Margarett L. Jones Landscape Ecologist/Consultant 62 Skyline Drive
Groton, CT 06340 860-941-7682

Field SURVEY of

GROTON LONG POINT VERNAL POOL

including

SURROUNDING HABITATS and CONSERVATION AREAS

24 February 2024

1.0 INTRODUCTION

This report has been prepared at the request of the Groton Long Point Conservation Commission (GLPCC), advisors to the GLP Association Board of Directors. It summarizes a 2-year field study of the Vernal Pool located at the corner of Duryea Drive and Mumford Cove Road in Groton Long Point, Groton, CT **(FIG 1)**. For decades, this low-lying wooded area with seasonal standing water has been known as “the skating pond.” A light pole originally installed for night skating still stands, though warmer winters have reduced opportunities for outdoor skating on natural ice. Technically it is a **Vernal Pool**, a unique wetland type protected by Connecticut’s Inland Wetland and Watercourses Law. Vernal pool wetlands provide habitat that is critical to the survival of particular wildlife species. Along with surrounding forested wetland, the vernal pool is important in flood control and groundwater recharge.

Site visits and field work took place from March 2022 - February 2024, during which time I conducted a detailed survey of the plants and animals associated with the pool, and a more general overview of adjacent and surrounding upland and wetland habitats. The 1.1-acre forested study pool lies within a contiguous 56.6-acre block of undeveloped property connected to four other smaller parcels designated as Conservation Area **(FIG 2)**. This landscape mosaic of forest, shrubby meadow, fresh and saltwater wetland habitats lies close to Bluff Point Coastal Reserve and Haley Farm State Park, and is physically connected to these larger preserves by water, tidal marsh, beach and undeveloped coastline/trails. My efforts have focused on one large (1.1acre) vernal pool, only a fraction of the total preserve. In the context of the associated upland and wetland habitats, it is a keystone feature, interconnected to surrounding life zones that collectively provide critical breeding, feeding, nesting, and refuge areas for a diversity of animals and plants year-round. I spent time surveying the surrounding habitats in order to better understand and describe these important connections. This document details the flora and fauna associated with the study pool and gives an overview of the surrounding habitats, their rich natural history and their importance to the pool and associated life zones. This study is in response to the concerns of various GLP residents and members of the GLPCC. The Groton Inland Wetland Commission has regulatory authority over vernal pools, intermittent watercourses, and freshwater marshes. The State of Connecticut Department of Energy and Environmental Protection (DEEP) regulates activities around tidal wetlands. Raising awareness and improving understanding of these fragile interconnecting ecosystems will help to ensure their protection and viability.

The goal of this project is to better understand the flora and fauna associated with the vernal pool and its relationship to surrounding natural communities and make scientifically informed management recommendations in order to protect GLP’s natural resources in alignment with GLPA goals. With increasingly evident impacts of climate change, especially sea level rise, this is a good time to raise awareness about the role of the natural landscape in helping to protect our low-lying shoreline community. This

report concludes with recommendations to better protect the vernal pool and surrounding habitat and gives high priority to species and habitat conservation for the benefit of human health.

2.0 SITE OVERVIEW

2.1 History and Ecological Change

A Native American presence on the land dates back at least 10,000 years, and remnant stone walls, wells and historic cultural features can be found in just about any coastal forest, including at GLP. Long Island Sound, Fishers Island Sound, Mumford Cove and Palmer's Cove surround the GLP peninsula. A stone wall, running from the upland forest through the salt marsh bordering Mumford Cove dates back to colonial times, if not earlier. Clearly sea level has risen over time, as the wall is now inundated during seasonal high tides and storms. These coastal areas, where salt and freshwater mix, create rich and diverse natural environments full of shellfish, fin fish and other natural resources important to wildlife and people for centuries. Sheltered coves provided food- large beds of oysters, scallops, clams in healthy eelgrass beds, lobsters, eels, striped bass and more— some of which still thrive today.

In the 19th and 20th centuries, most of GLPs original coastal habitat was lost due to development along its wild natural shoreline. Homes were built on sand dunes, marshes dredged and wetlands filled. Subsequent pollution from runoff and sedimentation, as rain falls on impervious man-made surfaces, causes flooding and washes pollutants into sewers and storm drains. This can overwhelm treatment plants and cause raw sewage discharges. While treated sewage no longer enters from upstream, excess nitrogen, heavy metals, plastic particles, pet feces, pesticides, lawn chemicals, and acids running off lawns and roads continue to contaminate our coastal resources. Excess algal growth due to increased nitrogen is one of several visible reminders of pollution in our coves and bays.

We are living in the *Anthropocene Age*— a relatively new term (2008) referring to this current period of time in history when human activities have become the most important drivers of climate change, causing the warming of both the atmosphere and the ocean, altering weather patterns and directly influencing the shoreline and species mix of local wildlife. Natural shoreline habitats play a crucial role in protecting the built environment near the coast. Beaches, dunes, and salt marshes act as mechanical buffers against storm waves and serve as giant sponges capable of absorbing and slowing storm-driven water runoff from built areas. GLP, Mumford Cove, and all low-lying shore communities are now more vulnerable than ever to severe storms, mostly because we have destroyed and built over natural coastal dunes, wild beach habitats and salt marshes that naturally buffer us from storms. With altered weather patterns attributed to climate change, hydrological changes and changes to the forest are evident in the upland conservation areas bordering GLP tidal marshes. Salt marshes also provide a

critical coastal buffer that filters and cleanses water flowing into LI Sound, now impacted by sea level rise. This makes it more important than ever to preserve the undeveloped GLP lands in their natural state, particularly in the designated conservation areas.

