Appendix G

Souhegan River Water Elevation Evaluation
April 2009

Souhegan River Water Management Plan

August 2013

SOUHEGAN RIVER WATER ELEVATION EVALUATION

APRIL 2009

SOUHEGAN RIVER WATER ELEVATION EVALUATION

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Table of Contents

Page

1.0 SOUHEGAN RIVER WATER ELEVATION EVALUATION OF SITES 19 AND 35 1

1.1 INTRODUCTION 1
1.2 SITE 19 1
1.3 SITE 35 8

2.0 LIMITATIONS OF EVALUATION 12

3.0 REFERENCES 13

List of Figures

Page

Figure 1. Site 19 topographic map. 2
Figure 2. Site 19 NWI layer from GRANIT 3
Figure 3. Site 19 NRCS soil map with hydric units 5
Figure 4. Site 35 topographic map 7
Figure 5. Site 35 NWI map 9
Figure 6. Site 35 NRCS soils map 10
Figure 7. Site 35 As-Built Plan, dated October 1963 11

List of Tables

Page

Table 1. Souhegan River Dam Site 19 Wetlands 4

1.0 SOUHEGAN RIVER WATER ELEVATION EVALUATION OF SITES 19 AND 35

1.1 INTRODUCTION

Normandeau Associates, Inc. (Normandeau) has evaluated the potential environmental impacts of elevated water levels at two of the state-owned dams on the Souhegan River, Site 19 and Site 35, as partial fulfillment of the New Hampshire Department of Environmental Services (DES) Souhegan River Protected Instream Flow Study (PISF) and subsequent development of a Water Management Plan (WMP). Both dams at Site 19 and Site 35 were chosen for evaluation due to their potential for use in future flow augmentation; based on their fulfilling several criteria, notably state ownership of the dams, their storage capacity and the potential for the modification of their current operating regime. Holding water at these impoundments longer into the summer season could allow for release later in the late summer/early fall to augment flows during low water months or drought conditions.

The significant potential environmental impacts that could occur from this action would be to the wetlands and uplands adjacent to the impoundments. Normandeau reviewed the following listed information in this exercise: National Wetland Inventory (NWI) maps via the Fish and Wildlife Service online mapping tool, aerial photos from TerraServer Imagery, soil maps from Natural Resources Conservation Service (NRCS) Web Soil Survey, and New Hampshire GRANIT ArcGIS which included aerial photos, topography and wetland layers, and maps and water elevation data provided by DES.

Normandeau also conducted a search of the New Hampshire Natural Heritage Bureau (NHNHB) online database to determine potential impacts to federal- or state-listed Rare, Threatened or Endangered (RTE) species or Exemplary Natural Communities for both sites. No RTE species or species of special concern for wildlife or plants are known to occur in or near these impoundments. Species at the extremities of their ranges, critical habitat for migratory fish and wildlife or exemplary natural communities were also not recorded in the data base for these areas.

1.2 SITE 19

Site 19 is located in the Town of New Ipswich immediately south of the intersection of Ashburnham Road (Route 123) and Ashby Road. The dam and impoundment are located on the South Branch of the Souhegan River (Figure 1, location and topographic map). An unnamed stream enters the impoundment at the northwest corner. The impoundment is approximately 26 acres in size and approximately 2,400 feet in length at full pool and is elongated in shape, with the eastern boundary defined by the topographic feature of Whittemore Hill, 1370 feet in elevation. The areas adjacent to the impoundment to the northwest and south comprise a wetland complex associated with the South Branch and unnamed stream floodplains (Figure 2, NWI/GRANIT map). Both of these areas are wide, relatively flat, and defined by an increase in elevation to the west and south.

As shown on Figure 2, and listed in Table 1, the wetlands adjacent to the impoundment are complex and diverse and reflect the uneven nature of the underlying topography. A typical “bowl” impoundment would have a fringe of emergent wetlands, then scrub-shrub wetlands lying upslope of the waters edge, and then a forested wetland further upslope and away from the water. This system

