TECHNICAL | MEMORANDUM

TO: Dan Hudson, Director of Engineering, Town of Salem

FROM: Laura Diemer & Christine Bunyon, FB Environmental Associates

SUBJECT: Task 2: 2018 MS4 Catchment Investigation

DATE: July 23, 2018

CC: James Danis, Town of Salem; Forrest Bell, FB Environmental Associates

BACKGROUND

Several waterbodies and beaches in Salem, NH have been identified by the NH Department of Environmental Services (NHDES) as impaired for the designated uses of aquatic life and primary and secondary contact recreation due to elevated pollutants such as nutrients, chloride, metals, and fecal indicator bacteria. Elevated levels of these pollutants are likely from nonpoint source pollution in stormwater runoff from developed land. As a designated Municipal Separate Storm Sewer System (MS4) community, the Town of Salem is required to screen all stormwater outfalls for pollutants to help satisfy Illicit Discharge Detection and Elimination procedures under the 2017 New Hampshire Small MS4 General Permit. Outfalls that are known problem areas or have water quality that does not meet permit criteria must be further investigated via upstream catch basins or other connecting stormwater conveyances to identify possible pollutant sources for remediation. **This memo provides a brief review of Task 2: Catchment Investigation results for select stormwater outfalls to Arlington Mill Reservoir.**

METHODOLOGY

In spring and early summer (April-July 2018), FBE staff conducted dry weather screening at 26 outfalls to Canobie Lake, Captain Pond, Millville Pond, and the Arlington Mill Reservoir, following procedures described in the 2017 New Hampshire Small MS4 General Permit. Out of the 26 outfalls screened, two outfalls (ARL-0425-OF and ARL-0879-OF) were flagged for further investigation due to elevated levels of total ammonia, total chlorine, and fecal indicator bacteria (Table 1). ARL-0425-OF showed total ammonia over the limit of 0.50 ppm and total chlorine above the detectable limit of 0.02 ppm, indicating possible human fecal contamination; however, surfactants at this site were below the limit of 0.25 ppm. Per guidelines in the 2017 New Hampshire Small MS4 General Permit, both total ammonia and surfactants, along with either fecal indicator bacteria or total chlorine, must exceed criteria for an outfall to be considered likely contaminated by human sewage. Olfactory (smell) or visual evidence of sewage alone or in combination with water quality indicators can also flag an outfall for possible human sewage contamination. ARL-0425-OF is unlikely to be impacted by human fecal sources, but possibly by other fecal sources. ARL-0879-OF showed elevated specific conductivity, total chlorine, and fecal indicator bacteria, indicating possible greywater and/or road salt contamination.

TABLE 1. Summary of MS4 water quality measurements during dry and wet weather screening. Bold, italicized text indicates exceedance of (failure to meet) criteria for water quality parameters.

Site ID	Weather	Temp (°C)	DO (%)	DO (ppm)	Salinity (ppt)	Spec Cond (µS/cm)	Total Amm (ppm)	Total Chlorine (ppm)	*E. coli* (mpn/100mL)	Surfactants (ppm)
Thresholds		<28.3	>75.0	>5.0	<0.5	<835	<0.50	<0.02	<88	<0.25
ARL-0425-OF	Dry	8.2	***53.4***	5.99	***0.5***	641	***1.00***	***0.42***	***2420***	<0.10
ARL-0425-OF	Wet	18.9	***60.0***	5.50	0.2	477	0.25	0.00	***>2420***	<0.1
ARL-0879-OF	Dry	12.5	***16.8***	***1.29***	***1.7***	***1694***	0.00	***0.17***	***548***	0.10

ARL-0425-OF on 6/25/18 (left) and ARL-0879-OF on 4/24/18 (right). Photo Credit: FBE.

Both catchments were investigated on 6/21/18 during dry weather (preceded by <0.10" of rainfall for each day within the prior 72 hours). FBE staff was assisted in the field by James Danis (Town of Salem) to remove catch basin grates and provide information on historic or current activities in the catchment areas. The catchment for ARL-0425-OF was also investigated on 6/28/18 during wet weather (1.13" of rain in prior 24 hours) due to the presence of System Vulnerability Factors (SVFs), as determined by Weston and Sampson. Each catchment area was surveyed and remapped (if applicable) according to in-field observations of hydrologic conveyance overland and to stormwater drains. Upstream catchbasins at major junctions (if applicable) were opened and inspected for flow. Samples were collected if flow was present. Observations were noted for potential contamination sources in the catchment area (e.g., fertilizers, pet waste, wildlife waste, etc.).

RESULTS

Observations, notes, and photographs were taken for each catchment investigation (Table 2) and maps were updated for corrected catchment area (if applicable) and possible pollutant sources (Figures 1-2). No catch basin had flowing water to sample in either catchments; most catch basins had sumps filled with stagnant water.