2.2 Landscape Setting

Groton Long Point peninsula is part of a diverse mosaic of unique marine, estuarine and terrestrial ecosystems located in Groton, a densely populated region of Connecticut and the east coast of the United States.

The study vernal pool is imbedded in a larger greenway bounded by Sound Breeze Avenue to the South, Atlantic Avenue to the West and extending North and West across Mumford Cove to Bluff Point Coastal Reserve and North and East along the old trolley trail and Palmer's Cove to Haley Farm State Park, **altogether comprising over 1200 acres.** These interconnected undeveloped habitats are an integral part of a complex of NATURAL COMMUNITIES: maritime and upland forest, shrubby thicket, meadow, sand plain, freshwater wetlands of varying ecologies (including forested wetlands with other small vernal pools), extensive tidal wetlands and beaches connected to Long Island Sound **(FIG 3)**.

3.0 VERNAL POOL OVERVIEW

A vernal pool is a small body of standing fresh water, most obvious during the winter and spring seasons when water level is at a peak. Vernal pools are typically temporary in nature, filling with water from autumn rains and melting snow in spring *(vernalis* is the Latin word for spring) and usually drying up by mid-late summer. The water collects in a depression that has an impermeable layer of soil, leaves and organic debris. Lacking an inlet to replenish supply, sun and heat eventually evaporate the water. A dense forest canopy of deciduous trees growing in and around the pool slows the drying of the pool and protects inhabitants from harmful ultraviolet radiation. The leaves that carpet the pool each year from the canopy and surrounding forest form the basis of the vernal pool and forest food chain. The pool may refill after heavy or prolonged rains, but the main characteristic is its temporary nature. **By definition, a vernal pool must: *contain water for approximately two months during the growing season; occur within a confined depression or basin that lacks a permanent outlet stream; lack any fish population; and dry out most years, usually by late summer.* The GLP vernal pool meets all these criteria.**

Vernal pool wetlands provide a unique microhabitat essential to the life-cycles and survival of certain wildlife species, especially amphibians and particular invertebrates. *Some of these organisms cannot successfully reproduce anywhere else*. Because vernal pools are dry much of the year, they can be easily overlooked and inadvertently damaged or destroyed. The fact that they dry up most years and therefore cannot support fish that would eat amphibian eggs and tadpoles is a key physical characteristic of vernal pools. For spotted and marbled salamanders, wood frogs, and others, it is a race against time- hatch, grow and get out before the pool dries up. Fairy shrimp and tiny invertebrates in the pool can *only* survive if the pond dries up, as their eggs require

a dry period. Amphibians worldwide have declined at an alarming rate. Causes include habitat loss and disturbance, especially when wet areas are drained for development and where forest fragmentation eliminates habitat needed for hatching eggs, growing larvae, and survival of adults (many of which live for decades). Vernal pools are more sensitive to disturbance than other types of wetlands. Because amphibians have a two-staged life-cycle, an aquatic larval stage and a terrestrial adult stage, they are sensitive to both terrestrial and aquatic environmental impacts. Amphibian skins are highly permeable, making them susceptible to toxins in the environment, road salt, chemical contaminants from pesticides and herbicides, ultraviolet-B radiation, artificial lighting (street lights, building lights), climate change and disease.

3.1 Survey Methods

I surveyed biota in and around the vernal pool between March 2022- February 2024, visiting 3-4 times or more per season. Specimens were identified by direct field observation- visually, by sound (frogs and birds), and by collection, wading into the pool using a dip net. I used Google Earth Pro and desk-top mapping to approximate the areas of interconnected land and wetlands. Because I live nearby, I walk, bike or drive past the pool daily, allowing opportunities to closely monitor the pool and surrounding habitats. During the study period, our region experienced below average rainfall in 2022, followed by above average rainfall in 2023, the third-wettest year on record for CT, (since 1904).This is good news for the current generation of vernal pool inhabitants whose life cycles can be disrupted during drought years. A list of documented flora and fauna is attached to this report (**Section 6.0**).

3.2 Results/Discussion Vernal Pool

The GLP vernal pool is identified in Connecticut's Natural Diversity Data Base, although until now no formal survey has been conducted. It supports a healthy diversity of flora and fauna based on samplings and observations during multiple visits in every season. From January-April, portions of the 1.1-acre pool have as much as 30"-36" of standing water. This 1-acre wooded wetland, at 12" deep, holds approximately 330,000 gallons of water; at 24" deep it holds over 600,000 gallons of water. Water temperature ranges from just above freezing in winter to about 80 degrees Fahrenheit in mid summer. The biological diversity of the pool is surprising for several reasons: (1) it lies close to an intersection of two roads and is subjected to runoff (including road salt and other contaminants) after heavy rain. During winter in 2023 and 2024, the pool filled to within 10 feet of the road in several spots; (2) In past years, treated municipal water was intentionally pumped into the pool (flushing fire hydrants?); (3) spraying of herbicides and pesticides, which can negatively impact water quality and overall ecosystem health (**Section 4.1**); and (4) tree cutting, hauling and dumping has occurred, with heavy machinery driving across the western end of the pool creating deep ruts. Additionally, the general topography to the north of the pool, along Mumford Cove Road, has been altered in the past by earth-moving equipment, the dumping of rocky fill and the creation of a parking area and ditches, including one long ditch and culvert connected to Groton Utilities' sub-station (**Section 4.2**). Some of these depressions create shallow decoy

pools that can trap developing amphibian and insect larvae. The water evaporates more quickly in small isolated pools, before the larvae can complete development. Overall, the study pool seems to have recovered from past disturbance in the immediate surrounding forest and wetland, a testimony to the resilience of nature. As the large study pool starts to shrink in mid-spring, developing amphibian tadpoles and young move to deeper sections. Amphibian larvae become more concentrated in smaller areas of deep water. By mid-July, 2 or 3 shallow puddles at the center is all that remains of the vernal pool. The importance of the quality of the surrounding upland is of critical importance (**Sections 3.3, 4.0**).

