A STUDY OF WETLANDS AND DEVELOPMENT IN ACTON, MA.

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INTRODUCTION

The Wetlands Protection Act (WPA) seems especially suited for application in the town of Acton, Massachusetts. Acton is located in eastern Massachusetts and much of the town falls into the resource area defined in the WPA as "bordering vegetated wetland." The fairly modest relief of the town belies the important role glaciers played in forming the present-day landscape. The retreating glaciers left a varied milieu of landforms and topography upon which the citizens of Acton have settled since the late seventeenth century. However, development of residential areas did not pick up steam until the 1950's, with the advent of suburbia. It was at this point that development encroached on the wetland areas. Without any law regulating development in or near wetlands, many developments have been "grandfathered" in before the passage of the WPA. Since that time, development has continued, but has been subject to the provisions of the law as applied by the Conservation Commission. In this paper, I hope to address both the state of pre-law development and the "nuts and bolts" application of the law today, all the while placing things in the framework of pre-existing geological and biological conditions. In this way, I hope to evaluate the impacts of development both on the wetland ecosystem and the quality of life for Acton citizens.

RESEARCH METHODS--SCOPE

My research concentrated mainly on an area of southwest Acton that is drained by the Fort Pond Brook drainage system. In addition to field work, various resources were collected from the town Conservation Commission offices. These included large plate (Plat?) maps of the areas under study (Maps 2-5) which show existing development, wetlands, and floodplain areas. Along with these maps are inland wetland reports (Appendices I-L) which describe the plant and animal species, geologic conditions, and value of the wetland indicated on the map. Four specific sites were considered for their interaction with wetland systems and relation to the WPA. These sites can be located on Map 1 as the shaded red areas. In addition to the four sites examined up close, the existing structures on Maps 2-5 were examined for their compliance with the present law. The long string of residence neighborhoods adjacent to the Fort Pond Brook and Nagog drainage and wetland areas were the main focus. Those structures lying within the floodway fringe or 100 foot buffer zone were shaded and the number of structures involved noted.

1. Site 1--This site is located at 10 Spencer Road, Acton. The area studied includes an area of standing water, near an outlet stream, which is colonized by wetland plant and animal species. A vegetational line transect (Appendix G) was preformed here to determine the incidence and diversity of wetland plant species. Also, a topographical transect (Appendix G) was preformed, to determine any change in elevation. Soil samples were taken in the area of standing water to determine the pH, grain size, and thus the possible origins of the soil (Appendices C and D).

2. Site 2--This site is located at 42 Washington Drive, Acton. As with Site 1, this is an area of standing water near an outlet stream, with some wetland plant an animal species. This site differs from that of the others in that it is not in the Fort Pond Brook drainage basin, rather the Nagog drainage basin, but the wetland does drain into the same river, the Assabet. A vegetational line transect and topographic transect (Appendix H) were preformed here as in Site 1. The soil was found to be matching that of Site 1, and soil samples were not taken.

3. "Meadow View" site--This site is located further south of Site 1, in an area slated for a twenty-one lot development that has run into trouble with the law (more on that later). This site is located upslope from the broadest area of the Fort Pond Brook, as evidenced from Map 1. Here, soil samples were gathered for comparison with the soil samples from Site 1 to determine any difference in composition and geologic history (Appendices E and F).

4. "Heron View" site--This site is located just to the south of the Meadow View site in South Acton, near the border with Stow, MA. A four lot development is in the final stages of construction. This development is of interest because some wetlands had to be filled to build the access road to the house, and as the wetlands have been replicated, the 100 foot buffer zone now emcompasses some areas of the development. Research on this site consisted entirely of gathering resources from Conservation Commission offices and the developer. These resources include a notice of intent, order of conditions, and wetlands replication schedule (Appendices M-O). Visually,

the area is represented both in Map 3 and in Map 6, a map provided by the developer.