Several possible contamination sources were noted in the catchment area to **ARL-0425-OF**. Residential lawns were large and well-manicured, suggesting that several properties likely fertilize their lawns regularly. Fertilizers can contribute to nutrient runoff. Although there was no visible pet waste, James Danis estimated that about 30% of residents in the area own a pet. Waterfowl have also been known to congregate on the lawn adjacent to the shoreline at map-lot 28-5506, where there are no barriers to the water's edge. Waterfowl waste, as well as pet waste, are likely

contributing nutrients and fecal indicator bacteria to areas at or near the catch basins or outfall. A dead and decomposing animal odor was noted between catch basins 3 and 5 (moving upstream from the outfall); a decaying animal in the storm drain may be causing the elevated total ammonia and fecal indicator bacteria levels. No evidence of household detergents (greywater) were found in the catchment during the dry weather investigation; however, during wet weather, an observation was made by a homeowner at 26 Marys Lane (map-lot 28-5604) regarding suds at the water's edge that were traveling from the south along his property. Sampled water at the outfall was also clearer during dry weather than wet weather, which appeared brown, and may be from washed-out organic matter in the sumps following the heavy rain storm.

Several possible contamination sources were noted in the catchment area to **ARL-0879-OF**. Roughly 70% of the catchment area was vegetated with a mix of deciduous and non-deciduous trees, leaving 30% of the catchment impacted by residential development and roads. Lawns west of the outfall were well-manicured and possibly fertilized. James Danis stated that there is less irrigation and chemical use further up in the catchment and roughly 10-20% of homeowners in this area have pets. A bag of pet waste was also spotted in the flow path downstream of ARL-0879-OF at the initial screening on 5/24/18 (but not during the investigation on 6/21/18), indicating that pet waste may be a significant contributor of elevated fecal indicator bacteria to the area. Twelve Canada geese were spotted swimming at the water's edge at map-lot 40-5257 where there was minimal to no buffer separating a well-manicured lawn with the Arlington Mill Reservoir. Although this area was outside of the ARL-0879-OF catchment, the newer homes on the water's edge (map-lot 40-5255, 40-5235, and 40-5252) have their backyard lawns leading directly to the water's edge, where waterfowl can easily access and defecate. No visual evidence of household detergents (greywater) were found during the site investigation.

Homeowner observation and comment regarding suds at water's edge at 26 Marys Lane (map-lot 28-5604).

A bagged pet waste specimen (circled in red) was found a few feet downstream of ARL-0879-OF.

TABLE 2. Catchment investigation notes and observations made on 6/21/18 during dry weather conditions and on 6/28/18 during wet weather conditions.

Site	Map-Lot	Catchment Investigation Observations
ARL-0425-OF	28-5600 28-5527 28-5537 28-5522 28-5504 28-5500 28-5503 28-5569	These properties had well-manicured, possibly fertilized lawns. No active flow was found at the catch basins; most were submerged with stagnant water and had no visible inlet or outlet flow. The submerged/stagnant catch basins are likely located at or below the water table and reflect groundwater seepage to the catch basins. No water was observed at the catch basins near map-lot 28-5536 (likely due to location at higher elevation above water table). There was a noticeable dead animal smell from catch basins 3 to 5 (adjacent to map-lot 28-5554, 28-5555, 28-5568). This odor was not apparent one week later during wet weather (and total ammonia was less during wet weather than during dry weather). About 30% of residents in the area have pets, but no pet waste was seen from the side of the street during the investigation.
ARL-0879-OF	40-5255 40-5253	No active flow was noted at the catch basins; most were submerged with stagnant water and had no inlet or outlet flow. Most of the catchment area was forested, but two large, possibly fertilized residential lawns were noted. A flock of 12 Canada geese were seen swimming along the water's edge three lots away from the catchment area and likely enter the catchment. A bag of pet waste was spotted on the day of initial screening (5/24/18) in the outfall flow channel but was not seen during the day of investigation (6/21/18).

RECOMMENDATIONS FOR NEXT STEPS

The catchment area to **ARL-0425-OF** was investigated because of elevated fecal indicator bacteria, as well as elevated total chlorine and total ammonia, suggesting possible greywater and fecal sources of contamination. The investigation showed that the outfall may be impacted by fecal sources from pets and geese, as well as possible fertilizers and improper disposal of household detergents (suds were observed along shoreline near outfall).

The catchment area to **ARL-0879-OF** was investigated because of elevated fecal indicator bacteria, as well as elevated total chlorine and specific conductivity, suggesting possible greywater, fecal, and road salt/water softener sources of contamination. The investigation showed that the outfall may be impacted by fecal sources from pets and geese, as well as possible fertilizers.

