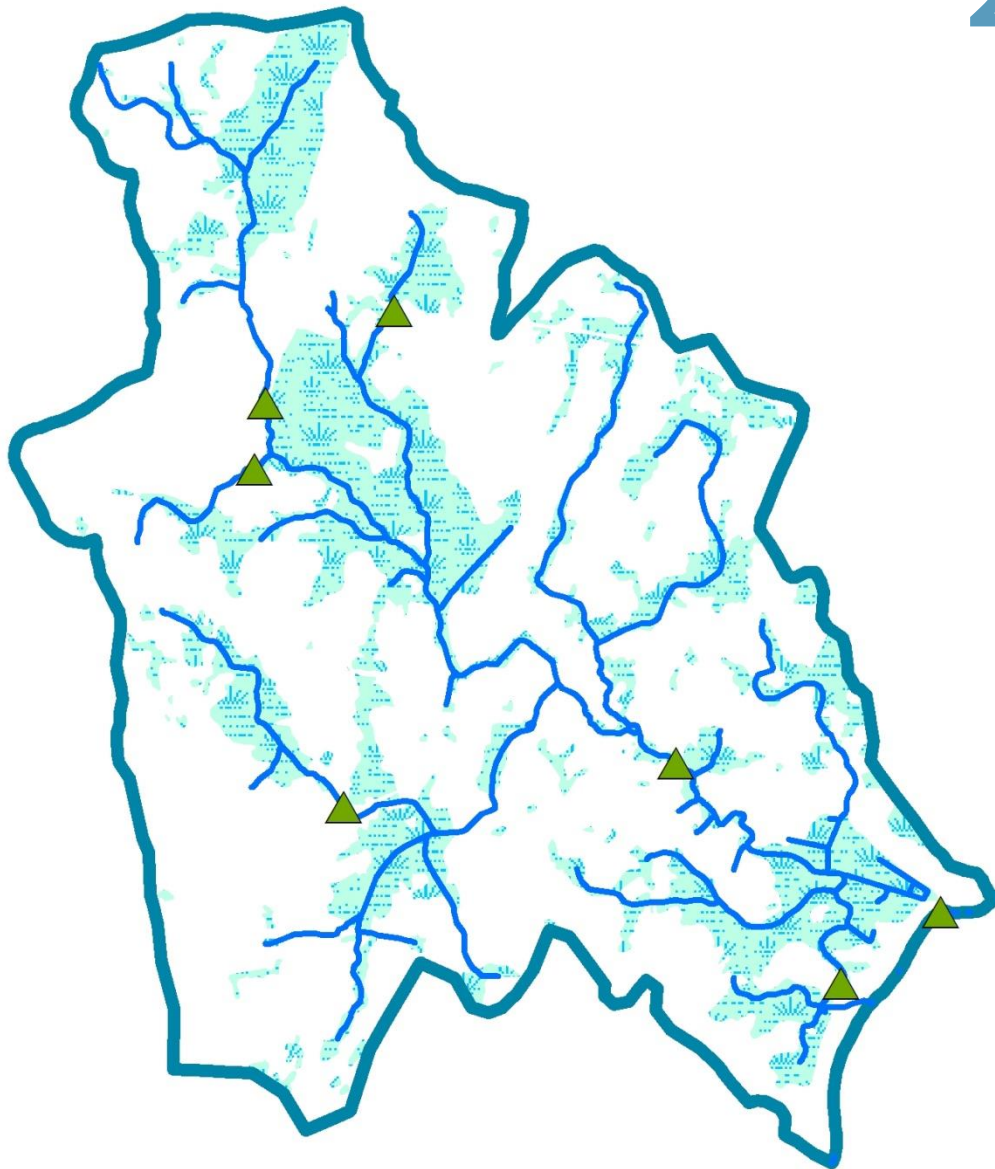


LITTLE RIVER

NORTH HAMPTON, NEW HAMPSHIRE

WATER QUALITY MONITORING REPORT 2015



PREPARED FOR



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BACKGROUND

The NH Department of Environmental Services (NHDES) lists the Little River in North Hampton, NH as impaired due to elevated concentrations of bacteria. This impairment is likely attributed to nonpoint source pollution in stormwater runoff and malfunctioning septic systems within the watershed. In recent years, these high bacteria counts have led to occasional beach advisories at North Hampton State Beach. FB Environmental Associates (FBE) has worked with the Town of North Hampton since 2009 to help identify and monitor potential sources of bacteria within the Little River watershed. This memo summarizes the results of continued watershed monitoring in 2015.

HIGHLIGHTS

- Geometric means for all sites exceeded State standard for *Enterococci* bacteria in 2015
- Bacteria levels overall have increased since 2009; highest counts measured in 2015
- Consistently-high bacteria counts observed near beach houses (BCH25)
- All sites showed low percent dissolved oxygen below the State standard in 2015

METHODOLOGY

During the summer sampling season (July 1 – September 30, 2015), FBE staff visited seven sampling sites within the Little River watershed. Each site was sampled four times - twice during dry weather conditions (8/3/2015, 9/18/2015) and twice during wet weather conditions (8/12/2015, 9/11/2015; Figure 1). Wet weather was determined as: >0.1" of precipitation in the prior 24 hours; or >0.25" in the prior 48 hours; or >2.0" in the prior 96 hours. Conditions were considered dry weather when precipitation was <0.1" for each day within 72 hours.

At each site visit, FBE staff collected grab samples for bacterial analysis (*Enterococci*). *Enterococci* bacteria are used as an indicator of the presence of fecal matter in saltwater by the NHDES Beaches Program. In New Hampshire, the State water quality standard for *Enterococci* is 104 colonies/100mL for a single grab sample and 35 colonies/100mL for the geometric mean of multiple samples. Though the Little River is a freshwater stream, the saltwater water quality standard was used to assess the impact of the Little River on potential beach closures in North Hampton. In addition to bacteria samples, FBE staff also recorded dissolved oxygen, salinity, and temperature.



North Hampton State Beach. Photo credit: FBE.