GEOLOGIC CONDITIONS

The pre-existing geologic conditions of the general Acton area as well as the specific sites lends insight into the suitability of the area for development. In general, the Acton area seems a classic low-relief glaciated area. The landforms present and sediment types reveal the past influence of receding glaciers. Examination of the USGS Maynard quadrangle map shows that the majority of the upland areas, that is areas that are not wetlands, appear to be hills with a northwest-southeast directional orientation. From Map 1, such hills would include Great Hill, Faulkner Hill, and Wright Hill, the names of which have been highlighted. Depending on the whether these hills are made up of sand and fluvial gravel or till, they could be derived from either ice-contact or subglacial glacial environments, respectively. In this way, glaciers moving over the terrain ten to eighteen thousand years ago would gather up sediments and dump them in characteristic "piles"--the hills seen on the map today. The low areas, those areas that are represented as swamps on Map 1, appear to be areas of glaciofluvial deposition which today correspond to the water table. These are in a way "plains," flat low-lying areas which today serve as the focus for drainage, receiving the inflows and moving them along in the form of waterways on the plain. Given these general characterizations of the geologic origins of Acton's landforms, it is helpful to examine the geology of each site to lend insight into the origins of specific areas.

From both the inland wetland reports (Appendices I-L) and the soil sample data (Appendices C-F) a clearer picture of the geology of the area emerges. Site 1 is described in Appendix I as a "wooded swamp associated with groundwater discharge at kame terrace-glacial till interface." The upland till areas can be seen on Map 2 as those areas with residential developments--e.g. Durkee Road, Lothrop Road, Spencer Road, and Tuttle Road. The wetland itself (D22 on the plate map) is associated with glacial stratified deposits, and specifically glaciofluvial in origin. It was from this area that the "swamp O" and "swamp clay" samples were collected. Given the description of geologic and hydrologic conditions, on the superficial layer this soil should be a fine-grained clay deposit overlain by a fine-grained layer of decomposed organic matter--the "O" horizon. From the samples attached to my poster and Appendices A, B, E and F, it is obvious the two swamp layers I collected conform to this analysis. The top layer is a dark, fine grained muck which is almost half biological material, the most of all the samples. Its pH is slightly acidic, possibly the result of anaerobic decomposition. The underlying layer is a grey, fine-grained well-clast sediment layer, obviously a clay. It is higher in pH than the upper layer, probably due to its lack of any decomposing materials. The same geologic conditions are present in the adjacent D22A wetland, described in Appendix J and seen on Map 4. In this way, Site 1 reflects the two major divisions of geologic origins in present-day landforms.

Site 2, in a different drainage basin, reflects different geologic conditions. The wetland described as A4 in Appendix K and found on Map 5, is described in the report as a "wetland associated with thick till deposits" and further described as "associated with streams flowing in predominantly

till valleys." This is to say that the deposition of till continues into the valley area, and the low elevation stream area is not glaciofluvial in origin. Regardless of the geologic material, groundwater flow seeps up to a certain baseline level, which seems to be about 200 feet. This accounts for the existence of the wetland at low-lying levels despite the difference in geologic material. On a superficial level, the soil was found to be identical to that of site 1--a layer of fine-grained organic muck underlain by a fine-grained clay layer--and yet the underlying parent material appears to be different. In both cases, the soil examined was from a wetland area--suggesting that the soil is also indicative of the type of ecosystem.

The Meadow View site encompasses an upland area, unlike those of Site 1 and Site 2. The description in Appendix K and the soil samples examined in Appendices A-D deal with fundamentally different areas. The description in the wetland report describes the broad area of Fort Pond Brook, a wetland "associated with glacial stratified deposits" and more specifically with "streams flowing on delta surfaces." In this respect, the wetland area differs both from the Site 2 wetland and the Site 1 wetland. The latter area drains eventually into this site, and is fairly close in proximity. The interconnectedness and proximity of these wetlands of separate geologic origin suggests some degree of variability within the general area. The soil samples, however, do not come from this wetland area, rather from the upland area northeast of Robbins Road. From the samples attached to the poster, the "Meadow View 'O'" and "Meadow View 'B'" samples appear to be different in composition from those collected from Site 1 and observed at Site 2. The "O" layer is lighter than the corresponding swamp "O" layer, and with more grains of larger size. The underlying "B"

horizon is a light-brown almost orange sandy sediment, fairly well-sorted tending towards small grain size. The pH of both samples is noticeably lower in comparison with the pH of those collected at Site 1. These differences lead me to believe that this upland area is some sort of glacially deposited moraine landform. This area is above the water table and thus above the wetland. The nearby Heron View site also is found in this upland "peninsula" and I would expect the soils there to be the same. In this way, the geologic origins of this upland differ fundamentally from the surrounding wetland areas as well as the other wetland areas.