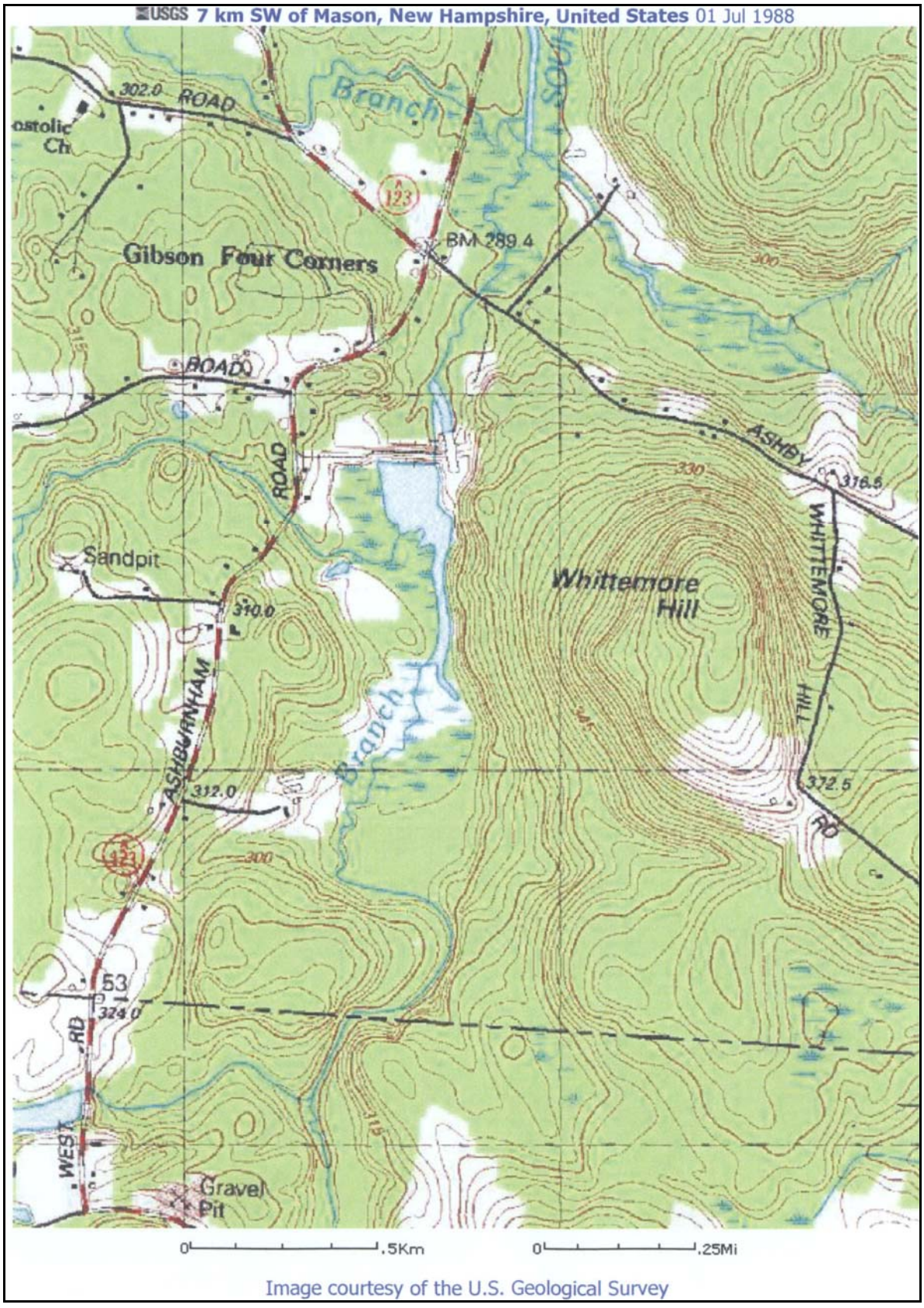

Figure 1. Site 19 topographic map.

