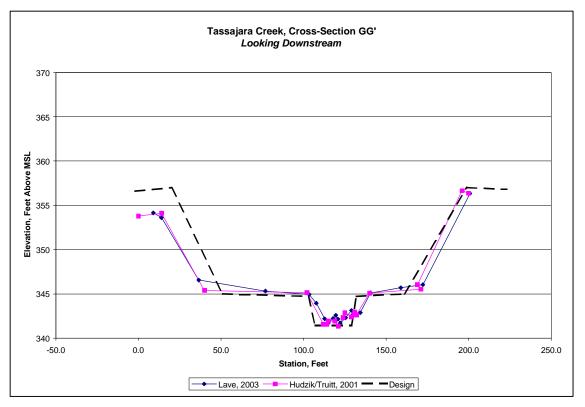
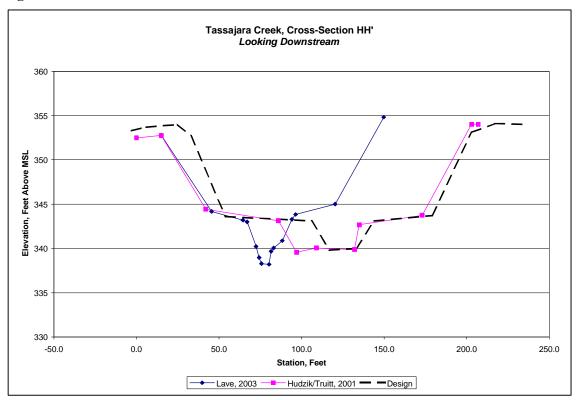


Figure 15.





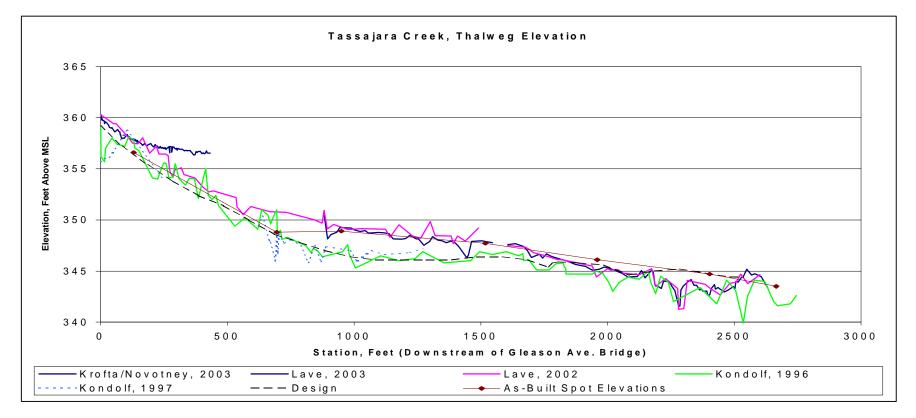


Figure 17.



Transect AA', looking north. October 11, 2003.



Transect AA' from thalweg, looking east. October 11, 2003.

Figure 18.



Transect BB', looking east from reflective marker. Image is rotated counter-clockwise 90 degrees. October 11, 2003.



Transect BB' from thalweg. Image is rotated counter-clockwise 90 degrees. October 11, 2003.

Figure 19.



Transects BB' and CC', looking east from reflective marker. October 11, 2003.



Transect CC' from thalweg. October 11, 2003.

Figure 20.



Transect DD', looking east. October 11, 2003.



Transect DD', looking south from thalweg. October 11, 2003.

Figure 21.



A debris jam upstream of Central Parkway. October 12, 2003.



An oak tree with exposed roots. Photo is rotated counter-clockwise 90 degrees. October 12, 2003.

Figure 22.



An oak tree with exposed roots. October 12, 2003.



Tassajara Creek, looking northeast from Central Parkway. October 12, 2003.

Figure 23.

Recommended Monitoring Plan for the Tassajara Creek Restoration Project: Modified from Hudzik and Truitt (2001)				
Action	Tassajara Creek Monitoring Plan	Completed as part of our study		
Establish objectives: Set goals that will guide the evolution of this plan.	Objective: Evaluate the success of the project in meeting the restoration objectives outlined in the 1996 plan.	Х		
Establish a database of baseline and existing data: Identify the data necessary to evaluate the success of the project.	Cross-section and long-profile surveys, site photos, and site observations tied into nearby landmarks and benchmarks.	Х		
Analyze data: Identify and fill in gaps in data.	Data needed: Professional assessment of the exposed oak tree roots health and the debris jam .			
Establish Sampling and Data Protocols: Ensure that data are comparable over time.	Quantitative: Survey cross sections in the same pre- established locations and plot survey data against pre-existing cross sections to identify any changes in channel form.	Х		
	Qualitative: Take photographs of the channel at each cross section and compare photographs to pre- existing images to identify noticeable changes in channel form. Take photographs of exposed roots and compare to pre-existing photos to determine if root exposure is persisting. Monitor debris jam for substances that may degrade water quality.	Х		
Determine frequency of monitoring events	Monitoring should be completed at least once per year, as well as after significant floods.	Х		
Development of implementation plan	Identify agency or organization and staff person resposible for overseeing monitoring. Create a regular schedule for monitoring. Identify people responsible for field monitoring.			