BIOLOGICAL CONDITIONS

The biological conditions vary depending on their geologic substrate and hydrologic conditions as well. In examining the biological conditions, it is also helpful to examine each site specifically, as well as taking into account the value of each wetland for each of the eight interests outlined in the WPA. Site 1, which is described by Appendices I and J, has some degree of plant species diversity. The flora at Site 1 corresponds to a wooded swamp type wetland, with an overstory canopy of tree species covering an understory of herbaceous species. Appendix G, the vegetational transect at Site 1, is deceiving in the number of species catalogued, due to the fact that many herbaceous species had not yet appeared. The species diversity would be much higher in the summer months. The quality and quantity of this vegetation lends the D22 area has high pollution prevention value, and moderate groundwater value. The adjacent D22A wetland has only moderate value for groundwater, pollution prevention, and water supply. This can be

ascribed to the fact that this wetland is surrounded by development, and a curtailed species diversity.

The Site 2 wooded swamp has slightly different flora, and its distribution affects the value of the wetland positively. As described in Appendix K, the vegetation of the A4 wetland has some different species. The diversity of species is about the same as that of the Site 1 wetlands. However, the area has significant value as a buffer zone, aiding in "water quality control." Given the proximity of the adjacent till hill, there is some mixing of upland and wetland species. This can be seen in Appendix H, the vegetational transect at Site 2. The area studied in fact is not a wetland, as there is not sufficient cover of wetland species, with white pine being dominant. However, there are wetland species in the area, suggesting that the "buffer zone" effect extends beyond the demarcated wetland to adjacent areas. The steepness of the surrounding upland areas also accentuates the function of the wetland as a receiving area for flood and storm waters. For these reasons, the area has high value for flood control, storm damage prevention, and prevention of pollution.

The large Fort Pond Brook wet meadow marsh adjacent to the Meadow View and Heron View sites is a much more important area biologically than the other, smaller wetlands. From Appendix L, the species diversity is much higher than that of the other wetlands. The area also supports much more in the way of fauna, limited in the description to bird and mammal species. Given the breadth and hydrological positioning of the area in addition to the "surrounding undeveloped wetlands," the area is described as "an excellent wildlife habitat." The vegetational communities and nutrient exchange give

the area high water supply, pollution prevention and groundwater value. On the other hand, the surrounding geologic conditions of drainage give the area high value for storm damage prevention and flood control. On the whole, this area is the most important of those studied in terms of species diversity and maintaining ecosystem stability as defined in the WPA.

PAST USES AND THEIR IMPACTS

The past uses of the sites involved also lend some insight into how the wetland areas were used previously, before the areas were developed. Resources in this area were at best sketchy, and most of the information had to be deducted from the evidence left behind at the sites. From the local Engineering Department, it was learned that the Site 1, as seen on Map 2 was used as an apple orchard up until the late 1930's. Some evidence remains in the upland areas of the present residential area of this prior use in the form of mature apple trees, found alone or in groups. For the upland areas, the existence of an orchard means that the pre-existing vegetation of a fairly large area was cleared. This could increase drainage into adjacent wetlands, but this impact appears to have not affected the wetlands to any large degree. The use of adjacent wetland areas could best be seen as that of a dump for materials that were not seen as useful. From Appendix G, the topographic transect at the D22 wetland, there is an obvious rise in elevation at eighty feet. This raised area was also photographed (see poster) and consists mainly of large boulders covered by some regolith and shrub and tree specimens. Since the surrounding trees are mature, it is obvious this artificial rise in terrain came about at least thirty years ago. Most likely, the wetland here was used as a dumping ground for large boulders dug up in the

orchard. The nearby D22A wetland, seen on Map 4, also appears to have been impacted, mainly by ditching and filling, probably done as the nearby houses and church were being constructed. This is highlighted in Appendix J, and this activity has adversely affected the value of the wetland's drainage and groundwater values. Very little was found on the Site 2 wetland. Given the steepness of the nearby terrain, the area was probably not used for farming or settlement in the pre-development past.

The area of the Meadow View and Heron View sites, as seen on Maps 2 and 3, were once used for small-scale farming, as recently as the 1960's. The town garden is situated at the end of Robbins Road, and there are areas of immature forest and grassy meadow which appear to have once been cleared and used for agriculture. The acidic soil and nearby water supply probably made this area attractive for such endeavors. In fact, some nearby areas are still utilized for small-scale farming. This type of activity impacted the upland by replacing the pre-existing biological communities, resulting in the successional vegetational communities found today. For the wetland, impact would appear to be minimal. Most farming was ceased before the introduction of fertilizers, negating their impact on the Fort Pond Brook area. Drainage and clearing do not appear to have been significantly altered either. In general, the past uses of the sites studied appear to be modest, with their impacts fairly modest on the wetland areas, with the exception of the D22A wetland. This would lead to the conclusion that most impacts on the system would have occurred with the advent of residential development (existing and proposed) of these areas.