The following provides recommendations for addressing these identified contamination sources in these catchments:

- Distribute educational materials about the water quality benefits of minimizing fertilizer use, discouraging waterfowl from roosting and defecating on lawns adjacent to the water (e.g., enhance shoreland buffer), maintaining septic systems, properly using and disposing of household detergents and chemicals, and properly disposing of pet waste.
- Post signs along the road that encourages proper pet waste disposal and discourages bird feeding.
- Work with private and/or public entities to reduce salt usage on road and parking lots and/or disconnect water softener discharge from leachfields or the stormwater drainage network.

FIGURE 1. Stormwater catchment area to ARL-0425-OF at Arlington Mill Reservoir. Potential pollutant sources noted.

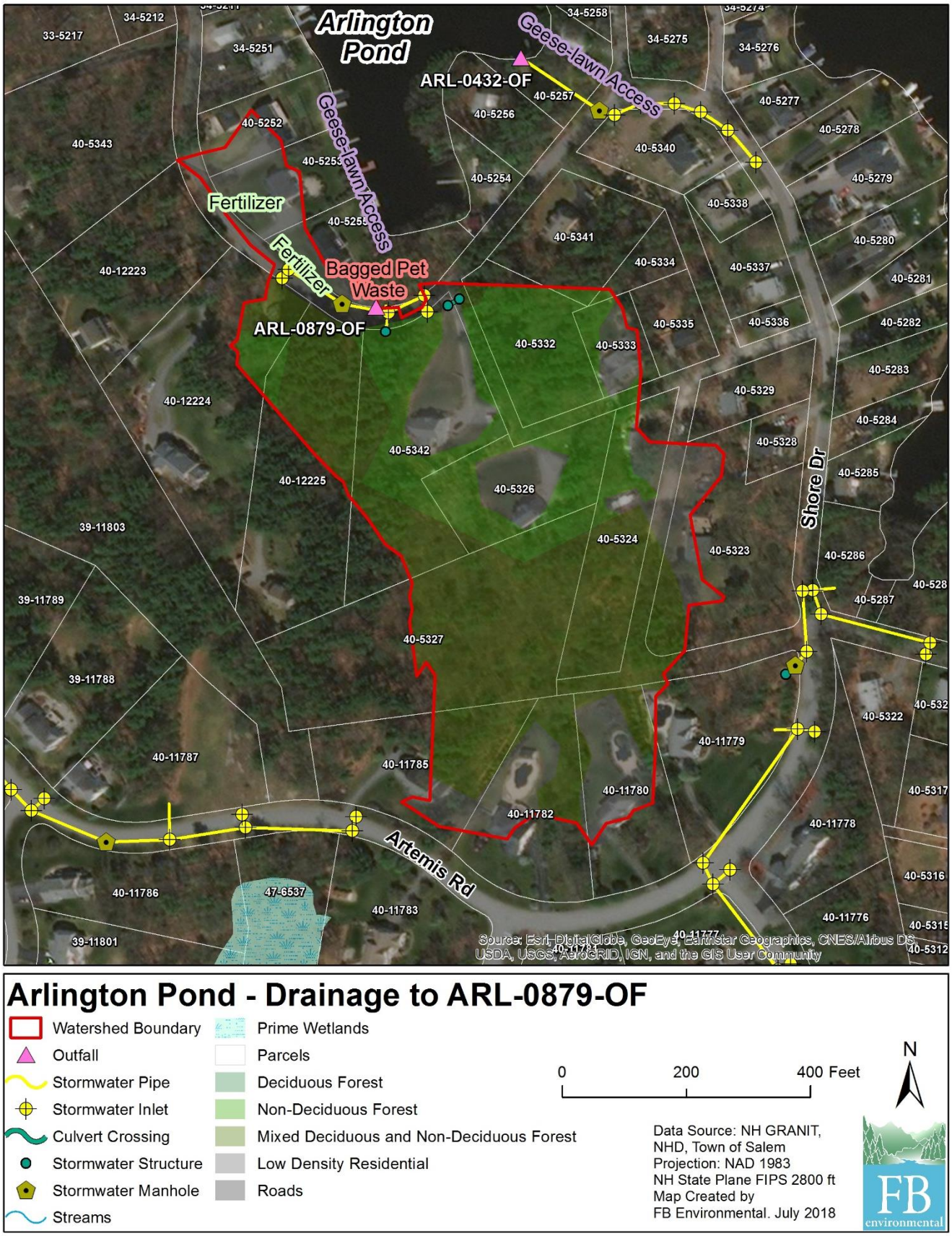

FIGURE 2. Stormwater catchment area to ARL-0879-OF at Arlington Mill Reservoir. Potential pollutant sources noted.