Monitoring Report – 2010

Fourth Evaluation of Five

Reconstruction of Route 66

Middlefield, Connecticut
ConnDOT Project Number: 81-80
U.S. Army Corps of Engineers Permit 199201685

Prepared by the Connecticut Department of Transportation
Bureau of Policy and Planning
Office of Environmental Planning

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Army Corps of Engineers Permit No.: 199201685
CT Department of Environmental Protection (DEP) Permit No.: IW-96-131
Mitigation Site Names: White Oak, Reservoir North and Reservoir South (Route 66, Middlefield)
Monitoring Report: 4 of 5
Name and Contact Information for Permittee: Connecticut Department of Transportation; Edgar T. Hurle, Transportation Planning Director; 860-594-2005
Party Responsible for Conducting Monitoring and Dates of Inspection: CT DOT Office of Environmental Planning (OEP) inspected the site on July 13, 2010 and November 10, 2010.

Project Summary: The reconstruction of State Route 66 in Middlefield, Connecticut was initiated primarily as a safety improvement project resulting from concerns regarding roadway geometry, insufficient roadway capacity, and a long history of fatal accidents. To this end, the project consists of widening a 2.1-mile stretch of Route 66 from two to four lanes and realigning a portion of it to improve stopping sight distances, alleviate a dangerous S-curve, and moderate roadway grades.

The reconstruction described above resulted in the permanent loss of 1.67 acres of wetlands within 16 sites. Approximately forty linear feet of perennial stream was also impacted as a result of the project. These impacts were primarily to palustrine-forested wetlands. The most typical functions of the impacted wetlands included wildlife habitat, production export, flood flow alteration, groundwater recharge/discharge, sediment/toxicant/pathogen retention, finfish habitat, and nutrient removal/retention/trans-formation. It should be noted, however, that most of the impacted wetlands had limited functions and values as a result of their small size and/or limited diversity, and that many of these areas were small drainage ditches that had been created during the construction of the original roadway.

Mitigation for these impacts consists of four created wetlands totaling 2.53 acres, a creation ratio of 1.5:1. These are the 1.0-acre White Oak, 1.16-acre North Reservoir, 0.28-acre South Reservoir, and 0.09-acre Central sites. The constructed wetlands were designed to replace like functions and values to an equal or greater degree.

Location and Directions to Mitigation Sites: All four mitigation areas are located along Route 66 in Middlefield. The Central site is located immediately behind the detention basin on the south side of Route 66 approximately 1500 feet east of the intersection of Routes 66 and 147. The White Oak site abuts the Mount Higby Reservoir on the same side of Route 66 approximately 500 feet south of the Central site. This is the only one of the four sites that is not visible from the road. The North Reservoir site abuts the Mount Higby Reservoir on the north side of Route 66 approximately 500 feet east of the Central site. The South Reservoir site abuts the eastern limit of the Mount Higby Reservoir on the south side of Route 66 and is located just southwest of a second detention basin located approximately 150 feet from the edge of the road. The Latitude/Longitude coordinates of the mitigation sites are provided below in decimal format.

Reservoir North:	41.53855	72.72538
Reservoir South:	41.53840	72.72036
White Oak:	41.53512	72.72681
Central:	41.53682	72.72671

Start and Completion Dates for Mitigation:
According to CT DOT records, mitigation began in the summer of 2004 with over excavation, placement of organic soils, and seeding culminating in the fall of 2004. The contractor hired All Seasons to conduct the

planting, and the initial planting of the North mitigation site in September and October 2004, while the remaining three sites were planted in April and May of 2005. An October 2005 inventory of the plantings and subsequent meetings revealed that a substantial number of the original plantings had died within the CT DOT-required one-year guarantee period. On November 3, 2006, All Seasons planted 12 replacement shrubs in the Central mitigation site and 1,688 replacement shrubs in the North mitigation site to compensate for these losses, thus completing the creation phase of the mitigation site. Maintenance and monitoring is now ongoing.

Performance Standards are/are not being met: All sites meet or exceed the ACOE's species diversity standards. As of the close of the 2010 monitoring season, portions of the mitigation areas still fall short of the ACOE's 35% plant survival requirement per cell and all sites fall short of the DEP's 85% total plant survival requirement. However, all sites meet (Reservoir South) or well-exceed (Reservoir North, White Oak, and Central) a density of 500 woody plants per acre in planned woody swamp areas, and all emergent marsh areas are well-vegetated as well. With the exception of Reservoir South, which is dominated by cattail in the emergent marsh, the diversity of species in the emergent marsh areas is also high.