3.3 Results/discussion of Animals and Plants found in GLP pool

Several different salamanders, including two types of **mole salamanders**- the **Spotted salamande**r *Ambystoma maculatum* and the **Marbled salamander**, *A. opacum* - utilize the study pool and surrounding upland and wetland habitats. These two species are **obligate vernal pool species**. They breed *only* in vernal pools, and nowhere else. They are large and long-lived, 25-30 years, returning to the same pool (or an adjacent pool) every year to breed. Females can reach lengths of 7”-9”. Male and female **spotted salamanders** migrate to the pool from the surrounding woodlands in late winter/early spring, usually on rainy March nights when temperatures are in the upper 40’s. The females lay eggs in gelatinous masses, about the size of a tennis ball, on submerged vegetation or fallen branches. Tadpoles develop over spring and early summer, gradually growing legs and losing their feathery gills before emerging as land-dwelling adults as the pond dries up. Adult salamanders leave the pool and live on land in leaf litter, under rocks or in burrows beneath the surface in surrounding wooded areas. Though they may travel up to a mile, their non-breeding home ranges are typically within a few hundred yards of the pool. In September or October, the smaller **marbled salamanders** (5”) arrive and await autumn rains. Females carefully guard their eggs under logs and roots in the dry pool until it fills with water. These and other vernal pool dwellers are extremely sensitive to disturbance. After breeding, adult salamanders leave the pool and migrate to upland areas. Some individuals cross Duryea Dr. and Mumford Cove Rd, as evidenced by road kills in 2022, 2023 and early 2024. They all rely on leaf litter, fallen branches, roots of standing trees and subtle features of the pool and surrounding habitat where they live and breed. This is why it is important not to cut or remove any trees or fallen branches in vernal pools and adjacent woodlands, to not remove or dump leaves or debris into the pool, or grade the surrounding substrate in a way that could impede amphibian migration or impact water levels in and around the pool. No berms should be constructed along the roads around the pool, Treated water from households or hydrants should never be used to fill the pool, even during drought years. Aquatic invertebrates and amphibians (which breathe through their skin) cannot tolerate heavy metals, road salt, pesticides or chemicals. No additional filling, draining, soil rutting, hauling or skid roads should take place near the pool. While not always possible due to site size, configuration, and pre-existing conditions, the Environmental Protection Agency **(EPA) recommends preserving 1000’ radius area beyond the edge of a vernal pool as forested upland habitat**.

Wood frog (*Rana sylvatica*) and **Fairy shrimp** (*Eubranchipus vernal*) are also **obligate vernal pool species** identified in the study pool. The distinctive “quack” of male wood frogs may be heard starting in mid-late February, as air temperatures approach 50 degrees F. They have a short early breeding season. Fairy shrimp, tiny crustaceans related to lobsters and crabs, can be seen swimming around upside down eating algae, flatworm eggs and plankton in the pool from late winter through spring. Like wood frogs, spotted, and marbled salamanders, they do not exist in permanent bodies of water. The cyst-like eggs of fairy shrimp are adapted to periodic prolonged droughts, and can survive for many years in the leaf litter of a dry pool.

In addition to the obligate vernal pool species found here, the study pool has several **facultative species**, animals that live and reproduce in the study pool, but may also use other wetlands. These include another salamander: **Red-spotted (Eastern) newt** (*Notophthalmus viridescens*), more **frog species**: **Pickerel frog** (*Rana palustris*), **Northern spring peeper** (*Pseudacris c. crucifer)*, **Gray tree frog** (*Hyla versicolor)*, **Eastern American toad** (*Bufo a. Americanus*); **turtles**: **Snapping turtle** (*Chelydra s. serpentina*), **Spotted turtle*** *(Clemmys guttata- **state listed), and many **invertebrates**: **Fingernail clams, snails, larval caddisflies** and **dragonflies, backswimmers, water boatmen, giant water bugs, diving beetles, water mites, copepods, midges, mosquitoes, water fleas, oligochaete worms, midges,** and **isopods**. Many facultative species are migrant predators that fly, crawl or hop into the vernal pool to take advantage of the abundant high-quality food supply. During wet years, some of these species can survive and complete development in vernal pools. Salamanders, frogs, dragonflies, caddisflies and their larvae all prey on mosquitoes and other small insects and larvae.

The **trees and shrubs** in and around the pool are adapted to the seasonally flooded soils, and the shade and leaf litter they provide is critical to vernal pool animals. The dominant species in the pool are **Pin Oak,** *Quercus palustris*, **Swamp White Oak**, *Quercus bicolor,* and **Red Maple** *Acer rubrum*. Several of the larger trees survived the 1938 hurricane, and are 80-100 years old. These larger trees have a high value in the pool and adjacent upland because their fallen branches, debris, and cavities provide shelter and overwintering places. Waterlines and buttressed roots are visible around the trunks of trees as the pool dries up. Vegetation in the shrub layer includes smaller trees and saplings (oaks, red maple, **Black Cherry** *Prunus serotina*, **Black birch**- *Betula lenta,* **Sassafras**- *Sassafras albidum*, **American Holly**- *Ilex opaca* and other woodland trees above a thicket of **Sweet Pepper bush**- *Clethra alnifolia*, **Highbush blueberry**- *Vaccinium corymbosum*, **Pinxter Azalea**- *Rhododendron periclymenoides* and various native (and non-native) species. The leaves they shed each fall collect on the bottom of the depression. This leaf litter is broken down by microbes, fungi, bacteria and protozoa forming the base of a complex food web. Decaying leaves are the principal source of nutrients for macro invertebrates including tiny mollusks, crustaceans and insects which are in turn consumed by salamander larvae, turtles, snakes, frogs, toads, birds and other animals. Many native moths and butterflies overwinter in dead leaves on the forest floor.