Appendix A: 2003 Survey Data

Date: 10/11/03 Model Recorder: RL Wather: 75 dig F Sumy Bit of Sum (Signa) Sum (Signa) Description 297.6 0.06 392.89 5.80 377.35 Stopa A 377.43 Stopa A 221.3 1 5.80 377.74 Stopa A 77.74 Stopa A 171.1 1 1 5.86 377.74 Stopa A 75.66 77.74 Stopa A 172.2 1 1.6.44 376.44 70.01 Fask River Right 79.01 Fask Low Flow Channel, River Right 135.6 1 21.52 381.37 In Channel The Channel Thalwag 135.6 1 21.52 381.37 In Channel The Channel Thalwag 135.6 1 21.52 381.37 In Channel The Channel Thalwag 136.7 19.05 387.78 14.66 17.74 365.15 Top of Bank, Low Flow Channel, River Left 137.4 19.05 387.778 14.66 17.93 376.40	Project:	Tassajara C Cross-Secti				Level: Rod:	CJK MEN
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31.0 7.25 369.47 46.0 7.81 368.91 Top of Bank 52.2 87.7 Slope Δ 66.5 13.82 362.90 Toe of Bank 82.0 94.4 19.66 357.06 100.0 20.58 366.14 Top of Bank, Low Flow Channel, River Left 104.6 22.13 354.59 Toe of Bank, Low Flow Channel/Middle Grade Control Structure 110.9 7.74 351.97 Toe of Bank, Low Flow Channel/Middle Grade Control Structure 110.9 7.74 355.71 18.85 357.87 113.5 17.84 375.71 18.85 351.58 111.9 17.84 375.71 18.85 351.36 111.3.5 116.3 345.31.39 In Channel, N. Edge of Silt Bar 111.6.3 24.32 351.36 Thalweg 116.3 24.32 351.31 In Channel 118.6 23.99 351.72 Toe of Bank, Low Flow Channel, River Right/Waterline 123.3 144.6 17.78 357.93 Top of Bank, Low Flow Channel, River Right 14.59 361.12 <td>Weather: Station 1.0</td> <td>Cross-Secti 10/23/03 80 deg F, S</td> <td>ion BB' Sunny HI</td> <td>FS</td> <td></td> <td>Rod: Elev 368.79</td> <td>MEN Description Base of Orange Reflector/BM1</td>	Weather: Station 1.0	Cross-Secti 10/23/03 80 deg F, S	ion BB' Sunny HI	FS		Rod: Elev 368.79	MEN Description Base of Orange Reflector/BM1
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	Station 1.0 6.6	Cross-Secti 10/23/03 80 deg F, S	ion BB' Sunny HI	FS	8.38	Rod: Elev 368.79 368.34	MEN Description Base of Orange Reflector/BM1 S. Edge of Road
66.5 13.82 362.90 Toe of Bank 82.0 94.4 18.77 357.95 Slope Δ/S. Edge Grade Control Structure 94.4 100.0 20.58 356.14 24.40 352.92 108.5 24.40 352.32 Toe of Bank, Low Flow Channel, River Left 110.9 24.75 351.97 In Channel, N. Edge of Silt Bar TP1 17.84 375.71 18.85 351.58 In Channel, N. Edge of Silt Bar/Waterline 111.3.5 24.13 351.41 In Channel, N. Edge of Silt Bar/Waterline In Channel 1114.5 24.32 351.36 Thalweg In Channel 114.5 24.32 351.39 In Channel Toe of Bank, Low Flow Channel, River Right/Waterline 118.6 24.32 351.39 In Channel Toe of Bank, Low Flow Channel, River Right/Waterline 123.3 24.52 353.19 In Channel Toe of Bank, Low Flow Channel, River Right/Waterline 128.6 17.78 357.93 Top of Bank, Low Flow Channel, River Right 1.0 161.0 17.10 358.61 N. Edge Grade Control Structure/Toe of Bank 182.0	Weather: Station 1.0 6.6 22.0	Cross-Secti 10/23/03 80 deg F, S	ion BB' Sunny HI	FS	8.38 8.01	Rod: Elev 368.79 368.34 368.71	MEN Description Base of Orange Reflector/BM1 S. Edge of Road
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Weather: 5tation 1.0 6.6 22.0 31.0	Cross-Secti 10/23/03 80 deg F, S	ion BB' Sunny HI	FS	8.38 8.01 7.25	Rod: Elev 368.79 368.34 368.71 369.47	MEN Description Base of Orange Reflector/BM1 S. Edge of Road N. Edge of Road
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Station 1.0 6.6 22.0 31.0 46.0 52.2	Cross-Secti 10/23/03 80 deg F, S	ion BB' Sunny HI	FS	8.38 8.01 7.25 7.81 8.75	Rod: Elev 368.79 368.34 368.71 369.47 369.47 368.91 367.97	MEN
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Station 1.0 6.6 22.0 31.0 46.0 52.2 66.5	Cross-Secti 10/23/03 80 deg F, S	ion BB' Sunny HI	FS	8.38 8.01 7.25 7.81 8.75 13.82	Rod: Elev 368.79 368.34 368.71 369.47 368.91 367.97 362.90	MEN Description Base of Orange Reflector/BM1 S. Edge of Road N. Edge of Road N. Edge of Road Top of Bank Slope ∆ Toe of Bank
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Station 1.0 6.6 22.0 31.0 46.0 52.2 66.5 82.0	Cross-Secti 10/23/03 80 deg F, S	ion BB' Sunny HI	FS	8.38 8.01 7.25 7.81 8.75 13.82 18.77	Rod: Elev 368.79 368.34 369.47 369.47 369.47 367.97 362.90 357.95	MEN Description Base of Orange Reflector/BM1 S. Edge of Road N. Edge of Road N. Edge of Road Top of Bank Slope ∆ Toe of Bank
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Station 1.0 6.6 22.0 31.0 46.0 52.2 66.5 82.0 94.4	Cross-Secti 10/23/03 80 deg F, S	ion BB' Sunny HI	FS	8.38 8.01 7.25 7.81 8.75 13.82 18.77 19.66	Rod: Elev 368.79 368.34 368.71 369.47 368.91 367.97 362.90 357.95 357.06	MEN Description Base of Orange Reflector/BM1 S. Edge of Road N. Edge of Road N. Edge of Road Top of Bank Slope ∆ Toe of Bank
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Station 1.0 6.6 22.0 31.0 46.0 52.2 66.5 82.0 94.4 100.0	Cross-Secti 10/23/03 80 deg F, S	ion BB' Sunny HI	FS	8.38 8.01 7.25 7.81 8.75 13.82 18.77 19.66 20.58	Rod: Elev 368.79 368.34 368.71 369.47 368.91 367.97 362.90 357.95 357.06 356.14	MEN Description Base of Orange Reflector/BM1 S. Edge of Road N. Edge of Road Top of Bank Slope Δ Toe of Bank Slope Δ\S. Edge Grade Control Structure
TP1 17.84 375.71 18.85 357.87 113.5 24.13 351.58 In Channel, N. Edge of Silt Bar/Waterline 113.5 24.30 351.41 In Channel 114.5 24.32 351.39 In Channel 116.3 24.32 351.39 In Channel 118.6 24.32 351.39 In Channel 128.6 21.48 354.23 Toe of Bank, Low Flow Channel, River Right/Waterline 128.6 17.78 357.93 Top of Bank, Low Flow Channel, River Right 161.0 17.10 358.61 N. Edge Grade Control Structure/Toe of Bank 182.0 14.45 367.30 S61.12 195.5 12.09 363.62 Slope Δ 209.0 8.41 367.30 Top of Bank, River Right 225.7 4.83 370.88 Top of Bank, River Right 233.0 4.47 371.48 Center Irrigation Control Valve/BM2 1.0 6.92 368.79 BM1	Station 1.0 6.6 22.0 31.0 46.0 52.2 66.5 82.0 94.4 100.0 104.6	Cross-Secti 10/23/03 80 deg F, S	ion BB' Sunny HI	FS	8.38 8.01 7.25 7.81 8.75 13.82 18.77 19.66 20.58 22.13	Rod: Elev 368.79 368.34 368.71 369.47 368.91 367.97 362.90 357.95 357.06 356.14 354.59	MEN
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Station 1.0 6.6 22.0 31.0 46.0 52.2 66.5 82.0 94.4 100.0 104.6 108.5	Cross-Secti 10/23/03 80 deg F, S	ion BB' Sunny HI	FS	8.38 8.01 7.25 7.81 8.75 13.82 18.77 19.66 20.58 22.13 24.40	Rod: 268.79 368.79 368.34 369.47 369.47 369.97 362.90 357.95 357.06 357.06 356.14 354.59 352.32	MEN
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Station 1.0 6.6 22.0 31.0 46.0 52.2 66.5 82.0 94.4 100.0 104.6 108.5 110.9	Cross-Secti 10/23/03 80 deg F, S BS 7.93	ion BB' iunny HI 376.72		8.38 8.01 7.25 7.81 8.75 13.82 18.77 19.66 20.58 22.13 24.40	Rod: 268.79 368.34 368.74 368.91 369.47 369.47 366.91 367.95 357.95 357.06 357.06 356.14 354.59 352.32 351.97 357.87	MEN
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Weather: Station 1.0 6.6 22.0 31.0 46.0 52.2 66.5 82.0 94.4 100.0 104.6 108.5 110.9 TP1 113.5	Cross-Secti 10/23/03 80 deg F, S BS 7.93	ion BB' iunny HI 376.72		8.38 8.01 7.25 7.81 8.75 13.82 18.77 19.66 20.58 22.13 24.40 24.75 24.13	Rod: 268.79 368.79 368.34 369.47 368.91 367.97 362.90 357.95 357.06 357.95 357.06 356.29 352.32 351.97 351.58	MEN
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Weather: Station 1.0 6.6 22.0 31.0 46.0 52.2 66.5 82.0 94.4 100.0 104.6 108.5 110.9 TP1 113.5 113.9	Cross-Secti 10/23/03 80 deg F, S BS 7.93	ion BB' iunny HI 376.72		8.38 8.01 7.25 7.81 8.75 13.82 18.77 19.66 20.58 22.13 24.40 24.75 24.13 24.30	Rod: Elev 368.79 368.34 368.71 369.47 368.91 367.97 362.90 357.06 357.06 356.14 354.59 355.45 351.97 351.87 351.87 351.87 351.87 351.87 351.41	MEN