As noted in previous reports, the most significant factors contributing to failure to meet the percent survival standards appear to be a high initial mortality rate among plantings and undesirable mowing activities, with the former being more significant that the latter. Replacement plantings were installed following the initial installation; however, the number of replacement plantings apparently did not match the number of plantings that did not survive the first season. The agreed upon number of replacements followed a lengthy disagreement with the Contractor regarding his replanting obligations. While it was noted in the 2009 report that the mowing activities appeared to have ceased too late for most of the original plantings in the mowing area to be able to recover, the 2010 site visit revealed that this is not necessarily the case. Many healthy shrubs were found in these mowing areas during the latest inspection, at least some of which are assumed to be plantings that have begun to recover and displayed healthy foliage, flowers and fruits. Others are assumed to be volunteers that have effectively taken hold because they were species not included in the original planting scheme. These latter species include green ash (*Fraxinus americana*,), white pine (*Pinus strobus*), bayberry (*Myrica pennsylvanica*), tulip tree (*Liriodendron tulipifera*), speckled alder (*Alnus incana*), and ironwood (*Carpinus caroliniana*). Additionally, while winterberry (*Ilex verticillata*) and red maple (*Acer rubrum*) were both planted on the project as a whole, individuals of sufficient size of both species were found in mowing areas in which they were not planted.

OEP expects the sites will eventually meet most or all of the vegetation goals set forth by the ACOE. That is to say, the number of survivors and volunteers will equate to the same number of plants as would a 35% survival rate with no volunteers. In fact, only a year or two without mowing (timelines are described below) have brought the sites very close to these goals for all four sites. White Oak has already exceeded this standard, largely due to the additional plantings found in the formerly mowed portion of the site. Still, it is unlikely the sites will meet DEP's significantly higher standards. As noted previously, the original planting densities were so high it is unlikely that all the plantings would have survived even in the absence of other stressors simply based on the space that each plant would have required to flourish. As an example, 5,964 woody plants were placed in Reservoir North, along with 4,385 herbaceous plantings. Even if the density calculation discounts all herbaceous vegetation and assumes that the entire acreage was dedicated to wooded swamp (in truth that number is closer to half of that), an 85% survival rate represents a tree/shrub density of 4,370 woody plants per acre. For comparison, the Army Corps permit's Monitoring Plan section (Section K) calls for 500 woody plants per acre, while the Planting Plan section (Section E) calls for 600. These equate to 11% and 14% respectively of the numbers required to meet DEP's survival requirements. Since the survival rate standards are based simply on original plant densities and not on a specific density goal for the sites as a whole, nor do they account for successful volunteers that are as or more desirable than planted stock, it seems more prudent to measure the success of the site by overall density and diversity goals. Finally, analysis of aerial photography indicates that at least some of the failed plantings on Reservoir North were likely planted

outside of the limits of the mitigation area. Again, this may have been a response to the lack of space allotted for the large number of plantings installed on this site. These concerns are discussed in detail in Section II of this report.

Soils data indicate that the majority of the acreage of all four sites has hydric soils. The only place where this is not the case is in the far eastern portion of Reservoir North, the area of greatest concern as far as both (local density of) vegetation and soils criteria. Soil test pits and an in-depth file review of the proposed and as-built conditions have led to the following conclusion and supporting observations. A portion of Reservoir North was not excavated deep enough to develop a hydric soil profile; however this area is smaller than was previously supposed. As noted in 2009, OEP reviewed aerial photographs in order to distinguish areas of failed mitigation from any upland that was planted beyond the limits of the mitigation area, and the available mapping seems to indicate that, many of the plantings in the far eastern portion of the site are outside of the 1.16 acre mitigation footprint. Much of the stock installed during the replanting efforts appears to have been placed in uplands that were beyond the proposed mitigation area. While it is unclear why these plants were installed in uplands, it is clear that they did not survive due to dry conditions. It is possible that the density of wetland plantings as a whole made it difficult to install all of them in the lower-lying portions of the site.

Invasive species are largely being contained, however there are still several invasive species standards set by the ACOE that are not presently being met. Diligent monitoring and control efforts are needed to ensure attainment of these standards. Mitigation success standards are discussed in detail in Section II below.