Several plants considered invasive can be found near the pool edges and within the surrounding woodlands (**Autumn Olive**, **Yellow Groove Bamboo**, **Japanese knotweed, Winged Euonymus**, **Japanese Honeysuckle, and Chinese Privet)**. Stands of invasive plants include aggressive weeds that replace diverse communities of native plants. Dumping of yard waste, filling, cutting and clearing around the edges of the conservation land supplies seeds of undesirable exotic species and creates pathways and platforms for them to become established (see **sections 4.2, 4.3**).

More than 30 animal species and 17 different native plant species were found that are *directly* associated with (breed, live or grow in) the GLP vernal pool. In addition to the creatures that breed *in* the vernal pool, dozens of other species utilize the pool and its surrounding life zones, including several state-listed species. A diversity of animals travel overland or fly long distances to visit the pool for nest sites, food, water, refuge or shelter.

3.4 Associated wildlife

Throughout the year a variety of different animals utilize the study pool, whether it is wet or dry. I would like to highlight a few species of particular interest that I have seen during the study period.

A family of **mallards** has nested on a small rock island in the pool during the survey period (with 8 ducklings in 2022 and 10 in 2023). This pool is a relatively safe and predator-free place to raise a family, and ducklings were observed scooting around until mid summer when they moved overland to salt water. **Wood duck** were observed swimming in the pond briefly during March 2022 and 2023, though they have not used the nest box. Generally, wood ducks prefer natural tree cavities. Herons and other wading birds take advantage of the concentrated food supply, especially as the pool shrinks, and visit frequently throughout the spring/summer season. Dozens of **snowy egrets** roost in the branches of the pool's trees in August. **Black-crowned night heron**, **Green heron**, **Snowy egret***, **Great egret** and **Glossy ibis***(* =state-listed species) nest nearby. **Great-blue heron** regularly hunt in the pool. By day, **Red-shouldered**, **Red-tailed** and **Cooper's hawks** feed on salamanders, frogs, snakes, songbirds and small mammals, especially squirrels, in and round the pool. At night, **Barred** and **Great horned owls** are regular visitors. These diurnal and nocturnal birds of prey are all documented nearby nesters, with both the Red-shouldered and Cooper's hawks having nested within 100' of the pool.

At dusk during summer and autumn, **Red bats** and **Brown bats** hunt for moths, mosquitoes and other insects around the pool.

A variety of insect-eating specialist songbirds nest in the trees, shrubby thickets and on the ground in the woodlands near the pool. These include **Red-eyed vireo**, **Gray catbird**, **Common yellowthroat**, **Blue-gray gnatcatcher**, **Brown thrasher***(state-listed), **American redstart**, **Wood thrush**, **Veery**, **Great-crested flycatcher** and several other long distance neotropical migrants that feed exclusively on insects. Tree cavities in the surrounding forest are utilized by the woodpeckers who create them: **Downy**, **Hairy** and **Red-bellied Woodpecker, Northern flicker**, along with several secondary cavity nesting birds that are here year round. Resident nesting birds include:

Black-capped chickadee, **Tufted titmouse**, and **Eastern bluebird**,. **Northern Cardinal**, **Song sparrow**, **America goldfinch**, **Blue Jay, Carolina wren** and many others. During migration, especially in May and September, many other migrant songbirds take advantage of the water, food and shelter around the pool. All native migrant birds are federally protected under the Migratory Bird Treaty Act.

Raccoon, mink, garter snake and other animals also feed on frogs and salamanders. Because the edges of the pool are dry, land mammals can walk into the basin during several months of the year. **Coyote**, **fisher, bobcat** and **fox** (both Red and Gray fox) patrol the area regularly year-round, feeding primarily on small rodents, including squirrels (red, gray and flying squirrels), mice, star-nosed mole and vole. A small mammal survey using traps would likely turn up several additional species. During late summer, the dry leaf litter offers a cool and protected refuge surrounding a small watering hole for deer. Small herds and family groups of **White-tailed deer** can be spotted year-round. A rare piebald deer was seen by me and others in the adjacent woodland for the past two years. The surrounding forest shows signs of their extensive browse on understory vegetation. During the study period, **bobcat** were seen several times in the vicinity of the pool along Duryea, Island Circle and adjacent tidal marsh. A female with 3 “teenage” kittens was observed in November 2022; an adult male and female were observed together in January 2024 (breeding season).
A large female **Snapping turtle** has been seen near the pool for several years, and likely overwinters there. Each spring, she moves from the pool along a swale that crosses Colony Rd. where she lays eggs in the upland. **Spotted turtle*** (state-listed) have also been observed nearby. Both of these reptiles are known to utilize vernal pools and associated networks of freshwater wetland and upland habitat. They utilize existing landscape corridors to travel between nesting and overwintering sites. A complete list of vernal pool inhabitants and associated wildlife appears at the end of this report (**section 6.0**).

4.0 SURROUNDING LANDSCAPE AND HABITATS

The study pool lies immediately adjacent to Duryea Drive and Mumford Cove Road, surrounded by designated conservation lands and a dense development of homes, roads and associated lawns and driveways around GLP and Mumford Cove communities (Fig 1). There is a close physical, biological and ecological relationship between the freshwater, saltwater, upland and coastal ecosystems and the built environment. Natural landscape corridors, especially forests, through and around developed areas allow animals to travel and colonize new habitats (**Fig 3**).