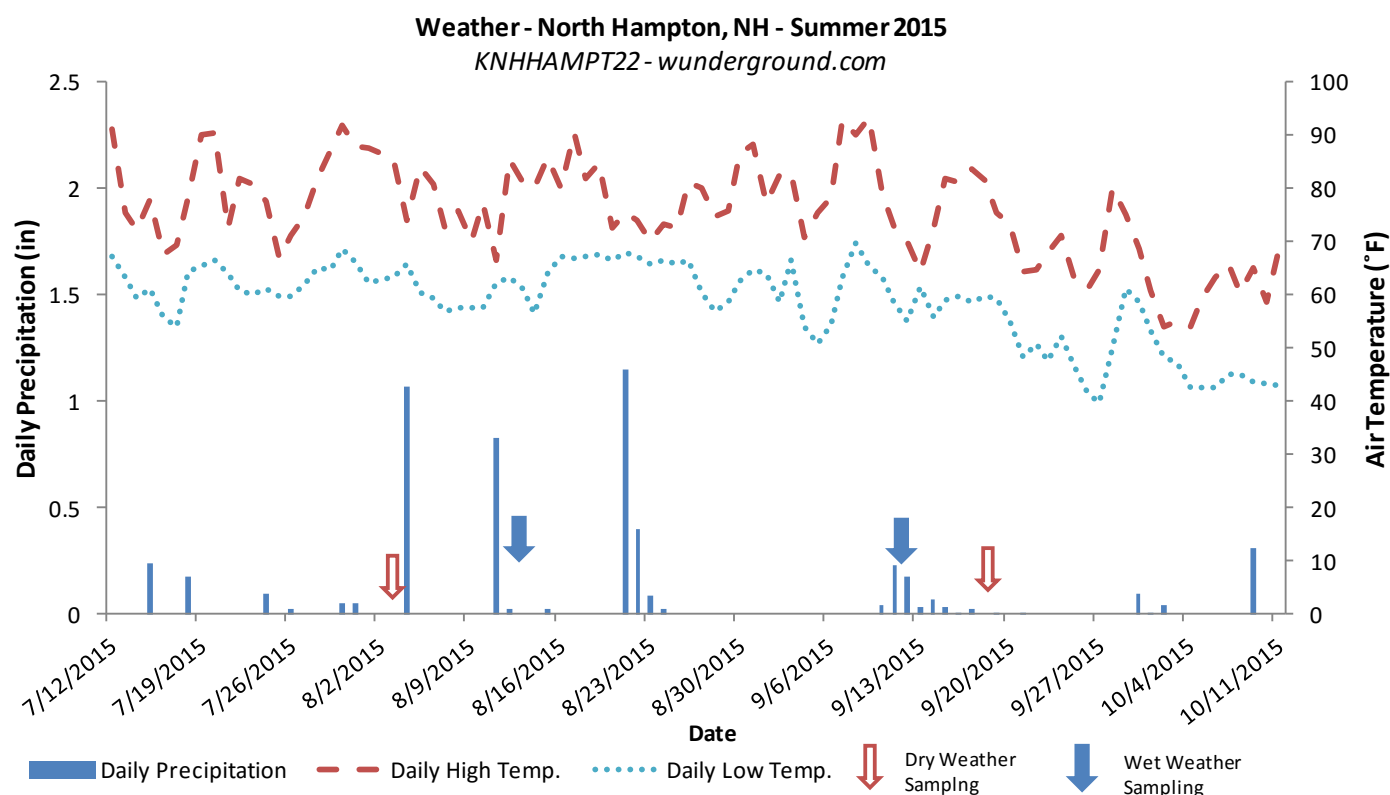


FIGURE 1. Hourly air temperature and daily cumulative precipitation for a weather station near the Little River, North Hampton, NH.

BACTERIA ANALYSIS RESULTS

Based on the geometric mean of four sampling visits, all sampling sites exceeded the geometric mean standard for *Enterococci* bacteria (Table 1). Additionally, 82% of samples exceeded the instantaneous standard, ranging from 20 to 14,100 col/100mL (Attachment 1). Two sites with the highest bacteria levels (BCH25, BCH17) are located at opposite ends of the watershed (Figure 2). BCH25 is located close to the river's outlet to the Atlantic Ocean; in contrast, BCH17 is close to the headwaters of the Little River, draining an area along Route 1 (Lafayette Road). As expected, fewer bacterial colonies were present during dry weather than during wet weather. Only NOHA2 had a geometric mean (during dry weather) that fell below the State criteria.

TABLE 1. Geometric mean of bacteria results by site and weather. Bolded and italicized text indicates exceedance of bacteria standard.

Site	<i>Enterococci</i> (colonies/100mL)		
	Overall	Dry Weather	Wet Weather
BCH 17	<i>1,346</i>	<i>942</i>	<i>1,923</i>
NOHA 2	<i>709</i>	<i>134</i>	<i>3,748</i>
NOHA 4	<i>67</i>	32	<i>138</i>
BCH 23	<i>828</i>	<i>401</i>	<i>1,713</i>
WOODLAND	<i>328</i>	<i>67</i>	<i>1,595</i>
BCH 25	<i>3,887</i>	<i>3,143</i>	<i>4,808</i>
LR OUT	<i>637</i>	<i>363</i>	<i>1,120</i>
State criteria for <i>Enterococci</i> geometric mean is 35 col/100mL.			