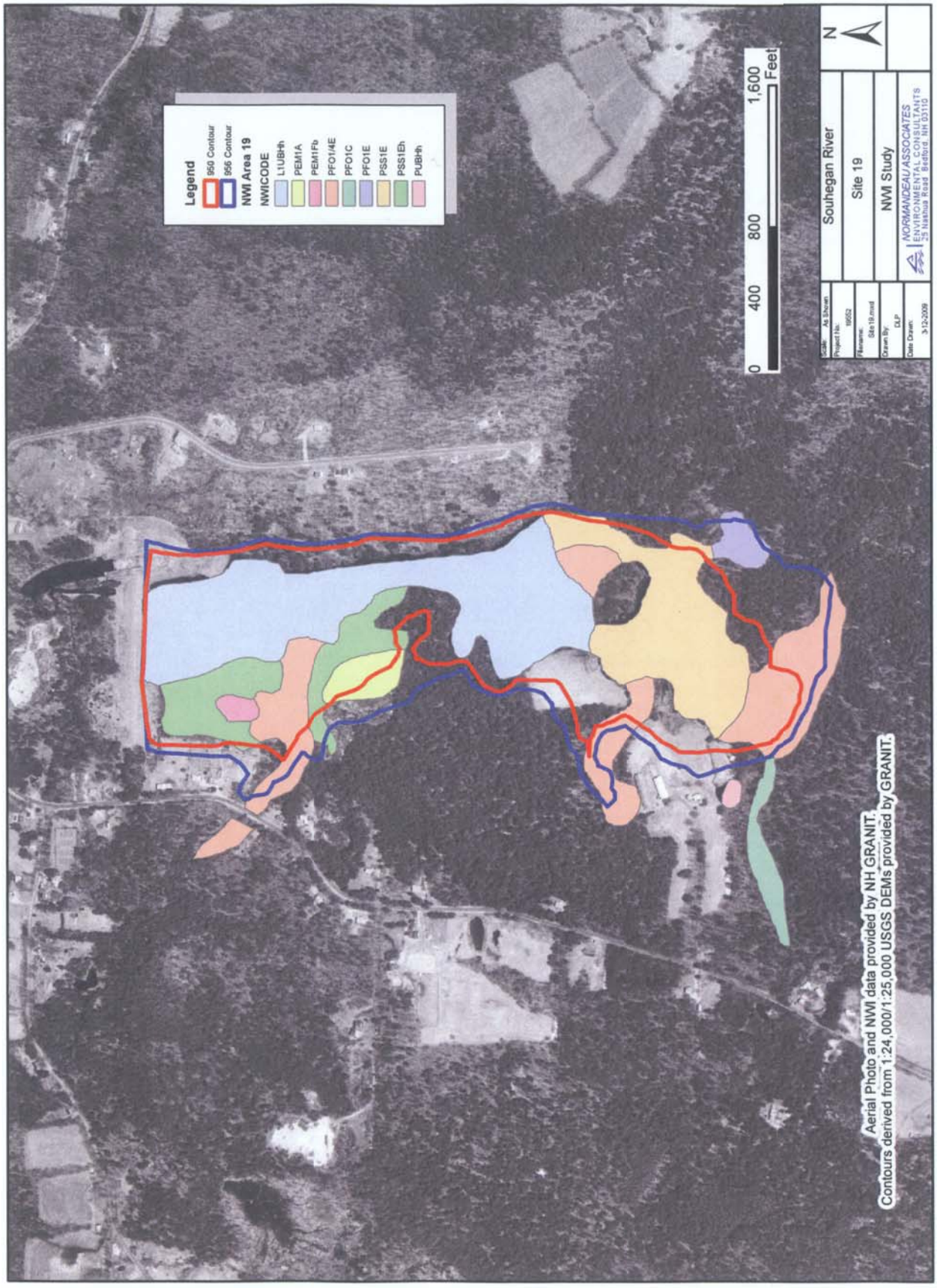

Figure 2. Site 19 NWI layer from GRANIT

contains a mix of emergent, forested and scrub-shrub wetlands. In the northwest corner an emergent wetland (PEM1FB, semi permanently flooded) is located quite a distance from the impoundment edge and is surrounded by a scrub-shrub wetland (PSS1Eh, impounded) to the north and a fairly linear forested wetland (PFO1/4E, seasonally flooded/saturated) to the south that reflects the riparian zone of the unnamed stream. South of this is more scrub-shrub wetland (PSS1Eh, impounded) adjacent to the impoundment, with a second emergent wetland (PEM1A, temporarily flooded) to the west. The location of the emergent wetlands away from the edge of the impoundment may indicate additional sources of water (tributary stream or beaver impoundment), topographic variability, or vegetation management. Soils are a mix of loamy sand, fine sandy loam and stony fine sandy loam (Figure 3). To the south, a large scrub-shrub wetland (PSS1E, seasonally flooded/saturated) follows the South Branch floodplain, with a small forested pocket of wetland (PFO1/4E) at the southeast edge of the impoundment and running further south along the floodplain and to the east following a break in the elevation and soils that may reflect an unmapped intermittent stream running off the small developed hill to the west. A forested wetland (PFO1C, seasonally flooded) also runs west off the southern edge of the forested wetland and a small forested pocket (PFO1E, seasonally flooded/saturated) exists in the southeast corner. All of these wetland areas contain Rumney loam or fine sandy loam, and as noted when comparing the soil and wetland maps, the wetlands have developed to the maximum potential based on the underlying soils and regional elevation.

Table 1. Souhegan River Dam Site 19 Wetlands

	Below Elev. 956		Below Elev. 950		Between 956 – 950	
NWI Wetland Code	**ft**	**acres**	**ft**	**acres**	**ft**	**acres**
L1UBHh	1144303	26.27	1144303	26.27	0	0.00
PEM1A (temp fld)	97214	2.23	58580	1.34	38634	0.89
PEM1Fb (semiperm fld)	28304	0.65	28304	0.65	0	0.00
PFO1/4E (seas fld/sat)	565074	12.97	365736	8.40	199338	4.58
PFO1C (seas fld)	245	0.01		0.00	245	0.01
PFO1E (seas fld/sat)	57606	1.32		0.00	57606	1.32
PSS1E (seas fld/sat)	612636	14.06	590752	13.56	21884	0.50
PSS1Eh (impounded)	348782	8.01	324760	7.46	24022	0.55
Total	1709861	**39.25**	1368132	**31.41**	341729	**7.85**

Figure 2 shows the approximate existing area of the impoundment, marked by the blue L1UBHh wetland designation, and the topographic contours of 950 foot and 956 foot have been located on the map in blue and red to show the proposed minimum and maximum levels of water that could be held in the impoundment for several months into the spring and summer. These contours were created from the 1:24,000 USGS Digital Elevation Models (DEMs) provided by GRANIT, which have a reduced accuracy for contours with less than a 20-foot interval. Thus, the contours were created for this exercise and can only be used for estimating areas. However, as Table 1 shows, the area of wetlands that would be under water at the 950 foot and 956 foot water levels is approximately 31.4 acres and 39.3 acres, respectively.