4.1 Adjacent woodlands, wetlands and meadow

The land immediately surrounding the pool is primarily forested wetland dominated by **Red Maple**. This wetland wraps around the pool to the north and west, with several stream-like connections to other temporary pools of standing water, most evident after rain in winter and early spring. I did not survey these other pools for the presence of salamanders or amphibian egg masses, though I heard calls of spring peepers, gray

tree frogs, and American toads, all facultative vernal pool species, during the breeding season. Though smaller than the study pool, two of these wetlands have many vernal pool characteristics and associated plant species. Importantly, these wooded wetlands store water after heavy rain. A 6” rise in water over a 10-acre wetland places over 1,500,000 gallons of water in storage with no harm to the surrounding biota. Most of the animal species living in the vernal pool require the surrounding forest for part of their life cycles. Tiny toad tadpoles feed on algae in vernal pools and associated wetlands. They take 2-3 years to develop into adults. Spotted and marbled salamanders take 8 years to reach maturity. Little rivulets, depressions, even a small pool created by an overturned tree, create wet corridors and “stepping stones” for amphibians to move across the land (remember, frogs, toads and salamanders breathe through their skin, which cannot dry out).

A rocky ledge, glacial boulders and a small (< 1-acre) meadow rise above the pool to the southwest, enhancing the conservation area’s overall biological diversity with old field and shrubby edge habitat. Several facultative vernal pool species utilize the flowers, fruits and seeds of meadow and edge/thicket plants for food or shelter. The **Brown Thrasher,** a state-listed bird, and **Eastern Towhee**, have been observed in the brushy meadow edge for the past 2 years during the breeding season. The GLP Butterfly Garden across the street focuses mainly on providing host plants (various native milkweeds -*Asclepias spp)*- for Monarch butterflies. Mowing or burning the meadow and managing invasive species will enhance the butterfly area by encouraging additional pollinators- including bumblebees, solitary bees, and butterflies- with a diverse menu of native plants (Goldenrod, Aster, forbs and grasses). Several desirable species grow nearby (along the Trolley line, upper marsh edge) and serve as seed sources. The combination of different habitats around the pool, extending for 700 feet or more, provides critical life zones for salamanders, frogs, birds, insects and other animals during the breeding and non-breeding seasons. I include a general survey list of flora and fauna observed here throughout the seasons at the end of this report (**section 6.0**).

Ditching and manipulation of the land around the vernal pool, primarily on the north side, likely occurred in the late 1960’s. Several of the trees along ditches between the study pool and the GU substation are at least 60 years old. Culverts and drainage pipes near the sub station and at the corner of Mumford Cove Rd and Colony Rd, intercept storm water, but thankfully little, if any, is delivered into the vernal pool. This underground infrastructure, largely abandoned, provides routes for migrating salamanders and turtles. A large female snapping turtle seems to use this pathway, along with many less conspicuous reptiles and amphibians that migrate on dark rainy nights. The Trolley Line R.O.W. provides an important natural corridor between the GLP vernal pool, surrounding forest uplands, and other freshwater marshes and pools.

4.2 GU Substation

In 1968, Groton Utilities purchased a plot of land (1.036 acre) within the designated conservation land, and constructed a substation close to the vernal pool. A pad of fill

was created within the forested swamp to support the structure. At the time the uniqueness of this natural habitat was perhaps not recognized, although it involved the filling of wetlands and the creation of drainage ditches. If this had happened after 1972, it would have required a permit from the Inland Wetlands Commission. Conservation land between the GU property and the vernal pool has been altered by excavation, the digging of ditches, and dumping of fill material. These activities likely impacted the vernal pool and interconnected wetlands and pools, along with ground nesting birds and other wildlife. Throughout this area, most of the forest seems to have recovered and native vegetation dominates the forested wetland in and around the vernal pool. Some of the trees are 60-70 years old. Much of the interconnected wetland habitat to the north and wrapping around the ridge is stream-like in nature with smaller vernal pools and ditches. While I did not specifically survey these areas for amphibians or egg masses, the habitat is ideal for **Northern Dusky salamander**(*Desmognathus fuscus*) and **Two-lined salamander** (*Eurcyea bislineata*). **Redback salamander** (*Plethodon cinereus)* is common in the surrounding woodland.They all forage in the leaf litter and hibernate under roots, rocks and brush piles. A small seasonal pool within the red maple swamp next to the GU substation may also support wood frogs, spotted and marbled salamanders, and fairy shrimp (vernal pool obligates). Coarse gravel used to create parking and roadbeds is difficult for small wildlife species to traverse. These disturbed areas of compacted, poor quality soil along Mumford Cove Road provide an avenue for invasive plants. Residents along Mumford Cove Rd, motorists, and others, regularly discard yard waste and garbage into the wet swale along the road near the substation. Other than the existing GU platform and roadbed, this area should not be expanded, and is not a desirable location for parking cars or depositing fill of any kind.

4.3 Abutting private properties, Conservation Land and Trails

The section of coastal and upland forest between Duryea Drive and the tidal marsh bordered by Mumford Cove (**FIG 2**) is dominated by various oaks and hickories, Red maple, Tupelo, and Sassafras. Several large **Red oaks (***Quercus rubra*) and **Red maple (***Acer rubrum*) are likely over 100-120 years old, along with a few tall **Sassafras** (*Sassafras albidum*) and stands of **Pepperidge-** aka Tupelo or Black Gum (*Nyssa sylvatica*- an important tree of coastal forests), and Black cherry (*Prunus serotina).* Sassafras and cherry, both sun-loving species, would have established here when the land was more open, after farming ceased. Native plants in the understory include **Highbush blueberry** (*Vaccinnium corymbosum*), **Pinxter azalea (***Rhododendron periclymenoides*), **Sweet pepper bush** (*Clethra alnifolia),* and several non-native invasive shrubs (**Winged Euonymus, Japanese Barberry, Privet, Bush honeysuckle**). Several homes along Mumford Cove Rd and Colony Road (within Mumford Cove Association neighborhood) dump yard waste and have created new trails on conservation property. While dumping leaves and yard debris “over the wall” or “into the woods” is a common practice in residential communities everywhere, most residents are unaware of the negative impacts this can have on native plant communities. Most concentrations of invasive plants occur along these edges where conservation and residential properties meet.

