

## Appendix B. Illustrations and Photographs



**Photo B1:** This photo is a reconstruction of cuts performed in the felling operation.

**Point A** shows the original horizontal cut made by Team 4 Trainee #2.

**Point B** shows the horizontal cut made by Team 4 Trainer.

**Point C** shows the downward diagonal cut made by Team 4 Trainer.



**Photo B2:** This photo illustrates the designated escape routes established at the start of the felling operations. Point A shows route on the cutter's side and B shows the route established on the offside.

## Illustration B1: Tree Felling Sequence of Events (Six Parts)



### Part One:

Team 4 Trainer finished the back cut and the tree began to fall in the intended direction.



### Part Two:

While falling, the tree hung up in a live aspen. The live aspen was pushed and bent approximately 5 to 6 feet by the weight and pressure until it came into contact with another live

tree of the same approximate size. Team 4 Trainer cut through the remaining holding wood on the off side in an attempt to free the tree. The attempt was unsuccessful.



**Part Three:**

Team 4 Trainer moved 2 to 3 feet forward of the stump and began a second cut with the intent to relieve the pressure on the leaning tree and bring it to the ground. As he completed the second cut, the tree came off the stump and the trunk broke into two separate pieces in addition to the butt piece.



**Part Four:**

The butt section broke and was forced out the cutter side. The lower or bottom part of the tree fell to the ground in the expected direction. The upper piece, however, was catapulted by the pressure of the bent live aspen, back toward where Team 4 Trainer was located.



**Part Five:**

The top section of the tree fell at an angle towards the cutter. The bottom of this piece hit the ground and impaled itself with the upper part continuing to fall toward the Team 4 Trainer's location.