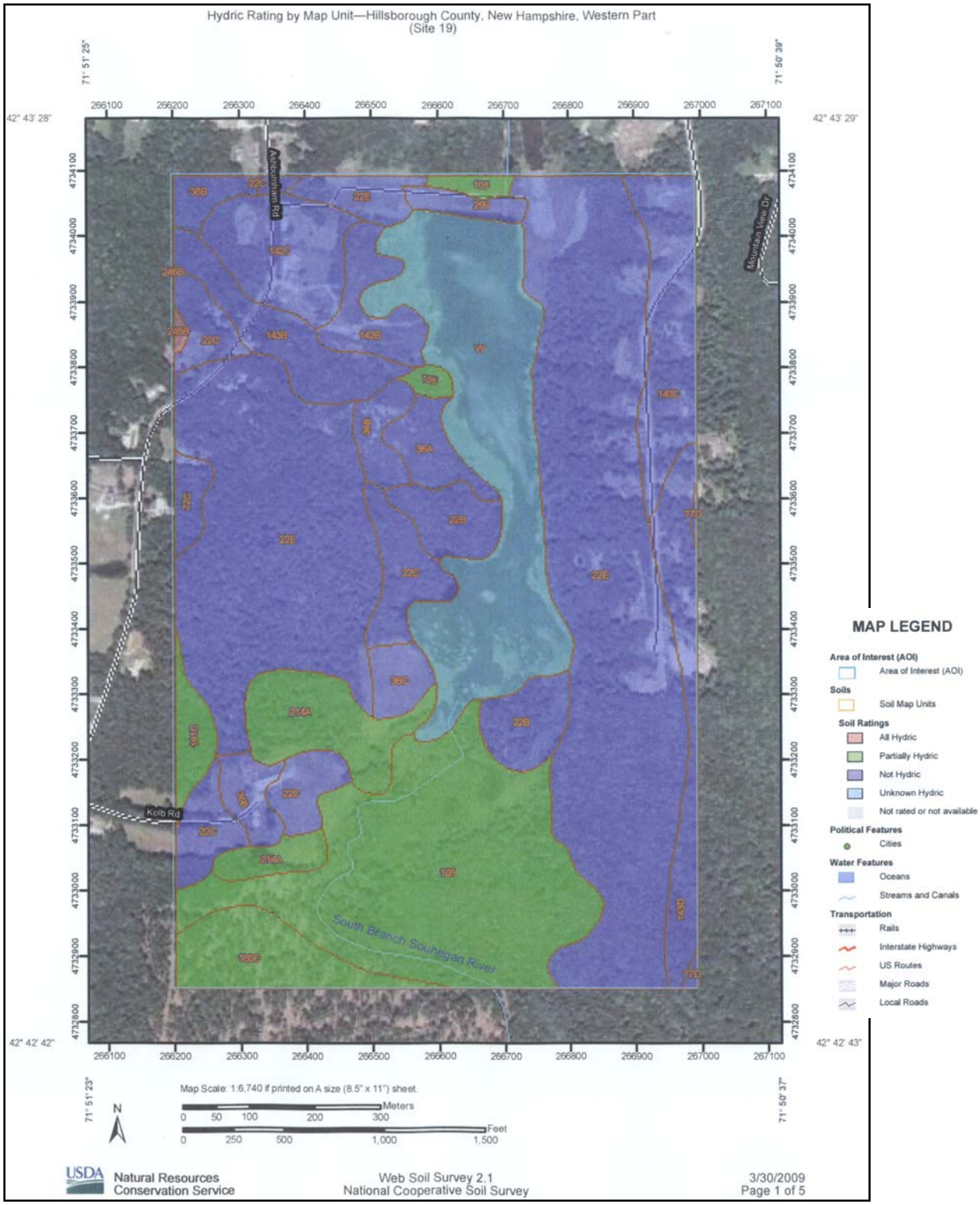

Figure 3. Site 19 NRCS soil map with hydric units

As previously stated, duration and timing of the water elevation changes will determine the nature of wetland impacts, and these are not precisely known. For estimating potential impacts, it was assumed that water levels would be higher than current levels by approximately 5-10 feet for most of the growing season. This range of water levels is based on the storage-elevation information for this site as provided by the NH Dam Bureau (Mattaini, personal communication). Using the approximate data from Table 1, the following predictions can be made:

1. The existing emergent marsh areas would be flooded, approximately 0.65 acres and 1.3 to 2.2 acres depending on the water level. These marshes typically contain plants such as burred, pickerelweed, and arrowhead - vegetation that is adapted to flooded conditions. Species composition may change due to the deeper water, and areas deeper than 6 inches may convert to open water or deep submergent and/or floating-leaved vegetation (Palustrine aquatic bed wetland).
2. Emergent wetlands are likely to increase in size, taking the place of the larger scrub-shrub and forested wetlands as water levels increase.
3. The scrub-shrub wetlands to the north, approximately 7.5 to 8 acres, may decrease in size depending on the species composition and water depth; as noted above, some areas will transition to emergent marsh as the less flood-tolerant species drown and are replaced.
4. The forested wetlands, approximately 8.5 to 13 acres, would see the largest net change in area. Trees within portions of the existing forested wetlands would succumb to prolonged flooding within a few years, and emergent and scrub-shrub wetlands (PEM1, PSS1) would become established where water is at or near the surface during the growing season. Vegetation dominance would shift from facultative wetland trees and herbs to obligate wetland shrub and emergent species.
5. The forested wetland to the southeast (PFO1E), approximately 245 square feet in size, would only be flooded if the water rises to the 956 foot elevation. At the 950 foot elevation it may transition, some or totally, to a scrub-shrub wetland with a forested fringe, but at the 956 foot elevation it may drown and disappear due to the immediate topographic ridge it abuts, or it could become emergent marsh.
6. Forested wetlands could be created as the trees and shrubs could shift upslope depending on the micro-topography and the persistence of the water elevations, especially along the western forested “arms” that follow the unnamed and unidentified stream and runoff areas that run along the foot of the western slopes. However, the South Branch is narrowly held to the streambed to the south by topography and sandy soils. NWI does not show a riparian buffer along this section of the stream and it is unlikely that increased water elevation in the impoundment would push water far enough south to create wetlands there.

In summary, based on available maps and without benefit of a field investigation or survey, it appears that there could be a net loss of vegetated wetlands, particularly forested wetlands, associated with a 5-10 foot increase in impoundment elevations. The remaining wetlands would shift to emergent and aquatic bed types (PEM and PAB). The available information is insufficient to make an accurate calculation of wetland loss and gain by cover type. It also appears that no known rare, threatened or endangered species or exemplary natural communities would be affected by an increase in water levels.