Native plant communities in the conservation land, extending well beyond the pool, preserve environmental conditions that are vital to the needs of resident wildlife, especially amphibians, and provide important environmental services, including water retention and recharge, moderation of the water temperature and relative humidity of the forested upland, wetland and pool environment. These ecosystem services also benefit the surrounding built environment and human community. The deciduous forest canopy of native forest trees, especially oaks, supports hundreds of different insect species, especially moths, butterflies and other pollinators, that are essential to forest health. Healthy trees and shrubs are the source of the annual leaf litter that provides the basis of the woodland and vernal pool food web. The mosaic of different interconnected life zones protects migratory routes and upland foraging areas for many different species. Some adult amphibians and reptiles may travel only a few dozen yards from a breeding pool, others may travel up to a mile. Naturally vegetated buffers around the pool also trap sediments and increase the ability of the system to purify water and maintain good water quality in the pool.

A trail system created by GLPCC meanders through the designated conservation land and allows access and views of the interconnected wetland and upland habitats. Their ***Self-Guiding Nature Trail*** booklet, updated in 2021, highlights points of interest, trees, birds and plants along a marked trail. The conservation land and trail wraps around the Mumford Cove marsh. Parts of the trail are now inundated during extreme high tides, and the trail may require re-routing away from the marsh edge. The landward migration of tidal salt marsh plants into the surrounding forest, including **Groundsel tree** - *Baccharis halimifolia*, **Marsh elder,** *Iva frutescens* and several marsh grasses document sea-level rise. Saltwater tidal marshes are recognized and protected for their important ecological benefits, and are crucial to coastal resiliency and buffering storm surges. The GLP DPW facility lies close to this state protected natural resource.

4.4 Discussion GLP DPW activities

The GLP public works department operates a maintenance facility surrounded by the designated conservation area. The facility includes a building and a combination of parking, loading and dumping areas adjacent to the conservation area, close to freshwater and tidal wetlands. Past activities along the edge have created sunny openings and bare ground inviting aggressive invasive plants to seed or penetrate into the conservation land. The area has been clearly delineated and is being cleaned up. Additionally, the noise, vibrations, chemicals and bright lights associated with surrounding development in general, and DPW activities specifically, can negatively impact wildlife. These activities also impact the ability of an otherwise healthy forested landscape to adapt to climate change and sea level rise.

4.5 Discussion of spraying pesticides and herbicides

Pesticide use- While I do not know the reasons or history, the vernal pool has been sprayed for mosquito control. Vernal pools are unfairly targeted for pest control, largely because of concerns about West Nile Virus (WNV) and Eastern Equine

Encephalomylitis (EEE). A large percentage (95%) of disease-transmitting mosquitoes (especially those testing positive for WNV) come from species that breed in artificial containers that collect with water, such as flower pots, bird baths, and pails around yards. Small insect larvae, like mosquitoes, are an important part of the food web and a source of protein for predatory insects, bats and birds. **The majority of invertebrates, frogs, salamanders, and birds living in and around the vernal pool and conservation land ALL consume and control pest insects.**

Herbicide application- Manually cutting, pulling, mowing, and in some cases burning, are the preferred methods of controlling and removing invasive plants. The chemicals in herbicides, especially surfactants, are highly toxic to pond breeding amphibians. Surfactants are used to help the herbicide adhere to leaves of target plant species, and easily spread onto the water surface. The **USEPA approves Glyphosphate** for use in wetlands. Herbicide labels must be carefully read to ensure no surfactants are present. Where needed most (bamboo stands around Mumford Cove Rd and Duryea Dr) it may be applied during the dry phase (late summer, early fall), which is generally when herbicide use is most effective. Each area of invasives should be evaluated for the most environmentally sensitive removal method.

5.0 RECOMMENDATIONS

- Maintain maximum buffers (life zones) around the vernal pool, and wetlands with seasonal pools. Where wetlands with multiple embedded small pools exist, as they do here, the buffer should encompass the cluster of pools. Where possible, a **minimum of 750' is recommended where any development is planned** though, by definition (and hopefully by-laws), designated conservation land should not be available for development. While not always possible to implement due to site size, configuration, and pre-existing conditions**, the EPA recommends extending the protected life zone to a 1000' radius** area beyond the edge of a vernal pool as forested upland habitat. Many animals, especially amphibians, migrate to forested areas across roads, especially during rainy nights in spring, summer and fall.
- Maintain vegetated buffers of native plants, especially along the road. Allow native shrubby vegetation to fill in around the study pool.
- Designate the Vernal pool basin as a no disturbance zone.
- Eliminate parking pull-offs and enforce no parking along Duryea Dr and Mumford Cove Rd, especially areas bordering the pool, to prevent soil compaction and disturbance year round.
- Do not install berms on either side of the roads bordering the pool and conservation lands as they create barriers to migrating amphibians. Post 'Amphibian Crossing' signs to alert motorists during prime migration nights in early spring when rain is forecast, and/or consider the installation of amphibian tunnels under the roadways closest to the pool (Duryea and Mumford Cove Rd).
- Remove nest box and lights from pole. Pole can remain as a tall perch.
- Work with GLP Public Works, Police, Fire Dept, Groton Utilities and abutting private property owners to ensure responsible stewardship of conservation lands. Avoid