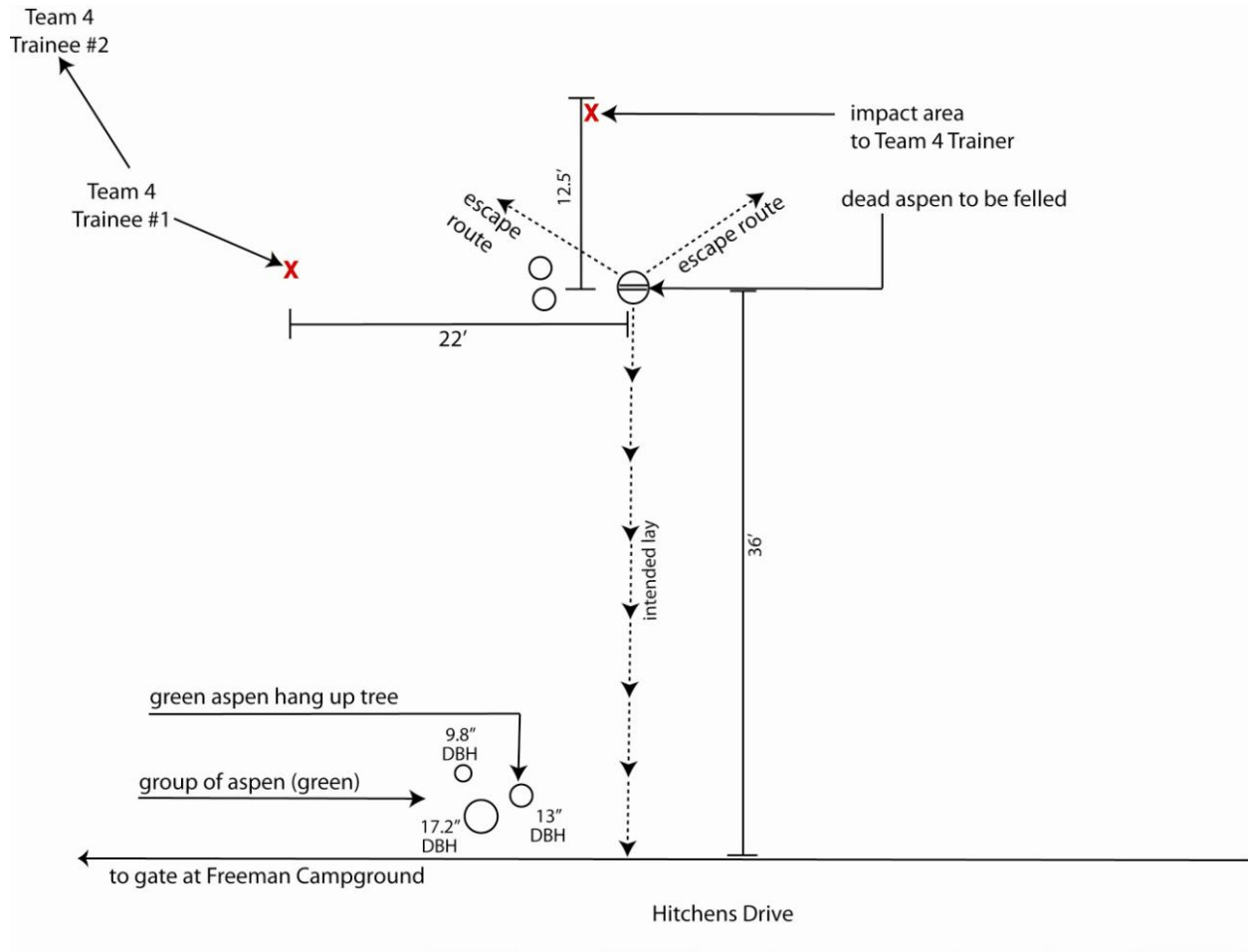


**Part Six:**

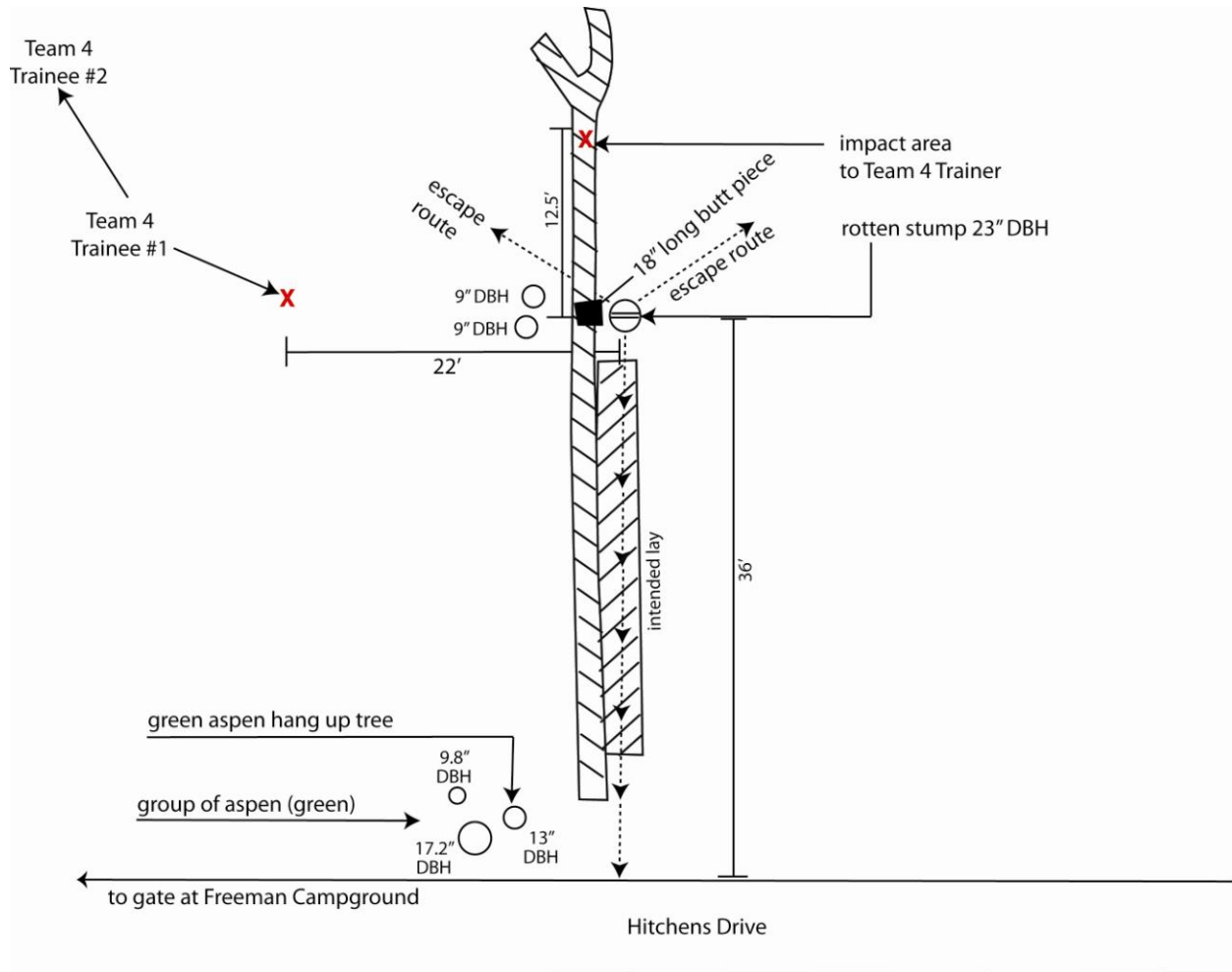
The upper portion of the tree strikes Team 4 Trainer in the back of the head and back, driving him to the ground, and coming to rest on top of him.