123.3 22.52 353.19 128.6 21.48 354.23 144.6 17.78 357.93 161.0 17.10 356.61 182.0 14.59 361.12 195.5 12.09 363.62 209.0 8.41 367.30 225.7 4.83 370.88 233.0 4.47 371.24 242.4 6.92 368.79 1.0 6.92 368.79	Weather: 1.0 6.6 22.0 31.0 46.0 52.2 66.5 82.0 94.4 100.0 104.6 108.5 110.9 TP1 113.5 113.9 114.5	Cross-Secti 10/23/03 80 deg F, S BS 7.93	ion BB' iunny HI 376.72		8.38 8.01 7.25 7.81 8.75 13.82 18.77 19.66 20.58 22.13 24.40 24.75 24.13 24.30 24.35	Rod: 368.79 368.34 368.71 369.47 369.47 362.90 357.95 357.06 357.06 356.14 354.59 352.32 351.41 351.358 351.41 351.36	MEN
128.6 21.48 354.23 144.6 17.78 357.93 Top of Bank, Low Flow Channel, River Right 161.0 17.10 358.61 N. Edge Grade Control Structure/Toe of Bank 182.0 14.59 361.12 195.5 12.09 363.62 Slope Δ 209.0 8.41 367.30 225.7 4.83 370.88 Top of Bank, River Right 233.0 4.47 371.24 242.4 6.92 368.79 BM1	Weather: Station 1.0 6.6 22.0 31.0 46.0 52.2 66.5 82.0 94.4 100.0 104.6 108.5 110.9 TP1 113.5 113.9 114.5 116.3	Cross-Secti 10/23/03 80 deg F, S BS 7.93	ion BB' iunny HI 376.72		8.38 8.01 7.25 7.81 8.75 13.82 18.77 19.66 20.58 22.13 24.40 24.75 24.13 24.30 24.35 24.32	Rod: 368.79 368.34 368.71 369.47 369.47 362.90 357.95 357.06 356.14 354.59 351.36 351.38 351.41 351.36	MEN
144.6 17.78 357.93 Top of Bank, Low Flow Channel, River Right 161.0 17.10 358.61 N. Edge Grade Control Structure/Toe of Bank 182.0 14.59 361.12 363.62 195.5 12.09 363.62 Slope Δ 209.0 8.41 367.30 Top of Bank, River Right 233.0 4.47 371.24 Top of Bank, River Right 242.4 6.92 368.79 BM1	Weather: Station 1.0 6.6 22.0 31.0 46.0 52.2 66.5 82.0 94.4 100.0 104.6 108.5 110.9 TP1 113.5 113.9 114.5 116.3 118.6	Cross-Secti 10/23/03 80 deg F, S BS 7.93	ion BB' iunny HI 376.72		8.38 8.01 7.25 7.81 8.75 13.82 18.77 19.66 20.58 22.13 24.40 24.75 24.13 24.30 24.35 24.32 23.99	Rod: 368.79 368.74 368.71 369.47 362.90 357.06 357.06 357.06 357.06 356.14 354.59 355.14 354.59 351.36 351.36 351.36 351.36 351.72	MEN
161.0 17.10 358.61 N. Edge Grade Control Structure/Toe of Bank 182.0 14.59 361.12 195.5 12.09 363.62 Slope Δ 209.0 8.41 367.30 225.7 4.83 370.88 Top of Bank, River Right 233.0 4.47 371.24 242.4 3.63 374.88 Center Irrigation Control Valve/BM2 1.0 6.92 368.79 BM1	Weather: Station 1.0 6.6 22.0 31.0 46.0 52.2 66.5 82.0 94.4 100.0 104.6 108.5 110.9 TP1 113.5 113.9 114.5 116.3 118.6 123.3	Cross-Secti 10/23/03 80 deg F, S BS 7.93	ion BB' iunny HI 376.72		8.38 8.01 7.25 7.81 8.75 13.82 18.77 19.66 20.58 22.13 24.40 24.75 24.13 24.30 24.35 24.32 23.99 22.52	Rod: 368.79 368.34 368.71 369.47 369.47 362.90 357.95 357.06 356.14 354.59 357.05 356.14 354.59 352.32 351.41 351.38 351.41 351.38 351.42 351.12 353.192	MEN
195.5 12.09 363.62 Slope Δ 209.0 8.41 367.30 225.7 4.83 370.88 Top of Bank, River Right 233.0 4.47 371.24 242.4 368.3 371.88 Center Irrigation Control Valve/BM2 1.0 6.92 368.79 BM1	Weather: Station 1.0 6.6 22.0 31.0 46.0 52.2 66.5 82.0 94.4 100.0 104.6 108.5 110.9 TP1 113.5 113.9 114.5 116.3 118.6 123.3 128.6	Cross-Secti 10/23/03 80 deg F, S BS 7.93	ion BB' iunny HI 376.72		8.38 8.01 7.25 7.81 8.75 13.82 18.77 19.66 20.58 22.13 24.40 24.75 24.13 24.30 24.35 24.32 23.99 22.52 21.48	Rod: 368.79 368.34 368.71 369.47 368.91 367.97 362.90 357.95 357.05 357.05 357.05 357.64 354.59 355.14 354.59 351.47 351.58 351.41 351.39 351.42 351.39 351.72 353.19 354.23	MEN
209.0 8.41 367.30 225.7 4.83 370.88 233.0 4.47 371.24 242.4 371.88 Center Irrigation Control Valve/BM2 1.0 6.92 368.79	Weather: Station 1.0 6.6 22.0 31.0 46.0 52.2 66.5 82.0 94.4 100.0 104.6 108.5 110.9 TP1 113.5 113.9 114.5 118.6 128.6 144.6	Cross-Secti 10/23/03 80 deg F, S BS 7.93	ion BB' iunny HI 376.72		8.38 8.01 7.25 7.81 8.75 13.82 18.77 19.66 20.58 22.13 24.40 24.75 24.13 24.30 24.35 24.32 23.99 22.52 21.48 17.78	Rod: 368.79 368.79 368.87 369.47 369.47 362.90 357.95 357.06 356.14 354.59 352.32 351.97 351.58 351.41 351.39 351.39 351.72 353.19 354.23 357.93	MEN
225.7 4.83 370.88 Top of Bank, River Right 233.0 4.47 371.24 242.4 3.83 371.88 Center Irrigation Control Valve/BM2 1.0 6.92 368.79 BM1	Weather: 1.0 6.6 22.0 31.0 46.0 52.2 66.5 82.0 94.4 100.0 104.6 108.5 110.9 TP1 113.5 116.3 118.6 123.3 128.6 144.6 161.0 182.0	Cross-Secti 10/23/03 80 deg F, S BS 7.93	ion BB' iunny HI 376.72		8.38 8.01 7.25 7.81 8.75 13.82 18.77 19.66 20.58 22.13 24.40 24.75 24.13 24.40 24.75 24.13 24.32 23.99 22.52 21.48 17.78 17.70 14.59	Rod: 368.79 368.34 368.79 368.34 368.91 367.97 362.90 357.95 357.06 357.06 357.05 357.06 354.59 354.59 354.59 351.41 351.36 351.39 351.41 351.36 351.39 351.42 354.23 357.93 354.23 357.93 358.61 361.21	MEN
233.0 4.47 371.24 242.4 3.83 371.88 Center Irrigation Control Valve/BM2 1.0 6.92 368.79 BM1	Weather: Station 1.0 6.6 22.0 31.0 46.0 52.2 66.5 82.0 94.4 100.0 104.6 108.5 110.9 TP1 113.5 113.5 113.5 116.3 118.6 123.3 128.6 144.6 161.0 182.0 195.5	Cross-Secti 10/23/03 80 deg F, S BS 7.93	ion BB' iunny HI 376.72		8.38 8.01 7.25 7.81 8.75 13.82 18.77 19.66 20.58 22.13 24.40 24.75 24.13 24.40 24.75 24.13 24.35 24.32 23.99 22.52 21.48 17.78 17.78 17.78 17.78	Rod: 368.79 368.34 368.71 369.47 369.47 362.90 357.95 357.06 356.14 354.59 352.32 351.58 351.41 351.36 351.39 351.72 351.72 351.72 351.39 351.72 351.39 354.23 357.93 358.61 361.22 363.62	MEN
242.4 3.83 371.88 Center Irrigation Control Valve/BM2 1.0 6.92 368.79 BM1	Weather: Station 1.0 6.6 22.0 31.0 46.0 52.2 66.5 82.0 94.4 100.0 104.6 108.5 110.9 TP1 113.5 118.6 123.3 128.6 144.6 161.0 182.0 195.5 209.0	Cross-Secti 10/23/03 80 deg F, S BS 7.93	ion BB' iunny HI 376.72		8.38 8.01 7.25 7.81 8.75 13.82 18.77 19.66 20.58 22.13 24.40 24.75 24.13 24.40 24.75 24.13 24.30 24.35 24.32 23.99 22.52 21.48 17.78 17.70 14.59 12.09 8.41	Rod: 368.79 368.79 368.34 368.71 369.47 368.91 367.97 362.90 357.96 357.06 356.14 354.59 356.14 354.59 351.97 357.87 351.36 351.12 353.19 354.23 358.61 361.12 368.61 361.12 368.61 361.23 367.30	MEN
1.0 6.92 368.79 BM1	Weather: Station 1.0 6.6 22.0 31.0 46.0 52.2 66.5 82.0 94.4 100.0 104.6 108.5 110.9 TP1 113.5 116.3 118.6 123.3 128.6 161.0 182.0 195.5 209.0 225.7	Cross-Secti 10/23/03 80 deg F, S BS 7.93	ion BB' iunny HI 376.72		8.38 8.01 7.25 7.81 8.75 13.82 18.77 19.66 20.58 22.13 24.40 24.75 24.13 24.30 24.35 24.32 23.99 22.52 21.48 17.70 14.59 12.09 8.41 4.83	Rod: 368.79 368.34 368.71 369.47 369.47 362.90 357.95 357.06 357.06 357.06 356.14 354.59 352.32 351.37 351.58 351.41 351.36 351.39 351.41 351.39 351.41 351.39 354.23 357.93 355.423 357.93 358.61 361.12 368.62 367.30 370.88	MEN
	Weather: Station 1.0 6.6 22.0 31.0 46.0 52.2 66.5 82.0 94.4 100.0 104.6 108.5 110.9 TP1 113.5 113.5 113.6 123.3 128.6 144.6 161.0 182.0 195.5 209.0 225.7 233.0	Cross-Secti 10/23/03 80 deg F, S BS 7.93	ion BB' iunny HI 376.72		8.38 8.01 7.25 7.81 8.75 13.82 18.77 19.66 20.58 22.13 24.40 24.75 24.13 24.40 24.75 24.13 24.35 24.32 23.99 22.52 21.48 17.78 17.78 17.78 17.78 14.59 12.09 8.41 4.83 4.47	Rod: 368.79 368.34 368.71 369.47 368.91 367.95 357.95 357.95 357.95 357.95 357.95 357.4 354.59 356.14 354.59 356.14 354.59 357.45 351.47 351.58 351.39 351.39 351.39 351.32 351.39 354.23 357.93 358.61 354.23 357.93 358.61 363.62 367.30 370.88 371.24	MEN
	Station 1.0 6.6 22.0 31.0 6.6 22.0 94.4 100.0 104.6 108.5 110.9 TP1 113.5 113.9 114.5 118.6 123.3 128.6 144.6 161.0 182.5 209.0 225.7 223.0 242.4	Cross-Secti 10/23/03 80 deg F, S BS 7.93	ion BB' iunny HI 376.72	18.85	8.38 8.01 7.25 7.81 8.75 13.82 18.77 19.66 20.58 22.13 24.40 24.75 24.13 24.40 24.75 24.13 24.35 24.32 23.99 22.52 21.48 17.78 17.78 17.78 17.78 14.59 12.09 8.41 4.83 4.47	Rod: 368.79 368.79 368.34 368.71 369.47 362.90 357.96 357.06 357.06 357.06 357.06 355.14 354.59 355.35 351.41 351.36 351.37 351.36 351.72 353.19 354.23 356.61 263.62 367.30 370.28 371.24 371.88	MEN