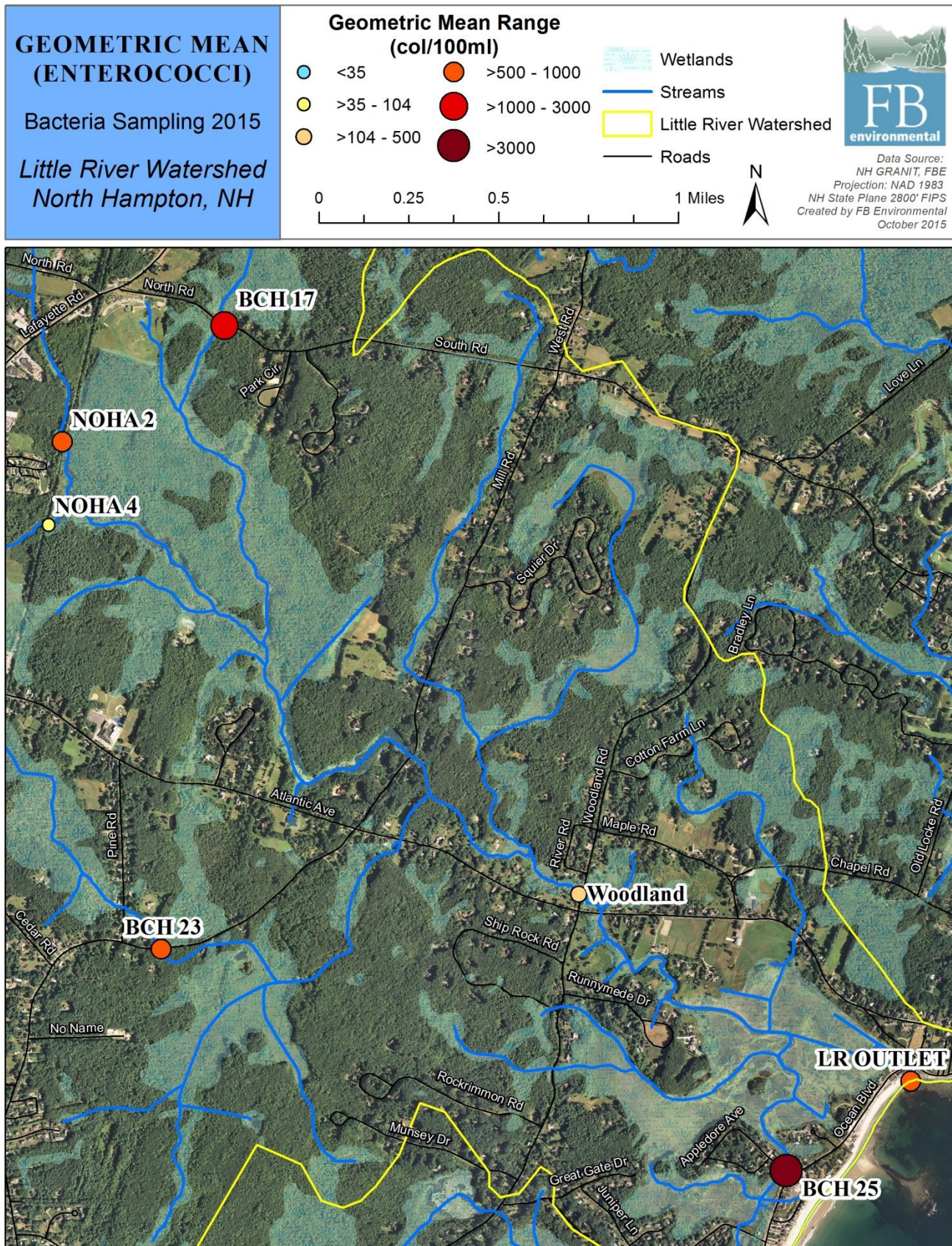


FIGURE 2. Summary of 2015 bacteria sampling results in the Little River watershed.

HISTORICAL AND RECENT BACTERIA PATTERNS

Overall, bacteria levels have increased over time, though sampling intensity has also increased and expanded seasonally. Sites can vary quite dramatically year to year; for example, the amount of bacteria at BCH17 quadrupled between 2014 and 2015. One pattern that has emerged since 2013 is the consistently-high bacteria levels near the dense housing by the beach.