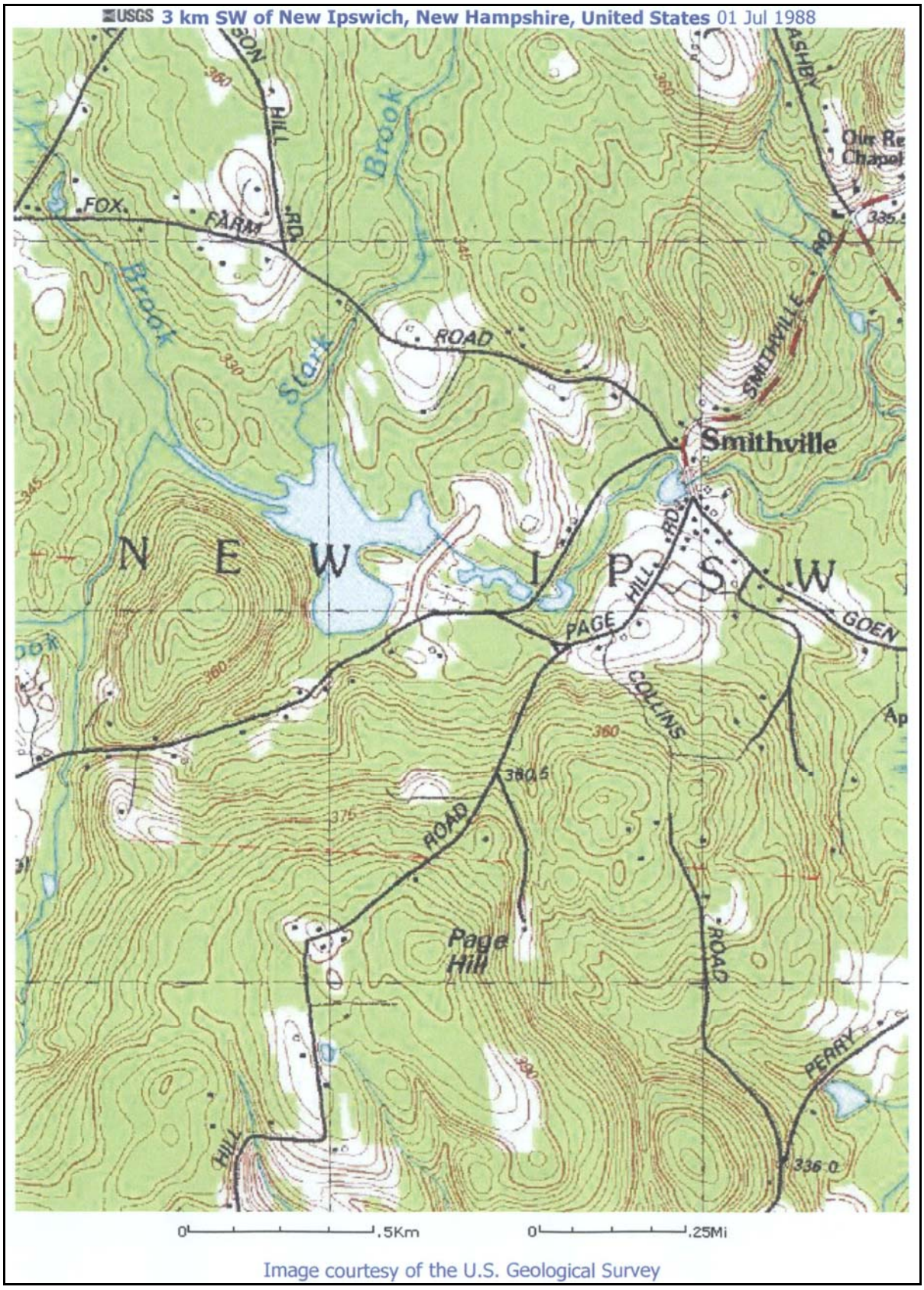

Figure 4. Site 35 topographic map

1.3 SITE 35

Site 35 is located in the Town of New Ipswich at the village of Smithville east of the confluence of Fox Brook and Pratt Pond Brook, which join to become the West Souhegan River downstream of the dam (Figure 4, location and topographic map). The 20-acre impoundment behind the dam forks to the south, north and west, mainly following the stream beds of Pratt Pond Brook and Fox Brook to the west and northwest and Stark Brook to the north. These streams, although not wide, have relatively flat floodplains on either side that have developed to accommodate the increased spring flows from the surrounding hills. The southern lobe fills the level space at the foot of Page Hill. Page Hill rises to 1250 feet and limits the western edge of the impoundment, forcing water to follow the streambeds listed above. The elevation of the surrounding areas is fairly level on the north and west sides of the impoundment, although a small hill between Stark Brook and Fox Brook/Pratt Pond Brook causes the split between the two northern lobes.