Project:	Tassajara C Cross-Secti				Level: Rod:	CJK MEN
Date:	10/11/03				Recorder:	
Weather:	75 deg F, S	unny			Recorder.	
mouthorn	70 dog 1 , 0	anny				
Station	BS	HI	FS	SS	Elev	Description
263.3	4.84	374.00			369.16	S. Edge of Path, River Right
256.0				4.79	369.21	Top of Slope
230.0				6.36	367.64	
206.0				7.46	366.54	
180.1				11.79	362.21	Slope Δ
174.6				14.20	359.80	
168.6				16.04	357.96	Toe of Slope
158.4				16.43	357.57	
147.5				16.57	357.43	
132.0				16.75	357.25	
124.2				18.05	355.95	Top of Bank, Low Flow Channel, River Right
118.8				19.71	354.29	Slope Δ
114.4				22.26	351.74	Toe of Bank, Low Flow Channel, River Right
114.0				23.07	350.93	In Channel
113.8				23.40	350.60	In Channel
111.9				23.53	350.47	In Channel
110.4				23.25	350.75	In Channel
108.0				22.83	351.17	In Channel/Waterline
105.3				23.07	350.93	In Channel, No Water
104.4				22.93	351.07	Toe of Bank, Low Flow Channel, River Left
102.0				19.80	354.20	Top of Bank, Low Flow Channel/Toe of Bank
99.0				19.44	354.56	
95.6				17.56	356.44	Slope Δ
84.6				16.39	357.61	
76.5				15.18	358.82	
64.0				10.77	363.23	
50.9				6.05	367.95	Top of Bank, River Left
37.0				4.77	369.23	
29.0				4.85	369.15	Slope Δ
14.0				5.46	368.54	Middle of Road
1.0				5.21	368.79	Orangle Reflector/BM1
263.3			4.84		369.16	S. Edge of Path, River Right
Σ	4.84		4.84			

 Project:
 Tassajara Creek Cross-Section DD'

 Date:
 10/11/03

 Weather:
 75 deg F, Sunny

Level: CJK Rod: MEN Recorder: RL

Station	BS	HI	FS	SS	Elev	Description
278.6	3.30	370.04			366.74	Base Street Light/BM1
258.8				3.57	366.47	N. Edge of Path
249.8				3.56	366.48	S. Edge of Path
246.7				3.72	366.32	Top of Bank
232.0				8.57	361.47	
218.7				13.75	356.29	Toe of Bank
200.0				14.50	355.54	On Terrace
183.0				14.60	355.44	
172.2				14.79	355.25	Top of Bank, Low Flow Channel, River Right
167.0				19.43	350.61	Slope Δ
166.2				21.88	348.16	Toe of Bank, Low Flow Channel, River Right
164.4				22.28	347.76	In Channel
162.6				22.06	347.98	In Channel
161.3				22.09	347.95	In Channel
158.6				21.86	348.18	Toe of Bank, Low Flow Channel, River Left
156.2				20.16	349.88	Slope Δ
153.3				17.84	352.20	
149.0				14.36	355.68	Top of Bank, Low Flow Channel
129.0				14.14	355.90	On Terrace
105.0				14.65	355.39	On Terrace
81.0				15.02	355.02	On Terrace
65.8				14.90	355.14	Toe of Bank
56.6				11.05	358.99	
38.1				5.11	364.93	Top of Bank, River Left
26.5				5.15	364.89	Middle of Road
7.0				4.84	365.20 S. Side of Road	
1.0				4.54	365.50	Base Cottonwood Tree/BM2
278.6			3.30		366.74	Base Street Light/BM1
Σ	3.30		3.30			

Project:	Tassajara Creek	Level:	MEN
	Long Profile Survey	Rod:	CJK
	Dublin St. Bridge to Central Pkwy. Bridge		
	From D/S end of reach (Station 0 = Dublin St.	Bridge)	
Date:	10/12/03		
Weather:	80 deg F, Sunny		