Dates of Corrective or Maintenance Activities Conducted Since Last Report: Purple loosestrife, autumn olive (*Elaeagnus umbellata*), multiflora rose, (*Rosa multiflora*) Oriental bittersweet (*Celastrus orbiculata*), and phragmites (*Phragmites australis*) have now all been found to varying degrees on-site. Some removal of all of the woody species noted was conducted during the monitoring year (concurrent with site inspections), but this is an ongoing struggle due to the seed sources in the soils on and immediately adjacent to the managed lands. Now that mowing has ceased, invasives control is more difficult because the higher eleveation areas are the most hospitable locations for most woody invasives to colonize.

It appears from the spring/summer site visit of 2010 that many of the original plantings in the mowed sections of Reservoirs North and South and White Oak which were thought in 2009 to be compromised to the point where they were unlikely to recover, are now doing just that. Many of these plants might also be volunteers, but the fact remains that they have reached a size that is substantial enough that it appears they will thrive. It is OEP's hope that the cessation of mowing and management of invasive species will continue to allow native herbaceous and woody species to colonize these areas and leave less room for invasives themselves to colonize. In Reservoir North, the portion of the site affected by mowing has not supported any invasive species to date. This is probably due to lengthier periods of inundation within the mowing limits on Reservoir North as compared to affected sections of the other mitigation sites. Mechanical removal, while tedious, is the only feasible option for the control of species for which no biological controls are available since chemical controls are not permissible in such close proximity to the reservoir.

Control of purple loosestrife (*Lythrum salicaria*) is one of the most crucial components of mitigation maintenance activities if these mitigation areas in general, and Reservoir South in particular, are to be successful. Field investigations in 2010 showed evidence of ongoing feeding activities of *Galerucella* beetles from previous years, and after increasing for several years, the number of adults observed during the beetles' active season now appears steady. During the 2010 site inspections, OEP found either the beetles themselves or evidence they'd been feeding at the Reservoir South (where they were originally released), Reservoir North and White Oak sites. They are also now at every impact site where purple loosestrife is present. It appears that the numbers of *Galerucella* presently within the mitigation areas and along the project corridor are enough to be effective at controlling purple loosestrife, and thus no additional releases are proposed at this time. It is

expected that the percent cover of purple loosestrife in this area will decrease now that it is clear the beetles have become established here; however, OEP will continue to monitor *Galerucella* and purple loosestrife throughout the mitigation and impact areas and will assess each year whether or not an additional release is necessary. No additional areas of loosestrife were located in 2010.

One of the main concerns at all four mitigation sites is that there had been extensive damage to woody plantings from seasonal mowing activities. During OEP's summer of 2007 inventory aimed at assessing the success of the mitigation plantings, OEP staff observed extensive damage to plantings at all four mitigation sites as a result of lawn mowing operations. At this time, OEP initiated contact with the City of Middletown Water and Sewer Department (MWS) to bring the problem to light and to request that the affected areas be staked to provide a clear visual cue for maintenance crews. The Water Company responded and scheduled to meet with OEP on-site on May 8, 2008 to establish and stake clear mowing limits. Some portions of the mitigation areas immediately benefited from these communications, however, many of the stakes were found to be missing during the September 2008 site inspection, and mowing of plantings was continuing to occur at the Reservoir North and White Oak sites, and to a lesser degree at the Central site beyond the limits established during the meeting. After several additional communications back and forth, the City of Middletown's Environmental Resource Specialist, James Sipperly, suggested a second field meeting. On March 12, 2009, Mr. Sipperly met OEP staff, and againmowing limits, staking, and signage were discussed. DOT Maintenance was also present on-site to install signs for the Reservoir South and Central sites. OEP was able to obtain signs for these two sites because DOT still owns these properties; however, there are presently no signs for the White Oak or Reservoir North sites, and it is not within DOT's power to install such signs on property it no longer owns. Mr. Sipperly followed up with the mowing crews to make sure they were aware of the mowing limits and offered to look into whether the Town could provide the remaining signs.

While it is largely the case that the formerly mowed areas have been left to regenerate since Mr. Sipperly's efforts to assist the DOT, photographs from the November 2009 site inspection do not appear to show a full year's growth in a limited portion of the White Oak and Reservoir North sites, leading OEP to assume these areas were mowed at some point during the 2009 growing season. It should again be noted that this area is not extensive. Following the issuing of the 2009 report relating this information, Mr. Sipperly initiated contact with DOT in January of 2010 to make certain the issue was resolved. While the exact limits of mowing in 2009 are still unclear, the entirety of the four sites appeared to have been left to grow a full year when they were inspected at the end of 2010. .