POST-DEVELOPMENT IMPACTS AND PRESENT LAW CONSIDERATIONS

The four sites examined offer a broad cross-section of stages of development in Acton. For Sites 1 and 2, it is appropriate to examine the impacts of development which took place before the institution of the WPA in its original form in 1973. It is also interesting to look at mitigation of any negative impacts on both the environment and the quality of life for residents. For the Heron View site, it is appropriate to examine the application of the law to a development which resulted in the filling of wetlands. Finally, the Meadow View site represents a proposed development which has run into problems with the WPA.

The impacts at Sites 1 and 2 are most evident from examining Maps 2, 4, and 5. From town records, it was found that the houses on Site 1 were constructed from 1955 to 1969, the houses at Site 2 from 1967 to 1969. This means the development was in place before the institution of the WPA. From the maps, it appears that the main impact on the wetland areas from this pre-WPA development is the change in drainage--both the amount of flow and its constituents. With the clearing and paving of the areas which were developed, drainage into the wetland most likely was increased. It is also evident from the maps that there were many drainage pipes leading from the streets directly to the wetland. These pipes lead from the street sewer grates (square dots on the maps) to an outflow in the wetland area ("V"s on the maps). These grates would supply pollutants from street salting and sanding as well as general litter. This puts a premium on the wetland's ability to handle pollutants. Also, the area of the wetland and its drainage would be important. In this respect, it becomes clear why the small, circumscribed D22A wetland has had its function impaired after years of

but also may be a source of water

drainage from Mallard Road and nearby Prospect Road. As for Site 2, one large impact that does not seem to be addressed in any resources is the proximity of Route 2, which passes to the west. Near the road, macro-litter was observed, and the stream flowing in from the west was polluted with garbage as well. Given these nearby impacts on the Site 1 and 2 wetlands, it would seem vital that they remain in their present state. Basically, the close proximity of development has resulted in increasing the importance of the unimpeded functioning of the adjacent wetlands.

Another dimension of the development in a wetland area is the quality of life for the residents in the area involved. For Site 1 this becomes problematic at times. Being so close in elevation to the water table means that often, basements of houses are flooded by storms. One resident of Spencer Road has had consistent flooding problems in his backyard. This phenomenon is shown in two pictures--one taken before a March snowstorm of two inches, one taken after. Also in the pictures is a storm sewer grate installed by the town in 1985 directly into the man's backyard in order to drain the water from his yard. To this point, the resident feels, the mitigation has not been successful. For many of the residents of Spencer, Flint, Lothrop and Mallard roads, sump pumps have become necessary equipment. Site 2 has had few of these problems, mainly because the bulk of the development is located far enough up from the wetland and water table to keep it high and dry during storm flows. In this way, the quality of life for residents at Site 1 has been affected negatively by the close proximity of wetlands, while Site 2 has remained largely unaffected.

Where does the storm sewer drain to?

The Heron View site, a four-lot subdivision that is now being finished by the developer, can be cited as a textbook case for application of the WPA. The notice of intent for this development was submitted May 21, 1987. Within the notice of intent (Appendix M), the developer, Mark Greenbaum, outlines what strategies he will employ to mitigate any effects on the bordering vegetated wetlands, buffer zones, and land bordering that subject to flooding (pages 3-2--3-5). These measures include the creation of a 4,765 square foot wetland to replace a 4,715 square foot wetland that had to be filled in to create the driveway. On Map 6, the wetland area being filled in is colored red. The area where a wetland is being created is colored green. To protect these wetlands from siltation, haybales were used. As can be seen in the accompanying drainage design summary, this newly created wetland is expected to provide added flood storage for the areas which drain into the small wetland area, seen on Map 6 as the green colored area. What follows in the drainage design summary is a series of lengthy calculations of the expected runoffs. The pertinent information pertains to the 100 and 10 year storm storage volumes for before and after development. These numbers basically are used to try to show that the increases in flood storage area to the Lynch wetland (the area being recreated) will in fact compensate for the changes in runoff patterns. This plan was accepted because the impacts were are all fairly modest in scale and were mitigated as the law requires.