Station	BS	н	FS	SS	Elev.	Description*
BM1	5.33	361.79			356.46	Dublin St. Bridge BM
TP1	4.72	361.48	5.03		356.76	-
50.0				16.73	344.75	No defined creek, damp soil and dispersed pools
63.0				16.87	344.61	No defined creek, damp soil and dispersed pools
82.0				16.31	345.17	No defined creek, damp soil and dispersed pools
94.5				16.96	344.52	S. edge of defined stream
105.3				17.16	344.32	
115.4				17.57	343.91	Deeley starsen had
124.2 128.0				17.48 18.18	344.00 343.30	Rocky stream bed
135.0				17.99	343.30	Deep pool, 1-1/2'
147.0				18.21	343.27	Pool, 1-1/2'
157.5				18.38	343.10	Pool, 1-3/4'
170.4				18.53	342.95	2'
184.9				18.27	343.21	1-3/4'
195.1				18.09	343.39	1-1/2'
205.5				18.24	343.24	1-3/4'
209.1				17.81	343.67	Riffle, 1-1/4'
219.8				18.14	343.34	1-1/2'
228.8				18.80	342.68	2-1/4'
235.0				18.85	342.63	2-1/4' Boulders is stream had 1 3/4'
239.5 254.5				18.42 18.46	343.06 343.02	Boulders in stream bed, 1-3/4' 1-3/4'
261.0				18.23	343.02	1-1/2'
267.5				18.35	343.13	1-3/4'
279.5				17.88	343.60	1-1/4'
289.7				17.87	343.61	Vegetation upstream
302.0	18.02	362.18	17.32	-	344.16	TP2, 3/4'
315.0				18.27	343.91	Vegetated channel (grass), 1/2'
331.5				18.65	343.53	Vegetated channel (grass), 1-1/2'
340.0				18.98	343.20	Vegetated channel (grass), 1/2'
342.5				19.08	343.10	Channel clear of vegetation, 2'
346.0				20.61	341.57	3-1/4'
350.0				20.62	341.56	3-1/4'
366.1				19.06 18.73	343.12 343.45	2-3/4'
376.5 388.1				18.22	343.45	Vegetation upstream
409.5				18.16	344.02	vegetation upstream
419.5				18.90	343.28	Thin vegetation
435.0				18.64	343.54	
443.7				18.54	343.64	D/S end of riffle
447.0				18.05	344.13	
450.0				17.35	344.83	Center of riffle, high stream velocity
456.5				17.06	345.12	D/S of thick cattails
483.5				17.84	344.34	
496.5				17.13	345.05	Large clump of cattails
513.3				17.71	344.47	41
531.0 548.5				17.73 17.80	344.45 344.38	1' 1'
572.3 ^A				17.42	344.38	1
TP3	11.95	364.26	9.87	17.42	352.31	
623.4 ^A	11.00	004.20	5.07	18.99	345.27	Vegetation in channel
623.4 644.0				18.85	345.27	1/2'
664.5				19.08	345.18	1/2'
690.0				19.19	345.07	1/2'
718.0				18.81	345.45	1/4'
757.2				18.62	345.64	
791.5				18.28	345.98	Thick vegetation
806.5	_			18.19	346.07	
TP4	2.29	364.82	1.73	40.00	362.53	Level had been to show a had a strike
851.7				18.38	346.44	Large boulders in stream bed, < 1/4'
871.3				18.13	346.69 346.27	1/3', high stream velocity 1'
887.3 900.0				18.55 18.19	346.27 346.63	1 1/2'
900.0 931.0				18.49	346.33	1/2
947.0				17.79	347.03	Thick vegetation
961.6				17.42	347.40	Very thick vegetation, high stream velocity
995.0				17.16	347.66	1/4'
TBM				0.49	364.33	Rock due S of SW bridge abutment (Central Pkwy)
TP5	3.48	364.30	4.00		360.82	
TP6	4.87	361.32	7.85		356.45	
BM1		I	4.81	1	356.51	Dublin St. Bridge BM
Σ	50.66		50.61			

Notes: * - Elevations given in shot description represent water level elevations ^A - Thick willows were located in between Station 572.3 and Station 623.4. No major elevation changes were found in this reach upon visual inspection.

Project:			MEN CJK				
Date:	10/12/03				0 /		
Weather:	80 deg F, S	Sunny					
	<u> </u>						
Station	BS	HI	FS	SS	Elev.		Notes
DMA	E C 4	2022.40			250 40	Dublis Ch Deides DM	

otation	50		15	55	Liev.	Notes
BM1	5.64	362.10			356.46	Dublin St. Bridge BM
0.0				18.71	343.39	At Dublin St. Bridge
25.0				17.66	344.44	-
BM1			5.64		356.46	Dublin St. Bridge BM
Σ	5.64		5.64			

Notes:

This section was surveyed seperately from the left bank because we could not see into the stream from the right bank, where the first long profile survey was performed.

Project:	Tassajara Creek	Level:	MEN			
	.ong Profile Survey Rod: 0					
	Central Parkway Bridge to Pedestrian Bridge					
	From D/S end of reach (Station 0 = Central Parl	way Br.)				
Date:	10/12/03					
Weather:	80 deg F, Sunny					

FS SS Station BS н Elev. Description* Rock due S of SW bridge abutment (Central Pkwy) 369.17 364.33 4.84 TBM 1025.0^A On D/S side of Central Pkwy Br. 347.59 21.58 TP1 5.24 370.40 4.01 365.16 BM on SW bridge abutment (Central Pkwy Br.) 0.0 22.62 347.78 42.0 22.45 347.95 Heavy vegetation 22.49 347.91 81.2 U/S edge of vegetation 94.3 23.86 346.54 99.5 24.11 346.29 Debris jam directly U/S, 3' 134.0^B 22.97 347.43 U/S of debris jam 147.4 22.63 347.77 3/4' 163.0 22.47 347.93 3/4' 22.64 347.76 3/4' 181.0 197.5 22.45 347.95 1/2' 213.5 22.39 348.01 D/S of vegetation 235.0 22.03 348.37 U/S of vegetation 247.0 22.49 347.91 347.53 269.5 22.87 290.5 22.25 348.15 300.0 22.78 370.92 22.26 348.14 TP2 22.44 325.9 348.48 vegetation in channel 341.6 22.74 348.18 U/S of vegetation, 3/4' 359.1 22.80 348.12 3/4' 390.9 22.77 348.15 Vicinity of of X-Sec DD' 407 1 22.28 348 64 Vicinity of of X-Sec DD' 426.6 22.18 348.74 449.0 22.15 348.77 Vegetation, 1/4 487.5 22.21 348.71 Vegetation, 1/4' 501.2 21.96 348.96 U/S of vegetation 520.8 22.05 348.87 Vegetation (grass) 543.0 349.03 Vegetation (cattails) 21.89 557.0 21.72 349.20 Vegetation (cattails) 602.0 21.67 349.25 U/S of vegetation 613.0 22.13 348 79 3/4 637.0 22.36 348.56 649.2 22.77 348.15 D/S edge of culvert under pedestrian br. 663.0 20.39 350.53 Midpoint of pedestrian bridge TP3 3.79 370.88 3.83 367.09 TP4 3.97 369.40 5.45 365.43 твм 5.11 364.29 Rock due S of SW bridge abutment (Central Pkwy) 40.62 40.66 Σ

Notes:

* - Elevations given in shot description represent water level elevations

^A - This point was on the long-profile section between Dublin St. and Central Pkwy.

^B - Water level elevation in the vicinity of Station 115.0 and Station 120.0 was 3'.

Appendix B: Compiled Survey Data

Tassajara Creek Cross-Section AA' Compiled Survey Data

Hudzik and	d Truitt, 200	1		 Krofta and	Novotney, 2	2003
Station	Corrected Station	Elev. (HI)	Elev.*	Station	Corrected Station	Elev.
0	13	-5.52	382.56	297.6	296.1	382.83
7	20	-9.18	378.90	261.0	259.5	378.39
13	26	-12.38	375.70	242.0	240.5	377.09
22	35	-14.56	373.52	221.3	219.8	377.53
34	47	-14.81	373.27	193.0	191.5	377.44
48	61	-14.96	373.12	171.1	169.6	376.45
59	72	-15.27	372.81	162.9	161.4	372.89
70	83	-15.51	372.57	150.2	148.7	368.75
80	93	-15.58	372.50	141.0	139.5	366.04
88	101	-18.18	369.90	136.6	135.1	364.37
106	119	-23.06	365.02	135.2	133.7	362.51
112	125	-24.84	363.24	133.0	131.5	361.37
115	128	-26.28	361.80	130.6	129.1	360.83
119	132	-27.41	360.67	127.4	125.9	361.39
120	133	-27.55	360.53	124.8	123.3	362.73
121	134	-27.41	360.67	122.9	121.4	365.15
124	137	-25.07	363.01	118.5	117.0	365.63
125	138	-23.22	364.86	109.9	108.4	368.23
150	163	-14.15	373.93	101.8	100.3	371.07
151	164	-9.48	378.60	97.2	95.7	372.79
172	185	-11.16	376.92	83.9	82.4	373.20
184	197	-11.33	376.75	58.0	56.5	373.63
197	210	-10.81	377.27	34.7	33.2	374.19
216	229	-11.76	376.32	27.0	25.5	376.40
232	245	-11.45	376.63	18.6	17.1	380.00
241	254	-10.36	377.72	11.2	9.7	382.99
264	277	-7.92	380.16	1.5	0.0	382.76
276	289	-6.96	381.12			

Notes:

* - Includes a correction of 2.66 feet added to each elevation reported by Hudzik and Truitt. The survey data provided by Hudzik and Truitt does not report elevations as relative to MSL for Cross-Secion AA'. Instead, they provide the elevation of the ground relative to the height of the instrument (HI). Their data is difficult to decipher, however it appears that they recorded their elevations 2.66 feet below the actual elevation of the ground at each point, because of their failure to account for the height of the instrument, which was 2.66 feet above the fire hydrant located at Station 0. This appears to be the case, as the corrected elevation align relatively well with our data.