# Illustration B2: Overhead View of Accident Site Prior to the Tree Falling

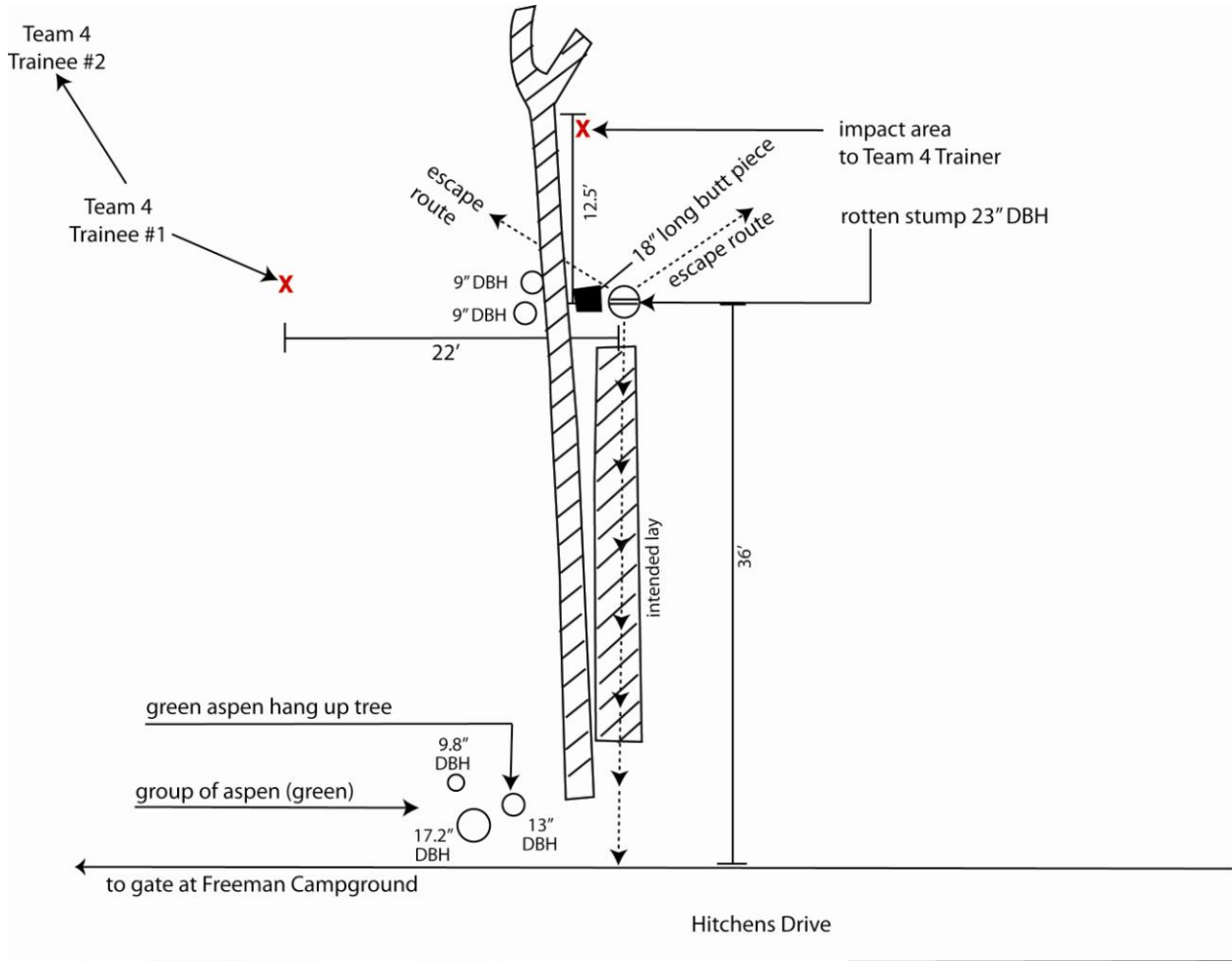
(Not to scale)