After a public hearing on July 15, 1987, the order of conditions for the development was issued. This document (Appendix N) sets forth the conditions that must be fulfilled for the interests marked at the bottom of page 1 of the notice. The first twenty-eight conditions, I was told, are basically the same for all projects that deal with the wetlands. These twenty-

eight broad conditions basically mandate that the methods and materials used will have as minimal an effect on the area as possible, and outlining the standard procedure as well as laying out what happens if standard procedure is not followed. Of the four remaining conditions, the most important is number 31. As can be seen in Appendix O, the Wetland Replacement Schedule prepared by B&C Associates for the developer, reed canary grass was planned to be used to revegetate the newly created wetland. The Conservation Commission decided that this species would be too invasive and exotic for use at the Heron View site. Given this limitation, the wetland replacement has proceeded pretty much along the lines of the methodology outlined in Appendix O. The only real problem remaining for the developer involves the fact that part of one of the septic system leaching fields now falls in the 100-foot buffer zone for the altered wetland. This area is colored in blue on Map 6. To alleviate this problem, the developer has decided to use the alternate leaching field area proposed directly beneath that which falls in the buffer zone. In most respects, therefore, the Heron View development has complied with the provisions set forth in the WPA.

One project that has not proven to be so simple is the adjacent Meadow View development. This twenty-one lot development is slated for building on the large moraine area northwest of Heron View (seen on Map 2). Documents were not allowed to be copied or taken out of Town Hall by private citizens because at this point, the project is still being considered by the Conservation Commission and a revised Notice of Intent to be submitted. From discussion with Conservation Commission officer Tom Tidman, however, I was able to get an idea of why the project didn't get through. The first problem was with drainage, especially towards the south and west.

Given the larger area being cleared, there are fears that the runoff to Robbins Road and the nearby wetland to the south will be too much. Also, there is a problem with the access road into the development. The Town Planning Board has mandated construction of a separated road entering and exiting the development from Robbins Road, instead of just one road. This is problematic because the entry road crosses a thin finger of wetland area, and a separated road will cross it in two places. The Conservation Commission therefore rejected the first Notice of Intent submitted. It is important to note that in Appendix L, the importance of the area as a wildlife habitat is enhanced by the "surrounding undeveloped uplands." With Meadow View, the habitat value would be greatly compromised. Also, there has been strident opposition to the Meadow View plan from abutting property owners who now have problems with flooding on their property and fear the problem will become worse if a large area is cleared and developed. In this way, the Meadow View plan has run into trouble and now awaits resubmission.

In conclusion, it would appear that wetlands and development have influenced each other in Acton. The influence on the wetland comes from adjacent development before the WPA was instituted and resides within the 100 foot buffer zone or the floodway fringe. To illustrate this point, I have colored those existing structures on Maps 2-5 that today would probably not get built without a permit and some mitigation of their negative effects. From this visual record, it can be seen that almost a hundred structures would not exist today had the law been in place when they were built in the late 50's through the 60's, including many private homes, a church, and a local department store. Certainly, many residential neighborhoods would not

It looks like 20% of houses in town shouldn't have been constructed — How many should in the town?

exist in their present densities given the effects they have as a whole on the surrounding wetland areas. The wetland affects the development in turn by mandating its limits--with the WPA in place, those limits have become more stringently enforced. The wetlands serve important functions for storing fauna. It appears their value has been perhaps over-utilized by past development. With the WPA in place, however, it seems that Acton's wetlands now have a better chance to fulfill their valuable functions.

N.B.: I would like to thank the following people for their aid in completing this project: Mark S. Greenbaum, M. Jacqueline Mayall, Dewitt C. Seward, and Tom Tidman.

A lot of data here and a lot of digging for info on your part. The amount of data at times is overwhelming and would be easier to handle (by the reader) if you had some sort of catalog or index – it would also be helpful to have some sort of watershed map early on that showed the 100 yr floodway and the boundaries of the immediate watershed – as well as a map locating Acton and the Assabet River in relation to a larger region —

Appendices A and B--Soil Analysis Tables

Appendix A--Soil pH

sample	soil pH
swamp "O" layer	5.73
swamp clay layer	6.25
Meadow View "O" layer	4.90
Meadow View "B" layer	4.79

Appendix B--Percent biological material in soil samples

Sample	Mass before baking (g)	Mass after baking (g)	Percent biological material
swamp "O" layer	30.59	15.69	48.7
swamp clay layer	35.66	31.53	11.5
Meadow View "O" layer	35.96	26.30	26.8
Meadow View "B" layer	32.34	28.31	12.4