Based on review of the surrounding elevation and topography, elevating the dam level would push water into the streambeds and floodplains of Stark, Fox and Pratt Pond Brooks. NWI maps (Figure 5) show a 4.5-acre emergent wetland system (PEM1E) that wraps along the edge of the impoundment from the west lobe to the north lobe. Although a vegetation survey was not performed in this assessment, typical deep emergent marsh vegetation observed elsewhere along the Souhegan River includes burreed, pickerelweed, arrowhead, and mild water pepper. On summer aerial photos, a band of vegetation extends from the emergent marsh into the impoundment – this is likely non-persistent, aquatic bed vegetation (PAB) such as pondweeds and spatterdock. These wetlands are often not shown on NWI maps, which are usually derived from photographs taken in spring or fall. We estimated the PAB wetland area to be approximately 3 acres. North of the emergent wetland on Stark Brook and west of the emergent wetland on Fox/Pratt Pond Brooks is approximately 5.5 acres of deciduous and coniferous forested wetlands (PFO1C and PFO4E). Deciduous forested wetlands are typically dominated by red maple, and the coniferous wetlands are often dominated by white pine and hemlock. The soils that lie along both of these streambeds and their floodplains (Naumberg fine sandy loam and Borohemists-ponded) are consistent with wetland vegetation (Figure 6, soils map), and extend well beyond the areas mapped as wetland by NWI. NWI maps may underestimate the area of forested wetland in this watershed.

Duration and timing of the water elevation changes will determine the nature of wetland impacts, and these are not precisely known. For estimating potential impacts, it was assumed that water levels would be higher than current levels by approximately 4 feet for most of the growing season. The 4 foot value is based on storage elevation information provided by the NH Dam Bureau (Mattaini, personal communication). Digital contour intervals in GRANIT and USGS maps are not small enough to precisely map the extent of standing water, and mapping scale issues between data sources did not allow for precise calculations of the existing wetlands areas and area of impact. We approximated the location of full pond on the 1963 topographic Plan of Storage Areas (USDA), which has four foot contour intervals (Figure 7, USDA Map). The following general predictions were made for the proposed action:

