Burn Severity

The 2010 Schultz Fire burned 15,051 acres of Ponderosa Pine and mixed conifer forest, two and a half miles north of Flagstaff, Arizona between June 20th and 30th, 2010. The fire burned across terrain with slopes ranging from 5 to 25% in the piedmont and up to 100% in the mountain highlands. Figure 1 below shows the burn severity and subwatersheds. And Table 1 shows the burn severity area summary. As the table shows, sixty-six percent of the affected area burned at moderate to high intensity, destroying much of the vegetation and organic duff layer that previously covered the forest floor. The burn severity in the watersheds created conditions favorable for the formation of debris flows and hyper concentrated flows. It is likely that while the magnitude of floods from a given amount of precipitation will diminish as time passes, the conditions favorable to flood formation will persist in the watershed for the next ten to twenty years (Haessig, 2010; Meyer et al, 2001).

Figure 1: Burn Severity and Subwatersheds.

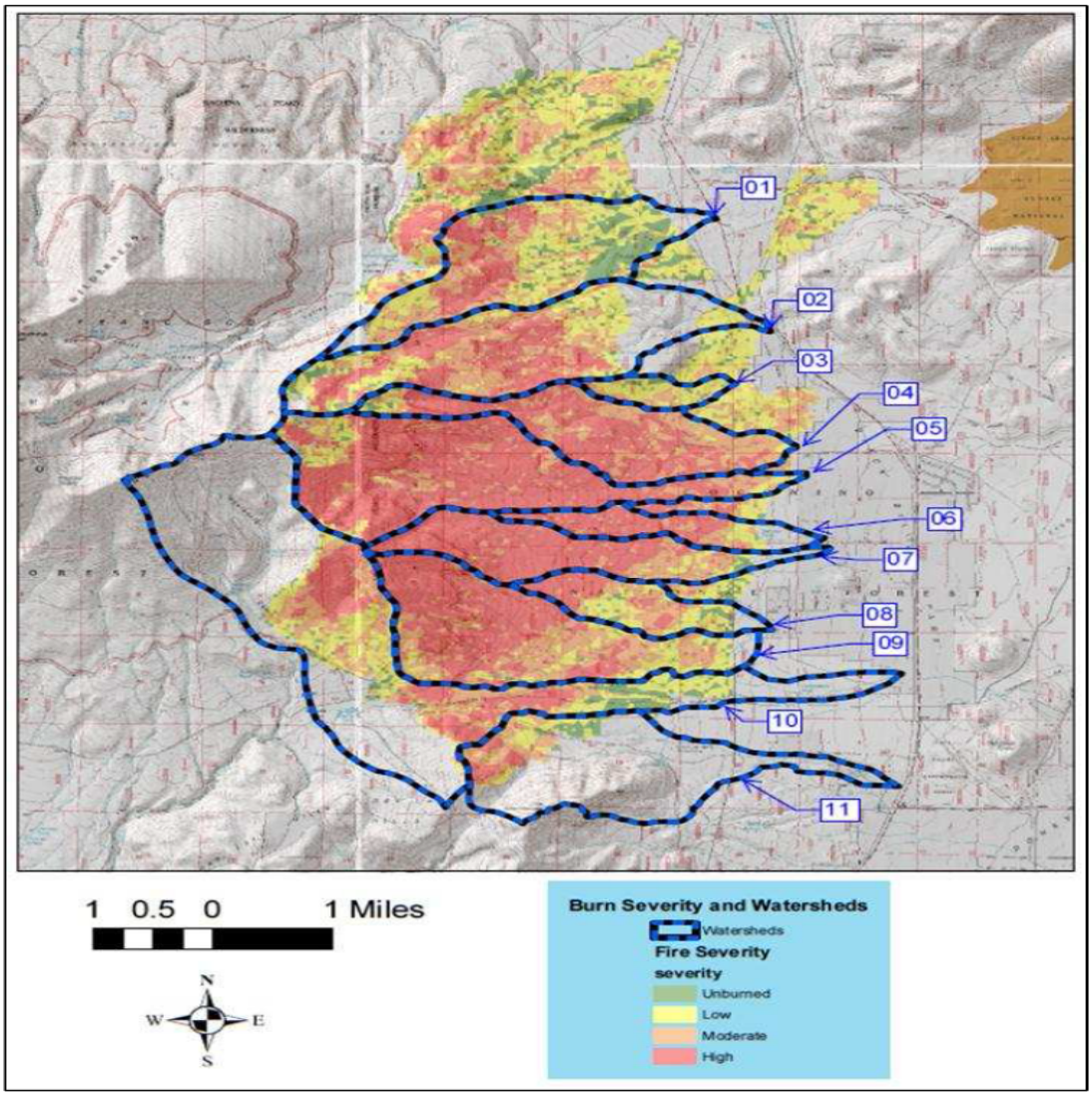

Table 1: Burn Severity Summary.

Burn Severity	Area (acres)	Percent of Burned Area (%)
Unburned	1,222	8%
Low	3,825	25%
Moderate	4,128	27%
High	5,876	39%
Total =	15,051	

Flagstaff Fireshed Hydrology will design watershed models of the project area located southwest of the past 2010 Shultz fire. The watershed modeling will depict the consequences of forest fires. The purpose of the watershed modeling is to determine the amount of runoff which will occur when taking into account several factors. First, the current watershed with existing conditions prior to a fire must be analyzed and modeled. After delineating and modeling the current watershed conditions, pre and post fire conditions on the watershed can be analyzed and modeled. Table 2 lists the burn severity by each of subwatersheds which are shown in Figure 1. Subwatersheds 4, 5, 6, 7 and 9 experienced high burn severities on more than 50% of the subwatershed area, and subwatersheds 5 and 7 experienced high burn severities on more than 70% of the subwatershed area.