Tassajara Creek Cross-Section BB' Compiled Survey Data

Hudzik and	d Truitt, 200 ⁻	1	Krofta and	I Novotney, 2	2003
Station	Corrected Station	Elev.	Station	Corrected Station	Elev.
0	4.1	369.90	1.0	0.0	368.79
24	28.1	369.86	6.6	5.6	368.34
46	50.1	369.72	22.0	21.0	368.71
55	59.1	367.44	31.0	30.0	369.47
65	69.1	363.62	46.0	45.0	368.91
71	75.1	361.12	52.2	51.2	367.97
79	83.1	358.68	66.5	65.5	362.90
92	96.1	357.83	82.0	81.0	357.95
95	99.1	356.24	94.4	93.4	357.06
103	107.1	354.08	100.0	99.0	356.14
108	112.1	351.76	104.6	103.6	354.59
114	118.1	351.51	108.5	107.5	352.32
117	121.1	352.21	110.9	109.9	351.97
120	124.1	353.11	113.5	112.5	351.58
134	138.1	355.27	113.9	112.9	351.41
144	148.1	357.72	114.5	113.5	351.36
164	168.1	359.46	116.3	115.3	351.39
184	188.1	362.26	118.6	117.6	351.72
199	203.1	365.64	123.3	122.3	353.19
220	224.1	370.51	128.6	127.6	354.23
237	241.1	371.71	144.6	143.6	357.93
			161.0	160.0	358.61
			182.0	181.0	361.12
			195.5	194.5	363.62
			209.0	208.0	367.30
			225.7	224.7	370.88
			233.0	232.0	371.24
			242.4	241.4	371.88

Tassajara Creek Cross-Section CC' Compiled Survey Data

Hudzik and Truitt, 2001						
Station	Corrected Station	Elev.				
0	252	369.74				
21	231	369.61				
47	205	366.31				
69	183	362.81				
87	165	358.94				
94	158	357.66				
106	146	357.48				
112	140	357.45				
123	129	356.59				
130	122	354.13				
137	115	352.94				
139	113	350.62				
139	113	350.89				
149	103	351.30				
157	95	354.84				
160	92	356.91				
169	83	357.63				
173	79	358.18				
180	72	358.86				
204	48	367.99				
252	0	368.79				

Krofta and Novotney, 2003					
Station	Corrected	Elev.			
	Station				
263.3	262.3	369.16			
256.0	255.0	369.21			
230.0	229.0	367.64			
206.0	205.0	366.54			
180.1	179.1	362.21			
174.6	173.6	359.80			
168.6	167.6	357.96			
158.4	157.4	357.57			
147.5	146.5	357.43			
132.0	131.0	357.25			
124.2	123.2	355.95			
118.8	117.8	354.29			
114.4	113.4	351.74			
114.0	113.0	350.93			
113.8	112.8	350.60			
111.9	110.9	350.47			
110.4	109.4	350.75			
108.0	107.0	351.17			
105.3	104.3	350.93			
104.4	103.4	351.07			
102.0	101.0	354.20			
99.0	98.0	354.56			
95.6	94.6	356.44			
84.6	83.6	357.61			
76.5	75.5	358.82			
64.0	63.0	363.23			
50.9	49.9	367.95			
37.0	36.0	369.23			
29.0	28.0	369.15			
14.0	13.0	368.54			
1.0	0.0	368.79			

Design Section				
Station	Corrected Station	Elev.		
123	0	371.3		
117	6	370.1		
110	13	369.2		
103	20	369.3		
102	21	368.5		
101	22	369.2		
81	42	369.8		
65	58	369.0		
43	80	360.2		
31	92	357.8		
17	106	351.6		
10	113	351.6		
8	115	353.0		
-12	135	361.0		
-18	141	361.3		
-24	147	361.0		
-29	152	359.0		
-62	185	359.0		
-74	197	364.0		
-90	213	365.0		
-105	228	368.1		
-118	241	369.0		
-122	245	370.0		
-132	255	370.1		

Tassajara Creek Cross-Section DD' Compiled Survey Data

Hudzik and Truitt, 2001					
Station	Corrected Station	Elev.			
209	243	366.14			
182	216	356.07			
157	191	354.65			
136	170	354.66			
132	166	349.23			
132	166	347.64			
130	164	346.78			
120	154	349.40			
120	154	351.26			
115	149	355.49			
71	105	354.89			
33	67	354.82			
6	40	364.41			
0	34	364.44			

Krofta and Novotney, 2003				
Station	Corrected	Elev.		
Station	Station	LIEV.		
278.6	277.6	366.74		
258.8	257.8	366.47		
249.8	248.8	366.48		
246.7	245.7	366.32		
232.0	231.0	361.47		
218.7	217.7	356.29		
200.0	199.0	355.54		
183.0	182.0	355.44		
172.2	171.2	355.25		
167.0	166.0	350.61		
166.2	165.2	348.16		
164.4	163.4	347.76		
162.6	161.6	347.98		
161.3	160.3	347.95		
158.6	157.6	348.18		
156.2	155.2	349.88		
153.3	152.3	352.20		
149.0	148.0	355.68		
129.0	128.0	355.90		
105.0	104.0	355.39		
81.0	80.0	355.02		
65.8	64.8	355.14		
56.6	55.6	358.99		
38.1	37.1	364.93		
26.5	25.5	364.89		
7.0	6.0	365.20		
1.0	0.0	365.50		

Elev.

360.18 352.81

352.53 351.97 345.55 344.58 345.83 345.83 346.45 352.45 352.89 353.26 358.58

Design Section					
Station	Corrected Station	Elev.			
187	-24	365.1			
163	0	365.0			
151	12	364.6			
149	14	363.8			
147	16	364.6			
126	37	364.9			
102	61	356.3			
24	139	356.0			
13	150	354.1			
10	153	349.8			
1	162	348.1			
-19	182	356.0			
-68	231	357.0			
-84	247	366.1			
-95	258	365.9			
-99	262	364.2			
-101	264	364.7			
-107	270	364.9			
-119	282	365.0			

Tassajara Creek Cross-Section EE' Compiled Survey Data

Hudzik and	d Truitt, 200 ⁻	1	Lave, 2003	
Station	Corrected Station	Elev.	Station	Corrected Station
146	359.33	146	123.1	146.0
143	359.24	143	101.7	124.6
124	351.62	124	96.9	119.8
111	351.38	111	69.8	92.7
95	351.00	95	64.5	87.4
82	343.51	82	61.8	84.7
81	344.46	81	59.3	82.2
79	344.48	79	56.9	79.8
78	345.21	78	54.9	77.8
75	347.26	75	46.7	69.6
68	351.53	68	36.9	59.8
45	351.82	45	19.2	42.1
26	357.55	26	0.0	22.9
0	357.66	0		

Design Section					
Station	Corrected Station	Elev.			
200	-117	361.1			
162	-79	360.9			
156	-73	361.1			
154	-71	360.4			
152	-69	361.1			
137	-54	361.4			
111	-28	359.9			
70	13	353.8			
19	64	351.0			
4	79	347.8			
-2	85	345.6			
-11	94	351.7			
-41	124	352.0			
-61	144	361.1			
-81	164	360.7			
-83	166	360.0			
-85	168	360.7			
-90	173	361.1			
-122	205	361.1			