Recommendations for Additional Remedial Actions: It is the OEP's intention to continue to monitor the presence and general health of purple loosestrife within Reservoir South and throughout the mitigation areas. If it becomes necessary to do so, OEP will release additional *Galerucella*, though several years of monitoring indicate that is likely to be unnecessary. OEP will also continue to monitor for the presence of other invasive species such as autumn olive and multiflora rose, and will continue to work to the best of its ability to remove plants that encroach upon the mitigation area. While these plants are not well represented on the sites at present, this is largely a result of the mowing activities that have now all but ceased as well as removal efforts exacted on very small plants before they can get a good hold.

With regard to mowing activities, it appears as though Mr. Sipperly has effectively educated the MWS's mowing crew about the situation at the sites, since no mowing seemed to have encroached on the planted areas in 2010, and a substantial number of woody plants, be they recovering plantings or volunteers, have colonized these area.

ii. REQUIREMENTS

The Special Conditions sections of both Department of the Army permit 199201685, issued January 24, 2003, and DEP Inland Wetlands and Watercourses permit IW-96-131, issued January 13, 2002, state that mitigation must be performed in accordance with the final approved mitigation plan as well as with the Army Corps Checklist for Review of Mitigation Plan. The CT DOT's December 12, 2002 Mitigation Plan sets forth that for each of the first five full growing seasons following construction of the mitigation sites, the sites shall be monitored biannually, with annual monitoring reports being submitted to the ACOE and biannual reports being submitted to the DEP. The requirements set out in these documents are included below for each site, as are the four appendices required by the ACOE Mitigation Checklist.

SUCCESS STANDARDS

(1). Vegetative Density and Diversity and Plant Survival Rates:

- "ACOE mitigation standards require that the site have at least 500 trees and shrubs per acre, of which at least 350 per acre are trees for proposed forested cover types, that are healthy and vigorous and are at least 18" tall in 75% of each planned woody zone AND at least the following number [numbers are listed for each site below based on the original number of species planted] of non-exotic species including planted and volunteer species. Volunteer species should support functions consistent with the design goals. To count a species, it must be well represented on the site (e.g., at least 50 individuals of that species per acre)."
- The DEP Inland Wetlands permit states that "A plant survival rate of less than 75% the first year, 80% the second year, and 85% the third, fourth and fifth year will automatically require two additional years of monitoring and remedial action to be taken which may include but not necessarily be limited to, replanting of dead or dying stock, substituting different plant species, or adjusting grading at the site to provide appropriate topography. Such remedial action may not be required if sufficient volunteer plants with good wildlife habitat value are well established."
- DEP also requires that an inventory of herbaceous vegetation be conducted once per year and include both seeded and volunteer species with approximate abundance levels.

All four mitigation wetlands were designed and planted as emergent marsh surrounded by a perimeter of shrub swamp. All four wetlands were also seeded with a wetland mix that included eighteen herbaceous species intended to supplement the plantings. The Reservoir North wetland plantings consisted of seven species of shrubs and seven species of emergent vegetation, the Reservoir South wetland was planted with five species of shrubs and five species of emergent vegetation, the White Oak wetland was planted with eight species of shrubs and seven species of emergent vegetation, and the Central wetland was planted with six species of shrubs and seven species of emergent vegetation. A large percentage of the original plantings did not survive, particularly in the Reservoir North wetland, and a portion of these were replaced in the fall of 2006.

OEP conducted an inventory of the living woody plantings in July of 2010 and conducted a full count of all woody plants within formerly mowed areas. A brief description of dominant woody vegetation at each of the four sites follows. Only those species meeting the ACOE's 50 individuals per acre criterion are listed. Also noted below is whether the number of dominant species meets the ACOE species diversity requirement (i.e. the minimum number of species that must be well represented, calculated based on the original number of species planted).

- Reservoir North: Shadbush (*Amelanchier Canadensis*), silky dogwood (*Cornus amomum*), buttonbush (*Cephalanthus occidentalis*), highbush blueberry (*Vaccinium corymbosum*) and arrow-wood (*Viburnum dentatum*) are dominant. This meets the diversity requirement of five successful woody species for this site based on the original planting of seven woody species. Additionally, now that mowing has ceased, the

number of red maples (*Acer rubrum*) that have volunteered make this a species that will likely be added to the list above in the next couple of years.

- Reservoir South: Common winterberry (*Ilex verticillata*), silky dogwood, arrow-wood and buttonbush are dominant. Therefore, this site contains all four of the woody species needed in numbers greater than 50 per acre to meet the vegetation success standards based on the original planting of five woody species.