Appendices C-F: Soil Sediment Size Graphs

Grain size analysis--Meadow View "O" layer

Grain size (mm)	Grams	Percent total
4	7.3	14.4
2	1.7	3.3
1	2.7	5.3
0.5	5.8	11.4
0.25	7.4	14.6
0.125	6.6	13
0.063	10.00	19.7
<0.063	9.2	18.1

Grain size analysis--Meadow View "B" layer

Grain size (mm)	grams	Percent total
4	1.5	2.4
2	3.1	4.9
1	3.1	4.9
0.5	5.7	9.5
0.25	8.7	14.4
0.125	8.2	13.6
0.063	15.5	25.7
<0.063	14.7	24.3

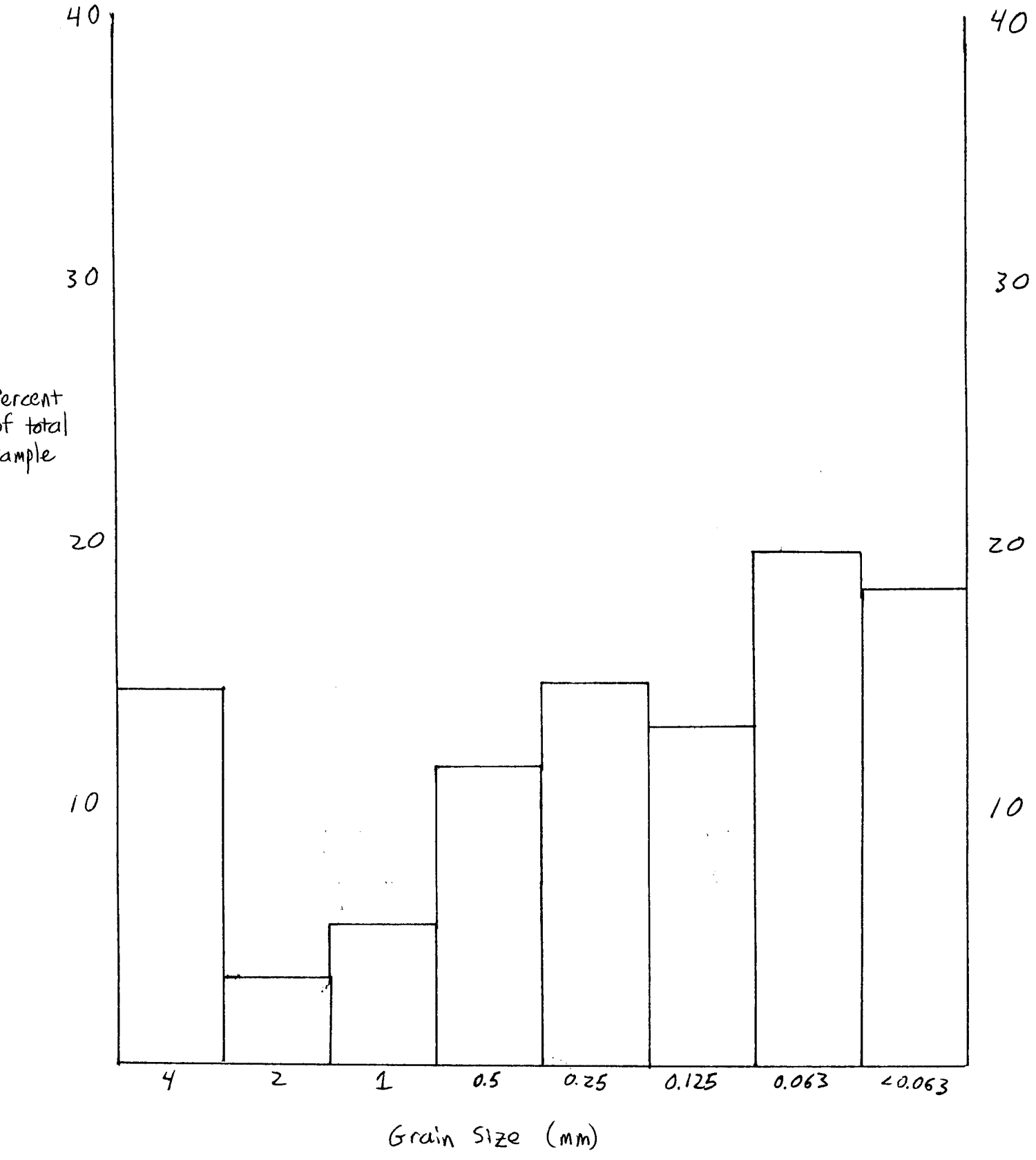
Grain size analysis--swamp "O" layer

Grain size (mm)	Grams	Percent total
4	0	0
2	0	0
1	0	0
0.5	5.7	24.7
0.25	3.4	14.8
0.125	3.1	13
0.063	4.5	19.6
<0.063	6.4	27.8