Tassajara Creek Cross-Section FF' Compiled Survey Data

Hudzik and Truitt, 2001				
Station	Corrected Station	Elev.		
189	189	356.14		
187	187	355.86		
172	172	350.48		
162	162	350.33		
133	133	349.69		
125	125	346.34		
120	120	344.22		
109	109	343.59		
104	104	345.69		
91	91	349.68		
30	30	351.34		
8	8	356.38		
0	0	356.74		

Lave, 2003					
Station	Corrected Station	Elev.			
190.0	190.0	356.02			
166.9	166.9	350.32			
129.5	129.5	350.22			
125.6	125.6	349.19			
121.4	121.4	347.53			
118.4	118.4	345.72			
115.2	115.2	345.48			
113.4	113.4	343.43			
112.2	112.2	343.71			
104.9	104.9	343.84			
102.4	102.4	344.53			
100.4	100.4	345.53			
93.5	93.5	347.81			
85.6	85.6	349.87			
24.1	24.1	351.50			
0.0	0.0	356.75			

Design Section

Design Section					
Station	Corrected Station	Elev.			
136	-25	355.0			
111	0	355.5			
82	29	349.1			
18	93	348.8			
6	105	344.5			
-5	116	344.5			
-20	131	348.8			
-59	170	349.1			
-77	188	357.2			
-100	211	357.0			
-116	227	356.0			

Tassajara Creek Cross-Section GG' Compiled Survey Data

Hudzik and	d Truitt, 200 [.]	1	Lave, 2003		
Station	Corrected Station	Elev.	Station	Corrected Station	Elev.
200	200	356.37	0.0	9.0	354.16
196	196	356.65	4.9	13.9	353.60
169	169	346.03	27.5	36.5	346.55
171	171	345.52	67.9	76.9	345.32
140	140	345.08	94.3	103.3	344.93
132	132	342.61	98.8	107.8	343.94
131	131	342.92	103.8	112.8	342.18
131	131	342.67	105.9	114.9	341.68
129	129	342.39	108.9	117.9	342.22
125	125	342.86	110.5	119.5	342.59
124	124	342.33	111.8	120.8	342.14
121	121	341.33	113.3	122.3	341.70
119	119	341.93	116.5	125.5	342.29
115	115	341.91	120.1	129.1	343.13
114	114	341.57	120.5	129.5	342.58
112	112	341.57	125.3	134.3	342.88
102	102	345.13	131.5	140.5	345.09
40	40	345.38	149.8	158.8	345.69
14	14	354.10	163.3	172.3	346.03
0	0	353.79	191.8	200.8	356.33

Design Section				
Station	Corrected Station	Elev.		
122	-2	356.6		
100	20	357.0		
69	51	345.0		
17	103	344.7		
13	107	341.4		
-9	129	341.4		
-12	132	344.7		
-41	161	345.0		
-79	199	357.0		
-103	223	356.8		

Tassajara Creek Cross-Section HH' Compiled Survey Data

Hudzik and Truitt, 2001 Corrected Station Elev. Station 207 354.01 207 354.02 203 203 173 173 343.73 135 135 342.67 132 132 339.87 109 340.04 109 97 97 339.55 86 86 343.12 42 42 344.41 15 15 352.75 0 0 352.49

Lave, 2003						
Station	Corrected Station	Elev.				
0.0	15.0	352.79				
30.5	45.5	344.17				
49.5	64.5	343.19				
52.0	67.0	343.00				
57.4	72.4	340.21				
59.3	74.3	338.96				
60.7	75.7	338.27				
65.3	80.3	338.19				
66.5	81.5	339.67				
68.1	83.1	340.05				
73.3	88.3	340.87				
79.2	94.2	343.28				
81.4	96.4	343.83				
105.3	120.3	345.00				
134.8	149.8	354.83				

Design Section											
Station	Corrected Station	Elev.									
128	-3	353.3									
119	6	353.7									
100	25	354.0									
92	33	352.7									
71	54	343.6									
19	106	343.1									
8	117	339.8									
-8	133	340.0									
-19	144	343.1									
-54	179	343.7									
-78	203	353.1									
-92	217	354.1									
-109	234	354.0									