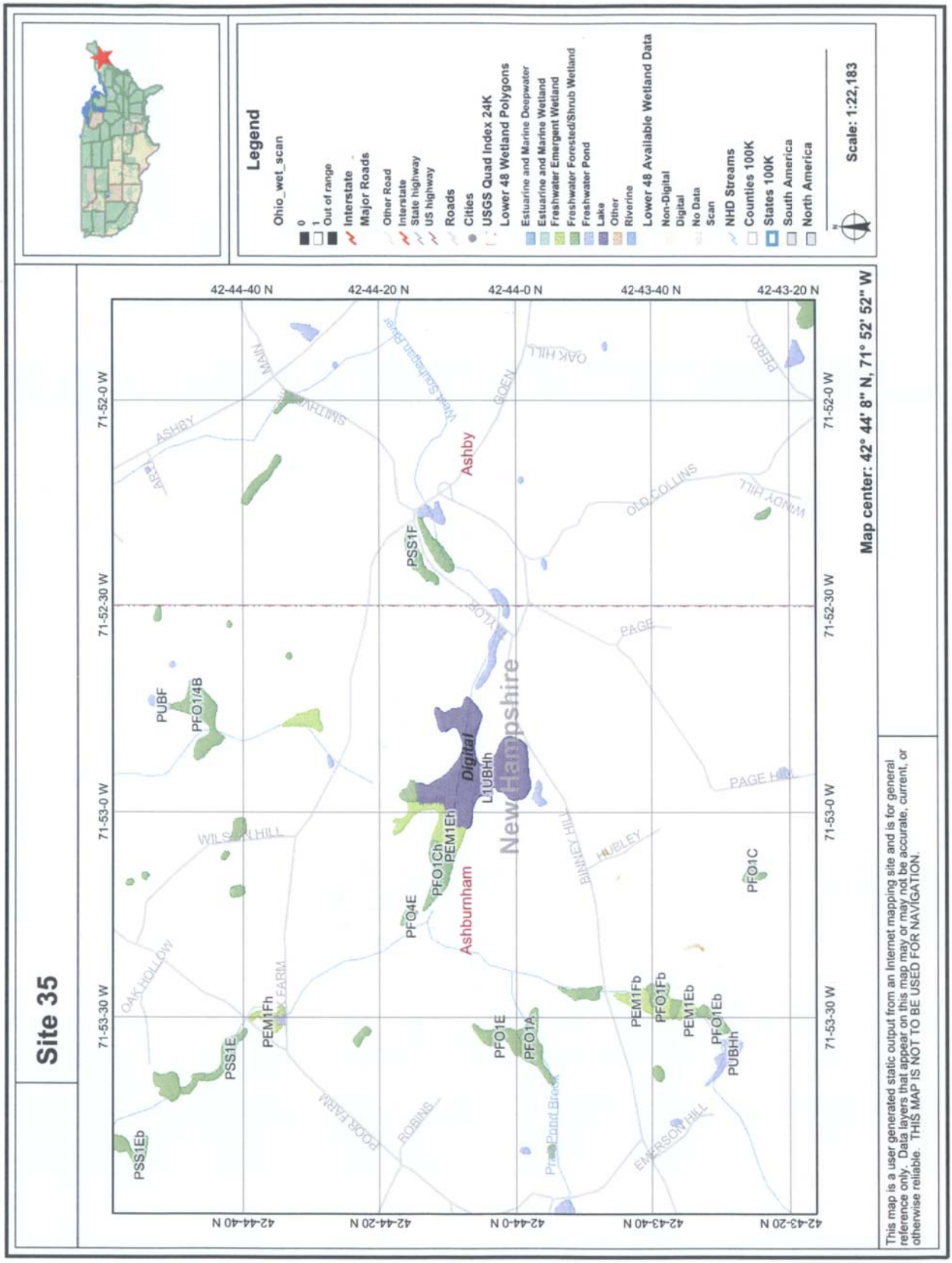

Figure 5. Site 35 NWI map

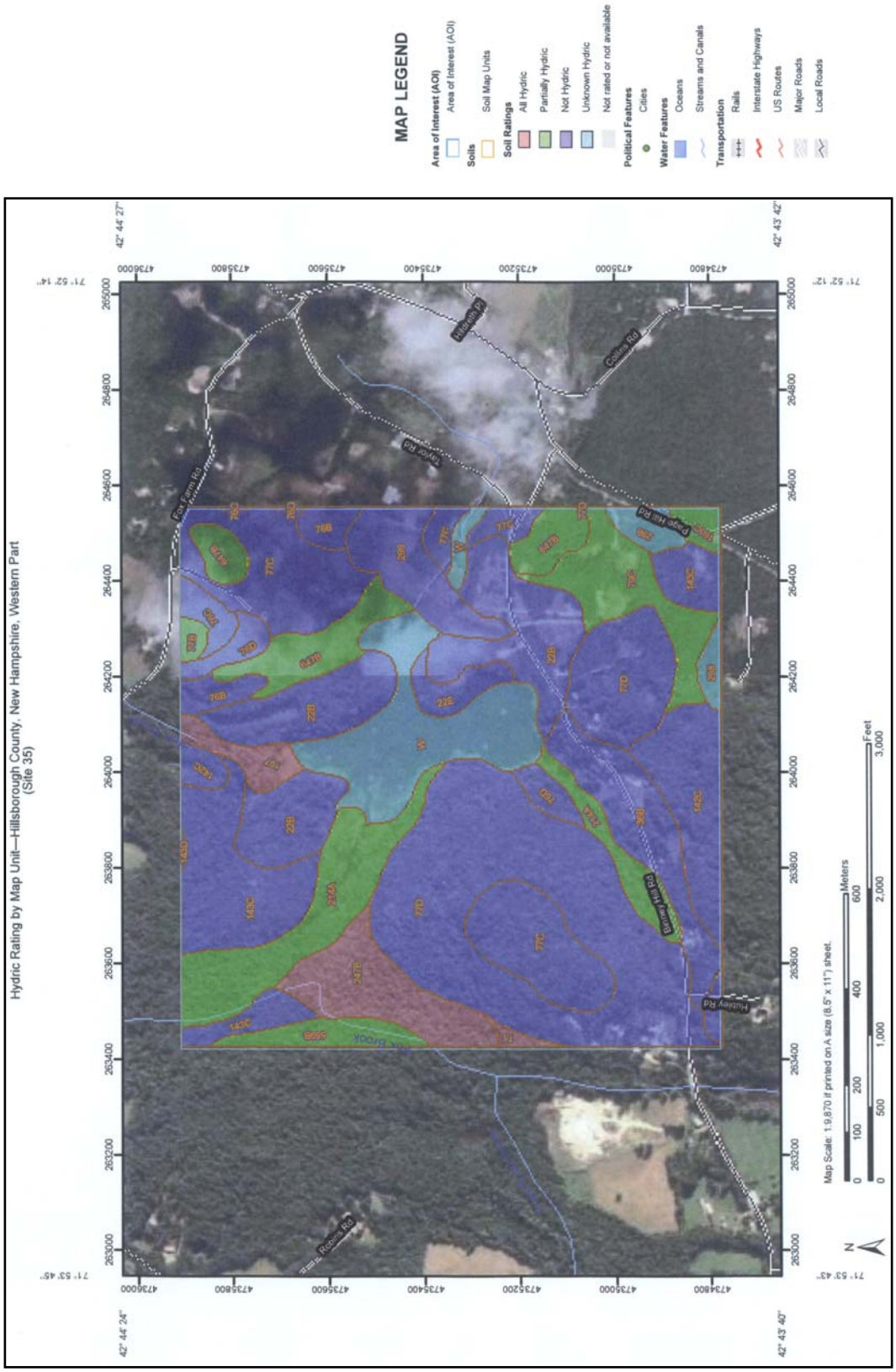

Figure 6. Site 35 NRCS soils map

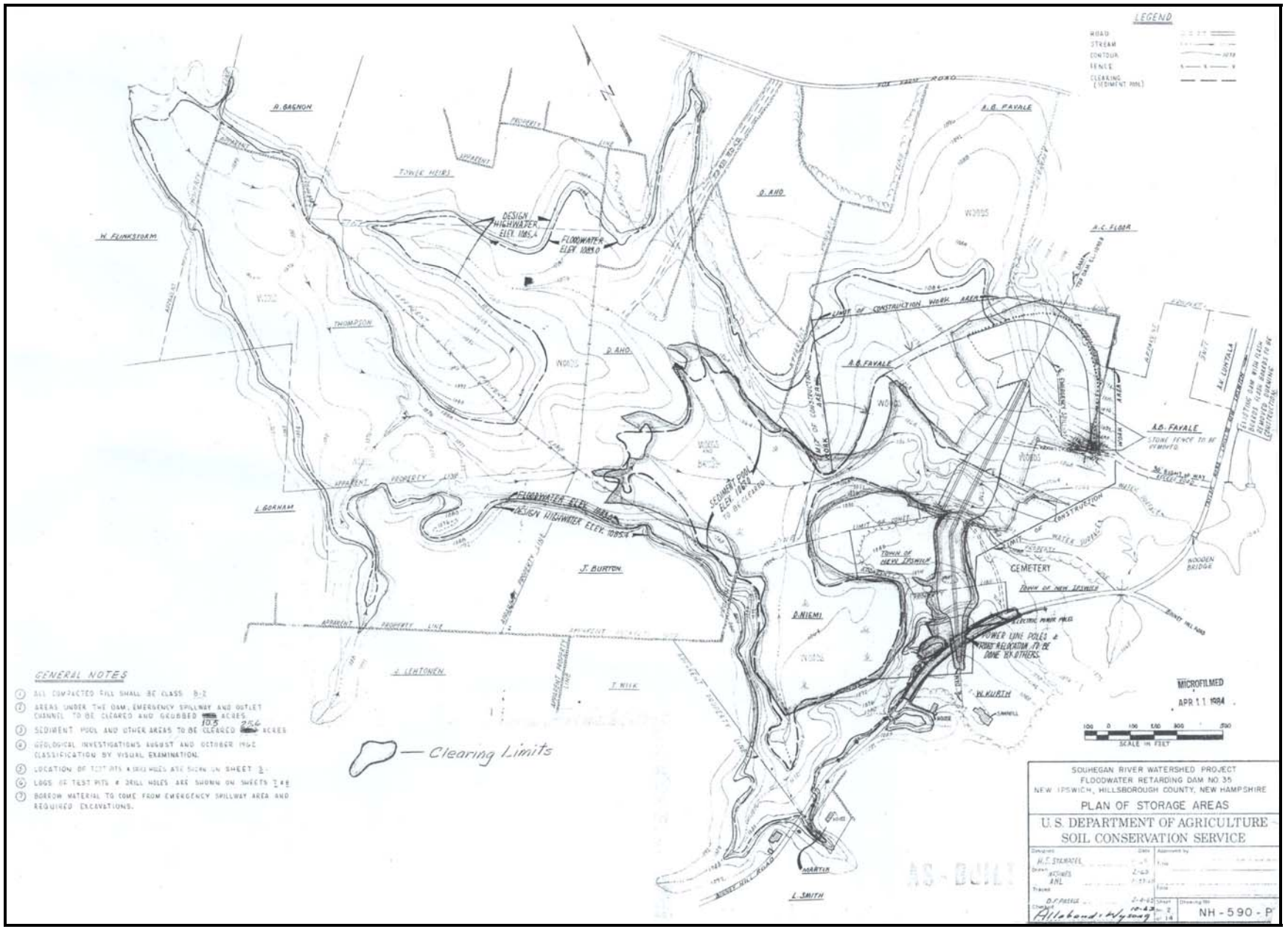

Figure 7. Site 35 As-Built Plan, dated October 1963

1. The existing deep marsh (PAB) would likely be replaced by open water or deep submergent vegetation.
2. Approximately 4.5 acres of existing emergent wetlands (PEM1Eh) bordering the impoundment will be converted to open water and submerged or floating-leaved aquatic plants (PAB) by a 4-foot increase in water levels, Over time, a new emergent marsh community may become established on stream floodplain terraces with summer water levels of approximately 1-6 inches, assuming some accumulation of organic matter. Based on a 1963 USDA topographic plan, this new emergent zone could be larger than the existing marsh. A zone of un-vegetated sand/gravel could develop just below the full pond elevation if water levels fluctuate frequently.
3. Trees within portions of the existing forested wetlands (PFO) that are inundated or saturated to the ground surface throughout the growing season would succumb within a few years, and emergent and scrub-shrub wetlands (PEM1, PSS1) would become established where water is at or near the surface during the growing season. As previously mentioned, the amount of emergent marsh may increase, and may extend beyond the NWI-mapped forested wetlands. Vegetation dominance would shift from facultative wetland trees and herbs to obligate wetland shrub and emergent species.