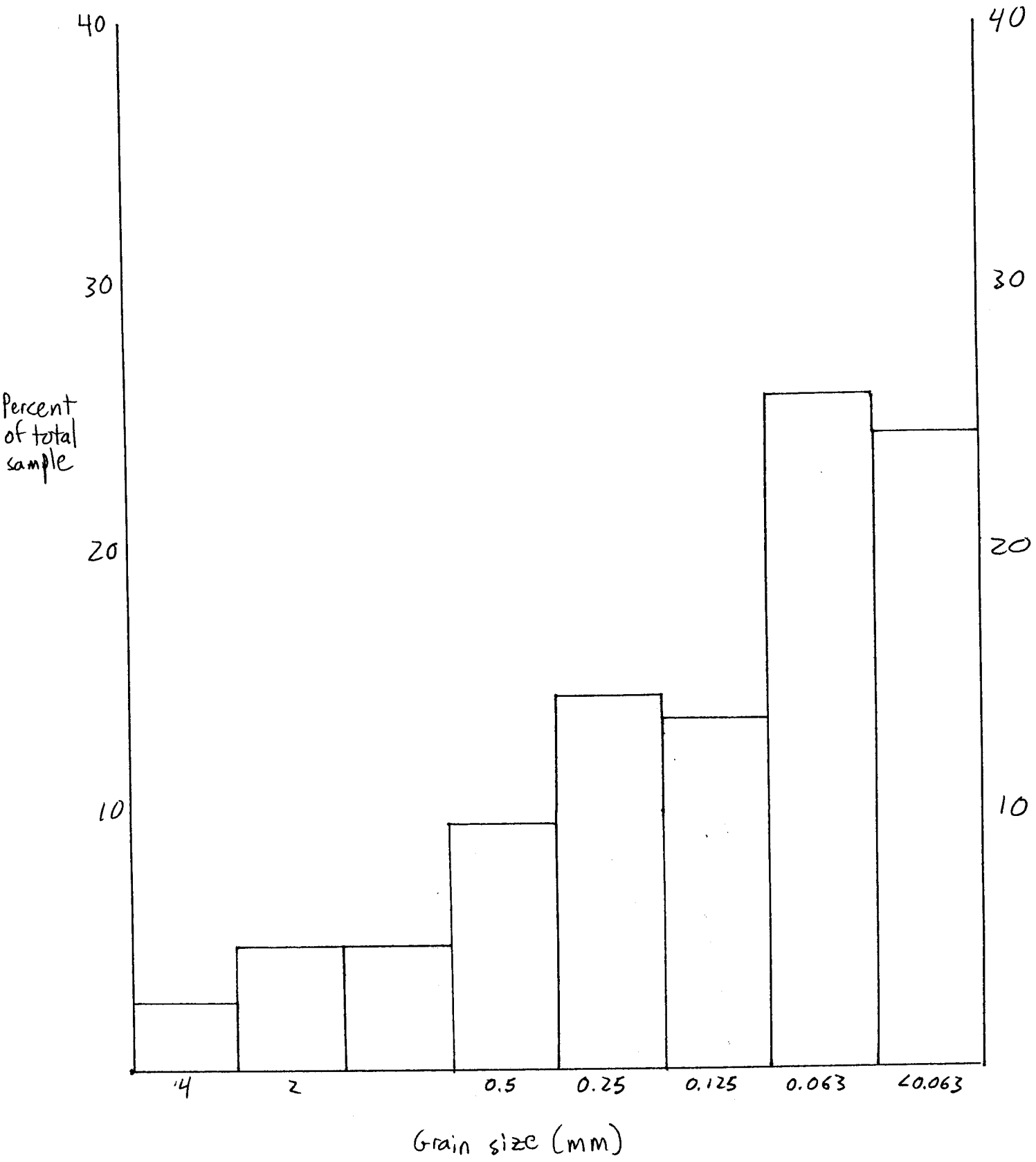
Grain size analysis--swamp clay layer

Grain size (mm)	Grams	Percent total
4	5.7	12.2
2	2.2	4.7
1	2.6	5.5
0.5	6.3	13.4
0.25	4.2	8.9
0.125	2.7	5.8
0.063	8.6	18.4
<0.063	14.4	30.8