Tassajara Creek Long Profile <u>Compiled Survey Data</u>

Compiled															-			
Station	Corrected	Elev.	1	Lave, 2003 Station	Corrected	Elev.	Lave, 20 Station	Corrected	Elev.	1	Kondolf, 19 Station	Elev.	Kondolf, 19 Station	Elev.	Station	n Drawings Elev.	Station	ilt Spot Elev Elev.
0.0	Station 2631.0	343.39		1.0	Station 1.0	360.30	0	0 Station	360.30		0	359.00	0	355.70	0	359.20	131	356.6
25.0 50.0	2606.0 2581.0	344.44 344.75		3.4 4.3	3.4 4.3	359.94 359.81	51 62	51 62	359.43 359.41		2 15	356.20 355.70	15 35	356.00 356.10	85 185	357.20 355.40	695 950	348.8 348.9
63.0 82.0	2568.0 2549.0	344.61 345.17		5.5 8.7	5.5 8.7	359.91 359.74	86	86 112	358.72 358.00		20 45	357.00 358.00	105 250	358.80 353.90	285	353.80 352.40	1518 1959	347.7 346.1
94.5	2536.5	344.52		12.5	12.5	359.73	112 127	127	357.52		65	357.40			485	351.40	2403	344.7
105.3 115.4	2525.7 2515.6	344.32 343.91		13.7 15.1	13.7 15.1	359.65 359.43	147 166	147 166	357.46 358.05		95 110	357.20 358.10	625 640	349.50 350.40	585 685	350.00 348.60	2665	343.5
124.2 128.0	2506.8 2503.0	344.00 343.30		18.2 21.7	18.2 21.7	359.60 359.55	193 220	193 220	356.54 357.19		130 135	357.90 357.00	665 670	348.00 347.80	785 885	347.80 347.00		
135.0	2496.0	343.49		26.8	26.8	359.42	230	230	356.46		150	356.80	690	346.00	985	346.40		
147.0 157.5	2484.0 2473.5	343.27 343.10		30.7 32.6	30.7 32.6	359.29 359.28	256 267	256 267	356.46 356.27		205 225	354.10 354.00	695 699	348.80 346.70	1085 1185	346.10 346.10		
170.4 184.9	2460.6 2446.1	342.95 343.21		33.6 34.4	33.6 34.4	359.15 359.07	271 274	271 274	355.23 354.67		240 250	355.00 355.60	705 725	348.80 347.70	1285 1385	346.10 346.10		
195.1 205.5	2435.9 2425.5	343.39 343.24		36.3 39.7	36.3 39.7	359.05 359.02	286 293	286 293	354.19 354.92		260 270	355.50 354.10	750 790	348.10 347.50	1485 1585	346.40 346.40		
209.1	2421.9	343.67		44.3	44.3	358.99	319	319	355.09		285	354.20	820	345.80	1685	346.10		
219.8 228.8	2411.2 2402.2	343.34 342.68		45.0 51.4	45.0 51.4	359.05 358.80	329 373	329 373	354.44 354.09		295 310	355.50 354.00	845 870	347.50 345.90	1765 1785	345.40 345.80		
235.0 239.5	2396.0 2391.5	342.63 343.06		56.6 67.0	56.6 67.0	358.59 358.86	402 427	402 427	353.24 352.75		335 350	353.40 354.10	890 985	347.40 347.00	1805 1885	345.90 345.80		
254.5 261.0	2376.5 2370.0	343.02 343.25		70.3 72.5	70.3 72.5	358.74 358.65	445 534	445 534	352.84 352.17		370 385	354.00 352.10	1010 1070	346.00 347.00	1985 2085	345.60 344.60		
267.5 279.5	2363.5 2351.5	343.13 343.60		76.9 77.4	76.9 77.4	358.59 358.33	539 562	539 562	351.29 350.53		415 425	355.00 352.40	1120 1220	346.60 346.80	2185 2285	345.00 345.20		
289.7	2341.3	343.61		78.8	78.8	358.34	593	593	351.31		440	352.00	1270	347.20	2385	344.80		
302.0 315.0	2329.0 2316.0	344.16 343.91		79.7 81.9	79.7 81.9	358.23 358.07	668 732	668 732	350.81 350.73		455 465	352.40 351.40	2380	342.80	2485 2535	344.40 344.40		
331.5 340.0	2299.5 2291.0	343.53 343.20		83.7 87.5	83.7 87.5	357.93 358.01	841 874	841 874	350.03 349.69		530 570	349.40 350.20	2485 2515	343.10 341.70	2665			
342.5 346.0	2288.5 2285.0	343.10 341.57		93.2 100.0	93.2 100.0	357.96 358.21	882 894	882 894	350.94 349.12		620 635	349.10 351.00	2545 2570	342.10 343.60				
350.0	2281.0	341.56		105.3	105.3	358.34	919	919	349.57		660	350.50	2598	343.00				
366.1 376.5	2264.9 2254.5	343.12 343.45		109.1 112.2	109.1 112.2	358.13 358.11	977 1028	977 1028	349.06 349.16		670 685	349.60 350.50	2620 2655	344.00 342.00				
388.1 409.5	2242.9 2221.5	343.96 344.02		114.6 118.1	114.6 118.1	358.14 357.92	1080	1080 1124	349.11 349.10		695 697	351.00 348.60	2670 2695	341.70 343.00				
419.5	2211.5	343.28		122.5	122.5	357.98	1142	1142	348.30		710	349.00	2705	343.10				
435.0 443.7	2196.0 2187.3	343.54 343.64		125.7 129.2	125.7 129.2	357.84 357.82	1177 1230	1177 1230	349.53 348.44		715 735	348.10 348.30	2735 2745	341.90 341.80				
447.0 450.0	2184.0 2181.0	344.13 344.83		135.6 137.3	135.6 137.3	357.90 357.73	1263 1301	1263 1301	348.20 349.84		810 830	347.50 346.80						
456.5 483.5	2174.5 2147.5	345.12 344.34		138.3 139.9	138.3 139.9	357.86 357.77	1319 1383	1319 1383	348.46 348.43		840 855	347.20 347.00						
496.5 513.3	2134.5 2117.7	345.05 344.47		141.7 144.3	141.7 144.3	357.76 357.62	1392 1408	1392 1408	347.69 348.43		875 955	346.40 346.90						
531.0	2100.0	344.45		145.0	145.0	357.78	1438	1438	347.93		975	347.60						
548.5 572.3	2082.5 2058.7	344.38 344.76		149.0 153.6	149.0 153.6	357.62 357.62	1491	1491	349.22		980 1005	346.70 345.30						
623.4 644.0	2007.6 1987.0	345.27 345.41		159.8 165.3	159.8 165.3	357.49 357.30	1606 1675	1606 1675	347.49 347.33		1105 1175	346.50 346.00						
664.5 690.0	1966.5 1941.0	345.18 345.07		173.3 177.8	173.3 177.8	357.48 357.33	1690 1707	1690 1707	347.15 346.80		1240 1270	346.20 346.90						
718.0	1913.0	345.45 345.64		183.4	183.4	357.27	1751	1751	346.53 346.10		1355	345.80 346.00						
791.5	1839.5	345.98		188.5	188.5	357.35	1820	1820	346.12		1495	346.90						
806.5 851.7	1824.5 1779.3	346.07 346.44		191.6 197.3	191.6 197.3	357.37 357.49	1940 1956	1940 1956	345.50 344.43		1545 1600	346.60 346.90						
871.3 887.3	1759.7 1743.7	346.69 346.27		199.2 204.3	199.2 204.3	357.43 357.26	2000 2012	2000 2012	345.22 345.09		1650 1665	346.50 346.70						
900.0 931.0	1731.0 1700.0	346.63 346.33		209.5 215.5	209.5 215.5	357.14 357.37	2041 2062	2041 2062	345.15 344.80		1670 1690	346.00 346.10						
947.0	1684.0	347.03		220.0	220.0	357.20	2125	2125	344.65		1720	345.10						
961.6 995.0	1669.4 1636.0	347.40 347.66		224.1 230.1	224.1 230.1	357.24 357.02	2175 2190	2175 2190	345.24 343.48		1770 1795	345.10 345.70						
1025.0	1606.0	347.59		234.9 239.5	234.9 239.5	357.21 357.02	2228 2277	2228 2277	344.28 343.29		1825 1830	345.80 345.40						
0.0 42.0	1545.0 1503.0	347.78 347.95		244.1 247.5	244.1 247.5	357.09 356.98	2280 2301	2280 2301	341.27 341.31		1835 1836	345.30 344.70						
81.2	1463.8	347.91		250.5	250.5	357.07	2314 2385	2314	344.09		1940	344.70						
94.3 99.5	1450.7 1445.5	346.54 346.29		251.9 255.5	251.9 255.5	356.98 357.07	2405	2385 2405	343.70 343.31		1955 1980	345.00 344.80						
134.0 147.4	1411.0 1397.6	347.43 347.77		257.9 263.0	257.9 263.0	356.87 357.03	2445 2482	2445 2482	342.68 343.78		2005 2020	343.90 343.00						
163.0 181.0	1382.0 1364.0	347.93 347.76		270.3 273.6	270.3 273.6	357.17 356.55	2497 2507	2497 2507	343.87 343.92		2045 2080	343.90 344.40						
197.5	1347.5	347.95 348.01		273.7 281.0	273.7 281.0	357.19 357.12	2525	2525	344.70 343.76		2125 2160	344.20 345.00						
235.0	1310.0	348.37		281.2	281.2	356.62	2553	2553	343.76		2170	343.90						
247.0 269.5	1298.0 1275.5	347.91 347.53		284.1 285.4	284.1 285.4	357.15 357.10					2190 2210	342.80 344.50						
290.5 300.0	1254.5 1245.0	348.15 348.14		290.0 291.3	290.0 291.3	357.14 357.03					2240 2260	343.90 342.00						
325.9 341.6	1219.1 1203.4	348.48 348.18		295.9 300.0	295.9 300.0	356.95 357.01					2365 2430	343.40 341.80						
359.1	1185.9	348.12		302.7	302.7	356.83					2470	344.10						
390.9 407.1	1154.1 1137.9	348.15 348.64		305.3 311.7	305.3 311.7	357.00 356.90					2505 2525	343.10 341.00						
426.6 449.0	1118.4 1096.0	348.74 348.77		316.8 322.5	316.8 322.5	356.90 356.91					2535 2552	339.90 342.50						
487.5 501.2	1057.5 1043.8	348.71 348.96		323.9 331.4	323.9 331.4	356.88 356.76					2580 2620	344.10 344.00						
520.8 543.0	1024.2 1002.0	348.87 349.03		336.9 342.0	336.9 342.0	356.82 356.77					2655 2670	342.00 341.60						
557.0	988.0	349.20		345.8	345.8	356.79					2720	341.80						
602.0 613.0	943.0 932.0	349.25 348.79		353.6 356.6	353.6 356.6	356.78 356.67					2745	342.60						
637.0 649.2	908.0 895.8	348.56 348.15		359.4 364.1	359.4 364.1	356.63 356.45												
663.0	882.0	350.53	J	367.3 373.5	367.3 373.5	356.35 356.37												
				377.1 380.7	377.1 380.7	356.69 356.61												
				384.4	384.4	356.71												
				389.2 391.7	389.2 391.7	356.70 356.69												
				393.8 399.0	393.8 399.0	356.72 356.47												
				404.3 407.8	404.3 407.8	356.55												
				410.4	410.4	356.48												
				415.5 418.4	415.5 418.4	356.65 356.75												
				420.1 423.9	420.1 423.9	356.55 356.54												
				428.0 432.8	428.0 432.8	356.53 356.53												
				432.8 439.9 443.9	439.9 443.9	356.52 356.38												
				448.3	448.3	356.09												
				462.2 466.6	462.2 466.6	356.51 356.56												
				470.7 481.3	470.7 481.3	356.49 356.54												