**Illustration B3: Overhead View of Accident Site Post Accident (Not to Scale)**



### Illustration B4: Overhead View of Accident Site Post Accident with Tree Moved (Not to Scale)



## **Appendix C. Hard Hat Inspection Report**

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On June 26, 2009, Brett Stearns, Engine Captain of the Little Snake Field Office, was fatally injured during a tree felling training exercise. At the request of Stan Palmer, Chief Investigator of the Serious Accident Investigation Team, Brett's hardhat was examined by John Smith of the Missoula Technology and Development Center (MTDC) on August 12, 2009.

### **Hardhat Data**

Manufacturer: Bullard, Model FH911C with Bullard Sure Lock® Suspension  
Date of Manufacture: Hardhat - May, 2006; Suspension – July, 2006  
Compliance: USTC certified to NFPA 1977-2005 and ANSI Z89.1-2003 Type I, Classes E & C (Figure 1)

### **Inspection Findings**

When it arrived at MTDC the hardhat suspension was clipped into the shell by 4 of the 6 attachment points (key and key slot system). Prior to arriving at MTDC, the suspension had been removed and then replaced in the hardhat, but it was reported that immediately post-accident the two side attachment keys had popped out of their respective key slots.

The only observed damage to the suspension system was to both of the rear attachment keys which were broken off of the suspension (Figure 2). The four remaining attachment keys appeared undamaged and functioned properly to attach the suspension to the shell.

A visual inspection of the hardhat shell revealed only one area of damage. There was a 1-1/2 inch long crack in the shell in the area of the right rear suspension key slot (Figure 3). This crack went through the full thickness of the shell material. Aside from this crack, the shell showed no visual effect of the impact sustained. In overall appearance the hardhat was in good condition with a normal amount of light scuffing and scratching as expected with use. There were no obvious misshapen or deformed areas.

### **Discussion**

The hardhat meets the head protection requirements of the 2009 Interagency Standards for Fire and Fire Aviation Operations (Redbook), Chapter 7. The hardhat appears to have performed as designed. This hardhat was certified as meeting the test requirements of ANSI Z89.1, Type I, which includes a test for protection from top impact. According to the investigation report, the impact received was to the back of the hardhat more than directly to the top. Therefore it would be inappropriate to make any comparison between the impact force received and the impact force specified in the ANSI Z89.1 test procedures. Discussion with the hardhat manufacturer indicated that the type of damage seen to this hardhat was unlike any their lab had seen in the course of

testing to meet the top impact standards as specified in ANSI Z89.1. Lacking additional information concerning the weight of the tree, falling height and strike angle, it is impossible to make any estimate of the impact force in this incident.

Figure 1 – Compliance Label



Figure 2 – Condition of inside of hardhat



Figure 3 – Damage to shell, right rear suspension attachment area

