

WATERSHED FIELD SURVEY

To gather physical data about land uses and pollutant sources, a field survey of the Upper Granite Creek Watershed was conducted in 2010 by Prescott Creeks and the Granite Creek Watershed Improvement Council. Creek Crew volunteers walked 16.5 miles of stream in this watershed to systematically document sources and causes of excess nutrients and *E. coli* bacteria in Granite Creek and its tributaries.

Survey Methods

A field survey data form was developed to provide a consistent approach to documenting volunteer observations along the creeks. The design of the data form was based on watershed surveys in other parts of the country, but adapted to the specific conditions and pollutants of concern in the Granite Creek watershed. This was the first field survey of its type in Arizona.

Creek Crew volunteers walked 16.5 creek miles in the Upper Granite Creek Watershed from March 27 to July 28, 2010, with nearly $\frac{3}{4}$ of the segments visited on March 27th during a full day training and field event. The field survey focused on the developed portion of the watershed within the City of Prescott and unincorporated Yavapai County jurisdictions. Because of the locations and lengths of creek within the developed areas, the mileage of each creek assessed was highly variable. The survey did not include segments in the Prescott National Forest. The survey also excluded a few urban segments as requested by land owners after a preliminary public notification by Prescott Creeks about the field survey.

The drainage area covered by the field survey, stream segments assessed, urban areas, and all sites documented are illustrated in **Figure 8**.

During the field survey event held on March 27, 2010, Creek Crew volunteers received training in local water quality issues, nonpoint source pollution, field survey protocols, and Global Positioning System (GPS) unit operation before assessing their assigned stream segments in small groups. The in-class training portion of the event lasted for approximately three hours. After lunch, volunteers spent three to four hours in the field. Volunteers were assigned segments based on their familiarity with the area, physical ability, and access to transportation. Nearly 40 volunteers participated in the day-long event.