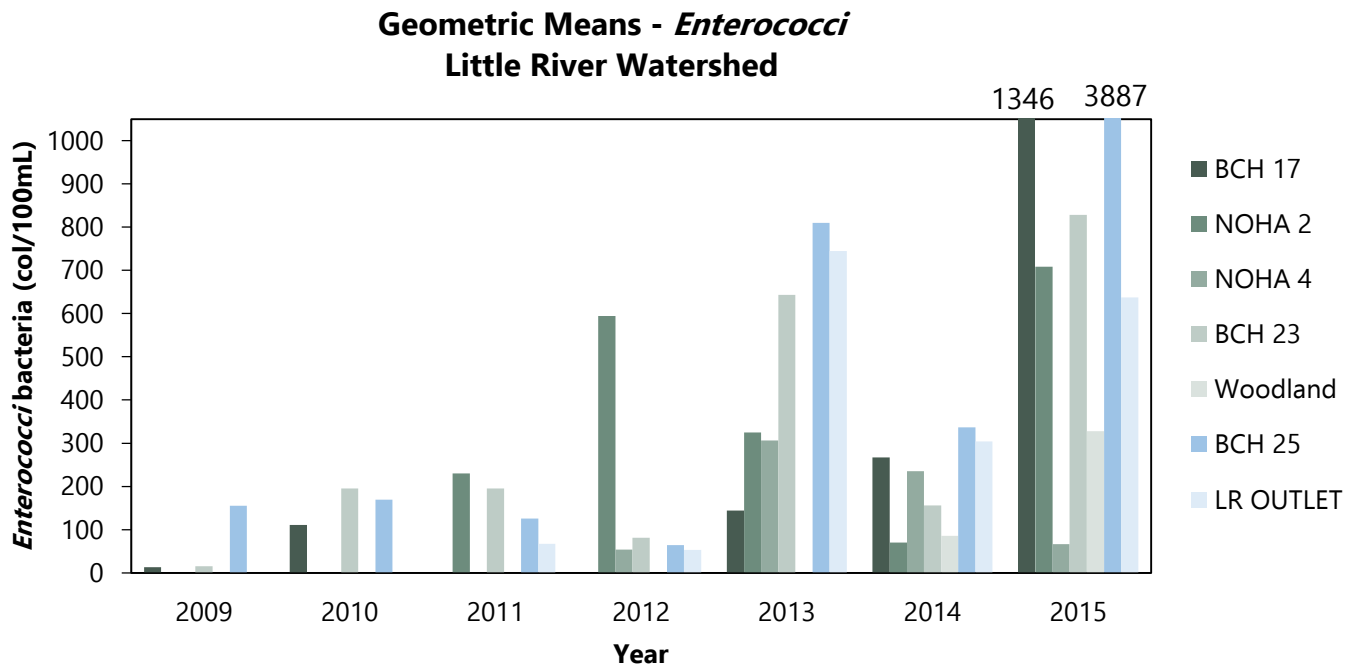


FIGURE 3. Summary of bacteria sampling in the Little River Watershed from 2009 to 2015. From left to right, sites are ordered from upstream to downstream. Blue sites are heavily influenced by tide and have salinity > 10 ppt.

TEMPERATURE AND CHEMICAL ANALYSIS RESULTS

Several sites showed low dissolved oxygen (Table 3). Aquatic life, such as macroinvertebrates and fish, are stressed in waters with oxygen below 5 mg/L. Water temperatures and salinity were within the typical range for each site, depending on its proximity to the tidal outlet of the Little River.

TABLE 3. Summary of water quality measurements for each site. Bolded and italicized text indicates exceedance of standards or thresholds for water quality parameters.