4. Forested and shrub-scrub wetlands may become established in uplands along the higher floodplain margins of the brooks, and in the upstream reaches of the impoundment fingers where somewhat poorly drained soils are present (including to the southwest and northeast of the impoundment where Naumburg soils are present but which appear to be forested uplands). This would likely occur slowly. Potential seed input from nearby wetland tree and shrub species is abundant, given the relatively undeveloped nature of the land in the surrounding area.

In summary, based on available maps and without benefit of a field investigation or survey, it appears that wetlands lost to flooding by a four-foot increase in impoundment elevations may be offset by the eventual development of additional wetlands along the tributary streams. The available information is insufficient to make an accurate calculation of wetland loss and gain by cover type. It also appears that no known rare, threatened or endangered species or exemplary natural communities would be affected by an increase in water levels.

2.0 LIMITATIONS OF EVALUATION

This evaluation was a “desktop” study and was conducted using the materials available online or provided by DES. No field assessment was conducted for this evaluation. In order to provide more precise approximations of the potential impacts of elevated water levels to the associated wetland communities, field studies should be conducted to confirm the existing wetland locations and community types (provided by the NWI and GRANIT maps). Updated survey or topographic data on a smaller scale than that which is available via online and existing maps, as well as additional data on the existing water levels, impoundment sizes and current operational regimes and detailed descriptions of the potential elevation changes and schedule would be needed to more precisely calculate the potential impacts.

3.0 REFERENCES

Mattaini, D. Personal communication (email) with Al Larson February 17, 2009.