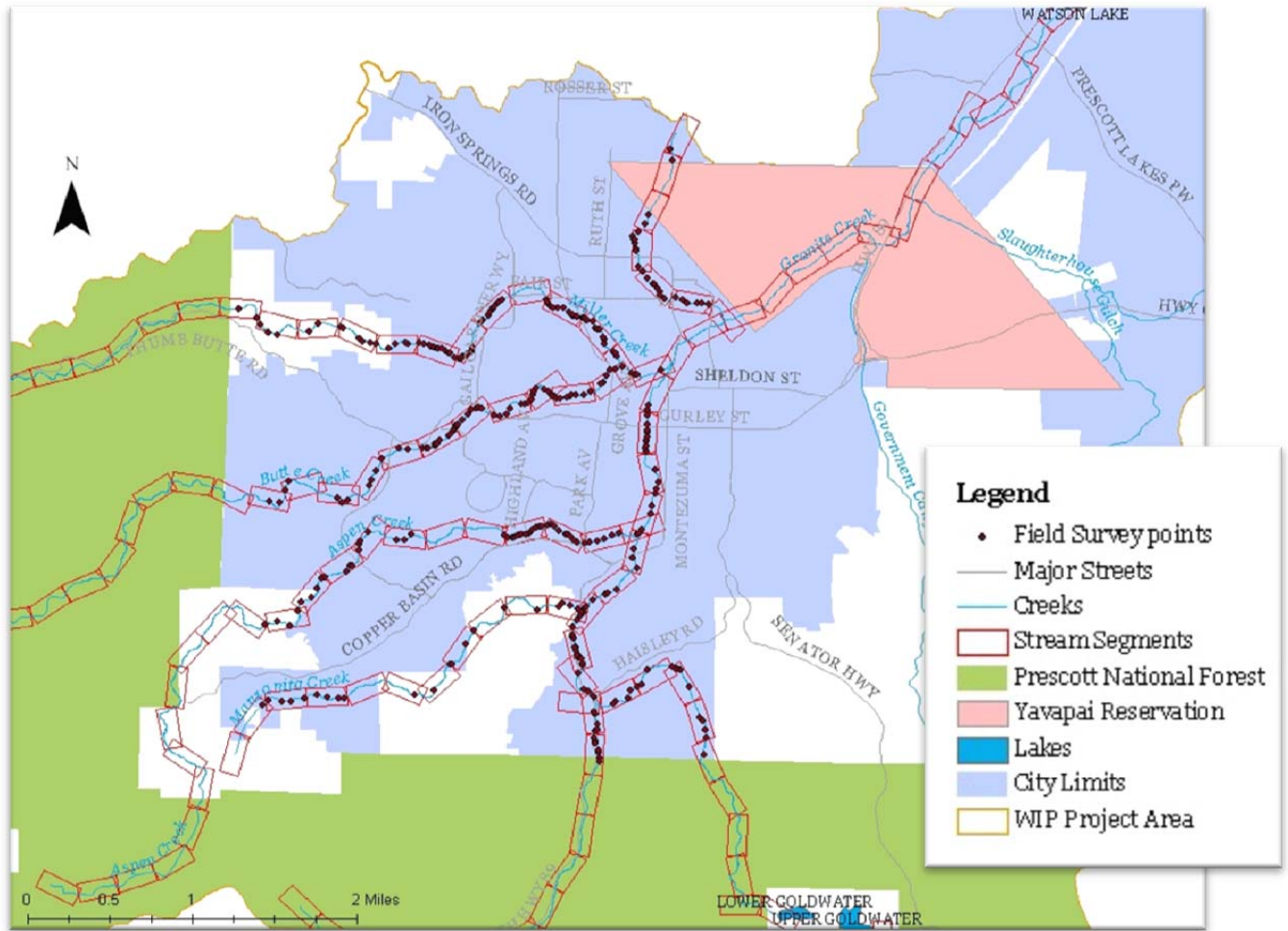


Figure 8: Field Survey Area & Impact Sites

The Upper Granite Creek Watershed Field Survey focused on the developed portion of the watershed within the City of Prescott and unincorporated Yavapai County. Drainage features, impacted riparian buffers, and other potential pollution sources were observed in the 16.5 miles of creek covered by the survey.

Source Categories

For analysis purposes, the information collected can be grouped into the following three categories:

- Stormwater drainage features – Pipes, ditches, and culverts are used in the watershed to directly convey stormwater discharges to the stream from roads, roofs, and parking lots
- Impaired buffer – Buffer impairments within 30 feet of the stream were recorded in two sub-categories:
 - Structures built within the riparian area, such as: buildings, walls, roads, bridges, patios, sewer manholes
 - Activities or land uses that might negatively impact riparian vegetation and stream bank stability: hiking paths, grazing, landscaping, animal corrals
- Pollutant hot spots – The survey focused on identifying documenting the following:

- Wastewater sources: gray-water discharges, sewer lines and manholes, and leaking septic systems within the riparian area
- Garbage and yard waste
- Drainage from fertilized areas such as lawns, golf courses, gardens, and crop land
- Disposal of pet wastes and drainage from animal corrals or grazing areas
- Recreation or gathering areas without toilet facilities

Survey Analyses and Findings

Creek Crew volunteers walked along the creeks and recorded activities, drainage features, and structures in the stream channel or within about 30 feet of the stream. Although the width surveyed varied due to terrain and structures, the area immediately along the stream was the focus of this survey. Activities, structures and piped discharges within 30 to 50 feet of the stream are the most likely to have a direct impact on surface water quality or riparian vegetation.

Photos

Figures 9, 10 and 11 provide examples of the types of impacts documented by volunteers through the field survey by source category.



Figure 9: Stormwater Drainage Features

Stormwater drainage features observed were pipes and culverts associated with the city and county stormwater infrastructure but also unofficial pipes and ditches draining roofs and properties.



Figure 10: Pollutant Hot Spots

Pollutant hot spots were potential sources of nutrients and bacteria that were not a land use or activity within the buffer or associated with stormwater drainage. Examples of pollutant hot spots were household garbage/waste; tree and lawn trimmings; sewer lines and manholes; animal corrals or waste; and drainage from fertilized areas.



Figure 11: Buffer Impairments

Buffer impairments were recorded as any structure or land use/activity occurring within 30 feet of the creek. Common buffer impairments included roads and driveways; walls, fences, and buildings; debris and bank stabilization efforts.

Data Limitations

Certain limitations are inherent in this data. A relatively large number of volunteers collected most of the data with only one morning of training. The ability to identify sources of nutrient and/or bacteria pollution and buffer impairments differed among the volunteers. Documentation of potential sources was also more difficult in older and more complex urban areas of town where multiple sources are embedded in the landscape.