		Temp. (°C)	Dissolved Oxygen (%) ¹	Dissolved Oxygen (mg/L)	Salinity (ppt)
Standards/Thresholds		24	75	5.0 freshwater	0.5 freshwater 32 seawater
SITE	BCH 17	17	65	6.3	0
	NOHA 2	17	74	7.1	0
	NOHA 4	20	17	1.5	0
	BCH 23	19	64	6.1	0
	WOODLAND	22	57	5.0	1
	BCH 25	19	37	8.0	25
	LR OUT	19	50	8.0	27

¹ Dissolved oxygen measurements corrected for the effects of salinity for salinity > 10 ppt.

<http://water.usgs.gov/software/DOTABLES/>

ATTACHMENT 1: 2015 WATER QUALITY AND BACTERIA RESULTS FOR THE LITTLE RIVER WATERSHED.

BOLDED AND ITALICIZED VALUES EXCEED INSTANTANEOUS LIMITS FOR ENTEROCOCCI (104 COL/100ML).

Date	Wet/Dry	Site ID	Temp (°C)	DO (%)	DO (mg/L)	Salinity (ppt)	Enterococci (col/100mL)
8/3/2015	DRY	BCH 17	19.0	69.7	6.5	0.0	<i>14,100</i>
8/3/2015	DRY	NOHA 2	17.9	75.9	7.2	0.0	<i>134</i>
8/3/2015	DRY	NOHA 4	22.1	8.5	0.7	0.0	52
8/3/2015	DRY	BCH 23	20.2	47.8	4.3	0.0	<i>419</i>
8/3/2015	DRY	WOODLAND	26.1	70.4	5.7	0.0	<i>146</i>
8/3/2015	DRY	BCH 25	19.0	63.9	7.8	30.0	<i>882</i>
8/3/2015	DRY	LR OUT	18.5	69.9	7.8	30.0	<i>565</i>
8/12/2015	WET	BCH 17	16.6	61.8	6.0	0.0	<i>638</i>
8/12/2015	WET	NOHA 2	17.2	71.4	6.8	0.0	<i>1,081</i>
8/12/2015	WET	NOHA 4	19.7	23.9	2.2	0.0	<i>364</i>
8/12/2015	WET	BCH 23	18.8	72.9	6.7	0.0	<i>813</i>
8/12/2015	WET	WOODLAND	19.9	41.1	3.7	2.0	<i>738</i>
8/12/2015	WET	BCH 25	18.7	18.7	8.3	20.0	<i>2,064</i>
8/12/2015	WET	LR OUT	18.4	42.5	8.1	25.0	<i>1,014</i>
9/11/2015	WET	LR OUT	18.3	36.4	8.0	28.0	<i>1,236</i>
9/11/2015	WET	BCH 25	18.5	15.4	8.1	24.0	<i>11,199</i>
9/11/2015	WET	WOODLAND	20.4	50.0	4.5	1.8	<i>3,448</i>
9/11/2015	WET	BCH 23	18.0	63.0	6.0	0.2	<i>3,609</i>
9/11/2015	WET	NOHA 4	19.8	7.0	0.5	0.3	52
9/11/2015	WET	NOHA 2	17.2	64.0	6.2	0.3	<i>12,997</i>
9/11/2015	WET	BCH 17	17.3	61.0	5.8	0.3	<i>5,794</i>
9/18/2015	DRY	BCH 17	15.0	68.0	6.8	0.0	63
9/18/2015	DRY	LR OUT	18.8	52.5	8.0	26.0	<i>233</i>
9/18/2015	DRY	BCH 25	18.8	50.3	8.0	25.0	<i>11,199</i>
9/18/2015	DRY	BCH 23	18.1	72.2	7.3	0.0	<i>383</i>
9/18/2015	DRY	WOODLAND	19.6	64.7	5.9	0.0	31
9/18/2015	DRY	NOHA 4	19.8	29.7	2.8	0.0	20
9/18/2015	DRY	NOHA 2	16.3	83.5	8.1	0.0	<i>134</i>