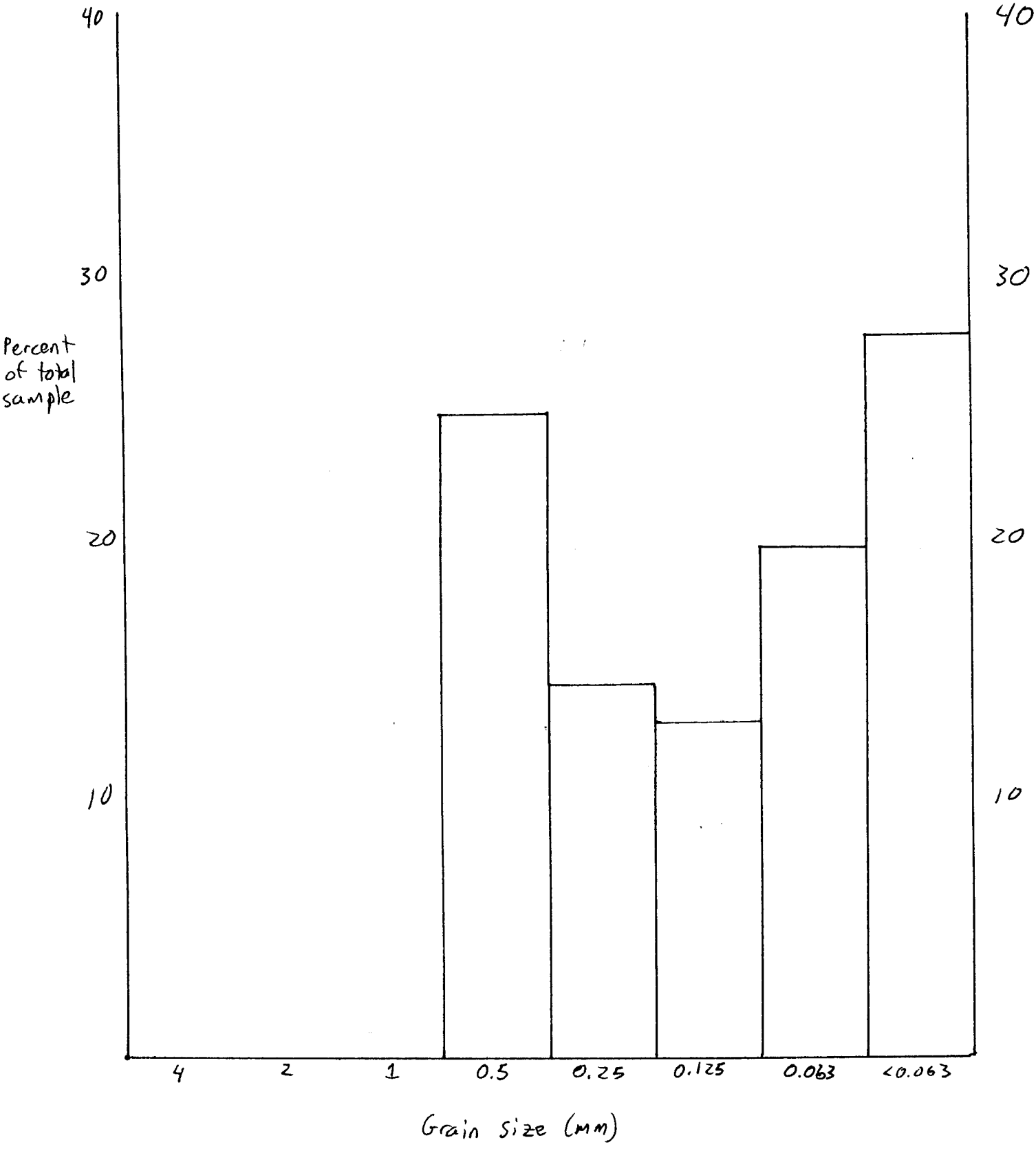
Grain size graph - Meadow View "0" layer



Grain size graph - Meadow View "B" layer



Grain size graph - swamp "O" layer



Grain size graph - Swamp clay layer