further development or degradation resulting in habitat loss in any designated GLP conservation land.
- Discourage the placement of fruit and other food offerings along the road and in the vernal pool. This creates a hazard for people and wildlife.
- Post Conservation Area boundaries.
- Notify/educate adjacent property owners about discarding yard debris and waste on conservation property. Dumping of plant material and yard waste impacts native plant communities and can favor the establishment and proliferation of invasive species. Send a formal letter to each household along Mumford Cove Rd and Colony Drive from the GLPCA and post property boundaries.
- Invasive plant species control- Continue targeting areas of Japanese Knotweed, Japanese Barberry, Privet, Yellow wood Bamboo, Bush Honeysuckle, Japanese Honeysuckle, Phragmites and Autumn Olive. Where possible, remove plants manually by hand cutting or pulling.
- Utilize a USEPA approved glyphosphate (no surfactants) for use in wetlands, and only when the vernal pool is in a dry phase. If herbicides must be used, have a licensed professional target specific invasive plants outside wildlife breeding seasons (usually late summer), preferably using the cut and spray method.
- Do not use pesticides near the vernal pool or surrounding areas to control mosquitoes or other pests. Vernal pool and woodland fauna provide superior natural pest control.
- Cut or burn meadow/thicket area bordering Duryea (ideally in February) to maintain habitat diversity and encourage native plants and pollinators. Maintain a narrow mowed path through the meadow, and consider extending the trail to include a second opening further East on Duryea.
- No heavy equipment, tree removal, cutting or grading in GLP Conservation Areas, especially near the vernal pool and other sensitive wetlands. Cutting fallen branches or tree stems to maintain a trail is O.K., but wood should be left on the forest floor.
- No filling or depositing of organic or inorganic materials.
- Work with GLP PW and GU to avoid use of salts, pesticides, herbicides, leaching of heavy metals and chemical contamination.
- Do not collect amphibian eggs or larvae.
- No dogs roaming around or swimming in the pool.
- Skating or walking on the ice (an increasingly rare opportunity) will not harm the pool or its inhabitants.

6.0 SPECIES LIST VERNAL POOL* and SURROUNDING WOODLAND

MAMMALS

Meadow Vole (also common in upper marsh)- *Microtus pennsylvanicus*
Eastern cottontail- *Sylvilagus floridanus*

White-Tailed Deer*- *Odocoileus virginianus*
Raccoon- *Procyon lotor*
White-Footed Mouse- *Peromyscus leucopus*
Gray Squirrel*- *Sciurus carolinensis*
American Red Squirrel- *Tamiasciurus hudsonicus*
Eastern Chipmunk- *Tamias striatus*
Southern Flying Squirrel*- *Glaucomys volans*
Red Fox- *Vulpes vulpes*
Gray Fox- *Urocyon cinereoargenteus*
Eastern Coyote*- *Canis latrans*
Bobcat- *Lynx rufus*
Woodchuck- *Marmota monax*
Long-tailed Weasel- *Neogale frenata*
Fisher- *Pekania pennanti*
Mink* - *Neogale vison*
Eastern Red Bat*- *Lasiurus borealis*
Big Brown Bat*- *Eptesicus fuscus*

BIRDS

Osprey- *Pandion haliatus*
Bald Eagle- *Haliaeetus leucocephalus*
Red-tailed Hawk*- *Buteo jamaicensis*
Red-shouldered Hawk*- *Buteo lineatus*
Cooper's Hawk*- *Accipeter cooperii*
Belted Kingfisher*- *Megaceryle alcyon*
Wood Duck*- *Aix sponsa*
Mallard*- *Anas platyrhynchos*
Hooded Merganser*- *Lophodytes cucullatus*
Wild Turkey- *Meleagris gallopavo*
Mourning Dove- *Zenaida macroura*
Yellow-billed cuckoo- *Coccyzus americanus*
Ruby-throated Hummingbird*- *Archilochus colubris*
American Woodcock- *Scolopax minor*
Barred Owl*- *Strix varia*
Great- Horned Owl- *Bubo virginianus*
Eastern Screech-Owl- *Megascops Casio*
Black-crowned Night Heron*- *Nycticorax nycticorax*
Yellow-Crowned Night-Heron*- *Nyctanassa violacea*
Great Blue Heron*- *Ardea herodias*
Great Egret*- *Ardea albus*
Snowy Egret*- *Egretta thula*
Glossy Ibis*- *Plegadis falcinellus*
Green Heron*- *Butorides virescens*
Common Yellowthroat- *Geothlypis trichas*
Blue-gray Gnatcatcher*- *Polioptila caerulea*

Brown Creeper- *Certhia americana*
Tufted Titmouse*- *Baeolophus bicolor*
Black-capped Chickadee- *Poecile atricapillus*
American Redstart- *Setophaga ruticilla*
Yellow Warbler*- *Setophaga petechia*
Ovenbird- *Seiurus aurocapilla*
Veery- *Catharus fuscescens*
Wood Thrush- *Hylocichla mustelina*
Eastern Towhee- *Pipilo eryythrophthalmus*
Brown Thrasher*- *Toxostoma ruff*
Cedar Waxwing- *Bombycilla cedrorum*
American Robin*- *Turdus migratorius*
Eastern Bluebird*- *Sialis sialis*
Gray Catbird*- *Dumetella carolinensis*
Great Crested Flycatcher- *Myiarchus crinitus*
Eastern Phoebe- *Sayornis phoebe*
Eastern Wood-Pewee- *Contropus virens*
Ruby-crowned Kinglet- *Regulus calendula*
Golden-crowned Kinglet- *Regulus satrapa*
Common Grackle*- *Quiscalus quiscula*
Downy Woodpecker*- *Dryobates pubescens*
Hairy Woodpecker*- *Dryobates villous*
Red-bellied Woodpecker*- *Melanerpes carolinus*
Yellow-bellied sapsucker- *Sphyrapicus varius*
Common (Northern) Flicker- *Colaptes auratus*
American Crow*- *Corvus brachyrhynchos*
Fish Crow*- *C. ossifragus*
Common Raven*- *C. corax*