Table 2: Burn Severity by Subwatershed

		Burn Severity Within Subwatershed									
		Unburned		Low		Moderate		High		Total Burned	
Subwatershed	Subwatershed Area (acres)	(acres)	(%)	(acres)	(%)	(acres)	(%)	(acres)	(%)	(acres)	(%)
1	1,525	355	23%	480	31%	423	28%	266	17%	1,525	100%
2	1,847	438	24%	399	22%	475	26%	535	29%	1,847	100%
3	216	24	11%	116	54%	63	29%	12	6%	216	100%
4	1,197	19	2%	59	5%	412	34%	707	59%	1,197	100%
5	2,026	58	3%	127	6%	309	15%	1,532	76%	2,026	100%
6	473	80	17%	35	7%	80	17%	277	59%	473	100%
7	1,003	57	6%	47	5%	182	18%	716	71%	1,003	100%
8	535	74	14%	153	29%	150	28%	158	30%	535	100%
9	1,715	74	4%	224	13%	540	32%	876	51%	1,715	100%
10	3,852	2,468	64%	480	12%	456	12%	447	12%	3,852	100%
11	1,563	1,268	81%	91	6%	133	9%	70	5%	1,563	100%
	Totals =	**4,915**		**2,213**		**3,225**		**5,598**		**15,952**	

Photo 1 to 4 shows the waterline is buried in FSR 146 which Brad Higginson and Jeremy Haines evaluated on 7/3/2010. Several of the crossings have the potential to threaten the waterline and road. The drainages are typically very steep and have the potential for debris flows due to the amount of high burn severity in the area.

Photo 1: Aerial views of the municipal water line and FSR 146.

Photo 2: The line crosses several steep drainages

Photo 3: Typical drainage crossings along waterline.

Photo 4: Risk of down cutting into the road is high at these crossings.

The intensity of the fire, granular soils, and steep slopes made the burn area highly susceptible to the generation of debris flows and hyper concentrated flows by runoff from intense summer monsoon storms common in the area. The first storm to generate such flows from the burn area occurred on July 16, with the largest occurring on July 20, exactly one month after ignition of the fire. On July 20, a 10-yr Average Recurrence Interval (ARI) storm dropped up to 92 mm (3.6 in)

of rain on the area. The resulting flows damaged houses and infrastructure in the communities immediately downstream of the burn area.