To mitigate such problems, the information collected was screened prior to data analyses to provide more consistency in documentation and to further focus on causes and sources of fecal bacteria and nutrient contamination. For example, sites where construction wastes (i.e.; concrete blocks) were noted but were unlikely sources of nutrients or bacteria were dropped from this analysis. Also, photos taken by the volunteers were used to fill in some missing information.

Survey Summary by Stream

A summary of the field survey findings is shown in the **Table 4**. “Sites per mile surveyed” were calculated to allow comparisons of the findings between streams.

Table 4: Granite Creek Field Survey Data Summary

A total of 328 sites were observed during the field survey. Miller, Granite, and Butte Creeks had the highest number of sites surveyed per mile while Banning and Manzanita Creeks had the lowest number of sites surveyed per mile. The majority of sites surveyed fell into the impacted buffer category.

CREEKS	TOTAL SITES	SURVEYED (miles)	SITES PER MILE SURVEYED	MAJOR CATEGORIES		
				Stormwater Drainage (sites)	Impacted Buffer (sites)	Pollutant Hot Spots (sites)
Aspen	51	2.75	18.5	18	48	35
Banning	17	1.50	11.3	14	7	4
Butte	63	2.75	22.9	31	47	31
Granite	66	2.50	26.4	35	49	22
Manzanita	22	2.25	9.8	15	10	3
Miller	82	3.00	27.3	39	64	39
North Fork Granite	27	1.75	15.4	18	19	14
TOTALS	328	16.5	19.9	170	244	148

Compared to the average sites per mile surveyed of 19.9, both Banning and Manzanita had many fewer sites, while Miller and Granite many more sites per mile. This suggests that pollutant loading is comparatively lower on Banning and Manzanita Creeks, and higher on Miller and Granite Creeks. For further explanation of each category, please refer to the document titled “Analysis of a field survey in the Upper Granite Creek Watershed, Prescott, Arizona in 2010: an assessment to identify major sources and causes of nutrients and *E. coli* bacteria.”

Conclusions

A summary of findings is provided in **Table 5**. It shows the major causes and sources identified in the field survey. To support comparisons among creeks, the sites per mile surveyed on each creek is provided.

Higher than average scores (red numbers) occur in more than one category along Miller, Granite, and Aspen creeks. Therefore, watershed improvement and education projects should be targeted in these areas.

Scores well below average (green numbers) indicate that Banning and Manzanita Creeks have lower scores in several categories. Therefore, areas along these streams likely provide good reference conditions – the conditions that improvements in other drainages would hope to meet in the future.

It is important to consider why the individual drainages are different as we explore potential sites for future water quality improvement projects. This includes land use restrictions or riparian area protection policies along different streams. If land along Banning and Manzanita is simply less developed than along Miller, Granite, and Aspen, we must also consider development or land use changes in the future.

Table 5: Source and Cause Comparison

Scores well above average are shown in red italics (problem areas), while scores well below average are in green italics (reference conditions). Out of the seven source and cause categories, Miller Creek had the highest number of problem areas in five categories, followed by Granite with three categories.

CREEKS	SITES	STORM WATER DRAINAGE	IMPACTED BUFFER		WASTE WATER	FERTILIZER	TRASH & YARD WASTE	ANIMALS
			Structure	Activity				
SITES PER MILE SURVEYED								
Aspen	51	<i>6.5</i>	14.9	<i>11.6</i>	6.9	<i>7.6</i>	2.2	2.2
Banning	17	9.3	<i>4.0</i>	<i>0.7</i>	<i>2.7</i>	<i>0</i>	<i>0</i>	<i>0</i>
Butte	42	11.3	13.8	6.9	3.6	4.4	2.2	0.7
Granite	66	<i>14.0</i>	<i>16.4</i>	<i>8.0</i>	6.8	<i>0.4</i>	1.2	1.2
Manzanita	22	<i>6.7</i>	<i>4.0</i>	<i>0.9</i>	<i>0.4</i>	<i>0</i>	<i>0.4</i>	<i>0</i>
Miller	82	<i>13.0</i>	<i>19.7</i>	6.0	<i>7.7</i>	2.3	<i>4</i>	<i>2.7</i>
No. Fork Granite	27	10.3	10.3	<i>2.9</i>	5.1	1.1	<i>4</i>	<i>0</i>
AVERAGE		10.3	12.8	5.9	5.0	2.6	2.1	1.2