REPTILES

Snapping Turtle*- *Chelydra serpentina*
Painted Turtle- Chrysemys picta
Spotted Turtle*- *Clemmys guttata*
Northern Diamondback Terrapin- *Malaclemys terrapin*
Eastern Garter Snake*-*Thamnophis sirtalis*
Northern Ring-necked Snake- *Diadophis punctuates edwardsii*

AMPHIBIANS

Spotted Salamander*- *Ambystoma maculatum*
Marbled Salamander*- *Ambystoma opacum*
Four-toed Salamander- *Hemidactylium scutatum*
Eastern Newt-* *Notophthalmus viridescens*
Red eft (juvenile form of Red-spotted newt)
Red-backed Salamander- *Plethodon cinereous*

Northern Dusky Salamander- *Desmognathus fuscus*
Two-lined Salamander- *Eurycea bislineata*
Gray Teefrog*- *Hyla versicolor*
Spring Peeper*- *Pseudacris crucifer*
Wood Frog*- *Rana sylvestris*
Pickerel Frog*- *Rana palustris*
American Toad*- *Bufo americanus*
Fowler's Toad- *Bufo fowleri*

INVERTEBRATES

Damselfly nymph*
Dragonfly nymph*
Dragonfly adults
Common Water Strider*
Predaceous diving beetle*
Whirligig Beetle*
Wold Spider*
Six-spotted Fishing Spider*
Mayfly*
Fairy Shrimp*
Caddisflies*
Amphipods*
Isopods*
Giant Water Bug*
Oligochete Worm*
Fingernail Clam*
Bloodworm*
Flatworms*
Red velvet mite*
Monarch Butterfly*
Black Swallowtail*
Giant Swallowtail*
Mourning Cloak*
Luna Moth*
Bumblebees, Honey bees, solitary bees*

PLANTS

Trees

_____Swamp White Oak*- *Quercus bicolor*
Pin Oak*- *Quercus palustris*
Northern Red Oak*- *Q. rubra*

White Oak*- *Q. alba*
Black Oak*- *Q. nigra*
Scarlet Oak- *Q coccinea*
Red Maple*- *Acer rubrum*
Black Birch- *Betula lenta*
Yellow Birch- *B. alleghaniensis*
Gray Birch- *B. populifolia*
American Beech- *Fagus grandifolia*
Pepperidge*- *Nyssa sylvatica*
Sassafras*- *Sassafras albidum*
Black Cherry*- *Prunus serotina*
Shagbark Hickory- *Carya ovata*
Mockernut Hickory- *C. tomentosa*
Bitternut Hickory- *C. cordiformis*
American Ash- *Fraxinus americana*
Pignut Hickory- *C. glabra*
Eastern Red Cedar- *Juniperus virginiana*
American Holly*- *Ilex opaca*
Norway spruce- *Picea abies*
White spruce- *P.alba*
Shad*- *Amelancier sp.*

Shrubs and vines

Sweet pepper Bush*- *Clethra alnifolia*
Pinxter Azalea*- *Rhododendron periclymenoides*
Highbush Blueberry *- *Vaccinnium corymbosum*
Black Huckleberry- *Gaylussacia baccata*
Virginia Creeper*- *Parthenocissus quinguefolia*
Poison Ivy*- *Toxicodendron radicans*
Staghorn Sumac- *Rhus typhinia*
Oriental Bittersweet^- *Celastrus scandens*
Chinese Privet^- *Ligustrum sinense*
Japanese Barberry^- *Berberis thunbergii*
Japanese Knotweed^- *Polygonum cuspidatum*
Yellow Groove Bamboo*^- *Phyllostachys aureosulcata*
Greenbriar- *Smillax rotundifolia*
Catbriar- *S. glauca*
Winged Euonymous^- *Euonymous alatus*
Wild grape*- *Vitis labrusca*
Japanese Honeysuckle^- *Lonicera japonica*
Marsh Elder- *Iva frutescens*
Bush Honeysuckle^- *Lonicera maackii*
Groundsel tree- *Baccharis halimifolia*

Herbaceous Plants

Nodding Smartweed*- *Polyganum lapathifolium*
Water milfoil*- *Myriophyllum spp*
Wool Grass-* *Scirpus cyperinus*
Sedges*- *Carex lurida; C. lupulina*
Marsh Fern*- *Thelypteris palustris*
Royal Fern*- *Osmunda regalis*
Cinnamon Fern*- *Osmundastrum cinnamomeum*
Manna Grass*- *Glyceria canadensis*
Beggar's Tick-* *Bidens frondosa*
Canada Mayflower- *Maianthemum canadense*
Striped Wintergreen- *Chimaphila maculata*
Shinleaf- *Pyrola elliptica*
Wild Leek- *Allium tricoccum*
Skunk Cabbage- *Symplocarpus foetidus*
Cattail- T*ypha lattifolia*
Common Reed^- *Phragmites australis*
Jimsonweed^- *Datura stramonium*
Moss, Lichen and fungi species

* Denotes flora and fauna found growing, feeding, or nesting in, or within 50 feet of, the vernal pool
^ Invasive plant species

Adjacent salt-marsh and coastline habitats support a variety of shellfish and finfish- including Eastern Oyster- victims of water pollution and siltation, and hundreds of shorebirds, seabirds and migratory waterfowl—too many to list.