- White Oak: Pussy willow (*Salix discolor*), arrow-wood, silky dogwood, common winterberry and highbush blueberry are dominant. Red maple is a frequent volunteer species in this area, and although their numbers are more than sufficient to qualify as dominant, many of the individual plants are still too small at this point to be counted. Buttonbush (*Cephalanthus occidentalis*) and green ash (*Fraxinus pennsylvanica*) are now nearly common enough to be counted as dominants as well. Eight species were originally planted on this site, although only five of these were planted in densities of 50 or more individuals per acre. Still, the five successful species match the requirement associated with eight original plantings and surpass the four that would be required if the calculation were based only upon the five species planted above the threshold density.

- Central: silky dogwood, highbush blueberry, arrow-wood, and winterberry are dominant. Based on the original planting of six woody species, the four dominants remaining match the ACOE diversity requirement.

As of the close of the 2010 monitoring season, some areas still fall short of both ACOE and DEP standards for plant densities and survival rates. The ACOE requirement of at least 350 trees per acre for proposed forested cover types is not applicable to any of the mitigation areas since no forested wetland was proposed. Presently, if calculated based upon raw wetland acreage rather than acreage of wooded wetland, only the Central mitigation site meets the ACOE vegetation success standard (i.e. at least 500 trees and shrubs per acre). If the acreage of planned open water and emergent marsh are removed from the calculation, however, all sites meet this criteria and three of them (Reservoir North, Central and White Oak) far exceed it. Although this distinction between plant communities is not made in the standard, it is assumed that such a density of woody plants would not be required in marsh or wet meadow community, for example, and so the distinction seems appropriate. None of the sites meets the DEP required 85% plant survival rate.

It is likely that several factors have played a part in the loss of plantings. The most significant factors appear to be a high initial mortality rate among plantings, particularly those at Reservoir North, and undesirable mowing activities. Following the first growing season, DOT had to undergo lengthy negotiations with All Seasons to secure replacement plantings in accordance with the contract. Still, the replacement plantings were not in kind, and the result was a reduction in numbers as well as diversity of species on the site in comparison to what was proposed. While OEP does expect that the mitigation sites will eventually meet most or all of the vegetation goals set forth by ACOE regardless, it is unlikely they will meet DEP's significantly higher standards.

It is OEP's position that all of the sites could be very successful without meeting this standard (85% survival of planted stock), since the standard itself is based not on any type of plant density goal for the site, but upon the exceedingly high number of plantings that were originally installed. Further, the originally plantings were so dense that it is unlikely that they all would have survived even in the absence of other stressors simply because each plant would not have had the space it required to flourish. As noted elsewhere in this report, the original planting densities were far higher both than one would observe in a natural wooded wetland system or than the Army Corps requires, and they are far higher than the USDA recommends as well.

Finally, analysis of aerial photography indicates that at least some of the plantings on Reservoir North are outside of the limits of the mitigation area. Again, this may have been in response to a lack of space for the large number planted, with the result being that species planted here, primarily arrow-wood and silky dogwood, are suited for wetter conditions than those in which they were planted. It is highly likely that the planting densities on all sites and the placement of plants above the true wetland boundary at Reservoir North are the two most significant contributors to the high overall plant mortality rate.

In support of OEP's position regarding the excessive planting densities, DOT records indicate that the subcontractor originally installed 10,349 plantings at the 1.16-acre Reservoir North site. Of these, 4,385 plantings were herbaceous and 5,964 were woody. This represents a planting density of 8,922 plants per acre (or one plant per every 4.9 s.f.), 5,141 per-acre of which are woody plantings. If the herbaceous plantings are discounted entirely, the planting density is still one plant for every 8.5 s.f., which translates to a distance between woody plantings of 3.3 ft on center. It should further be noted that there are substantial portions of all four sites that consist of open water and/or emergent marsh, neither of which have any appreciable number of woody plants. Therefore, while a spacing of 3.3 feet on center is already too dense for most woody plant species according to the USDA, this number is in reality a substantial overestimate of how much space each plant would have had in Reservoir North (see Table 1 below).

The USDA's online plant database lists maximum planting densities for many species. The maximum recommended planting densities for all seven woody species in Reservoir North are well below the actual planting density of 5,141 plants per acre. Silky dogwood has the highest maximum recommended density of the seven species at 4800 plants per acre, while the maximums for all remaining species are under 3000 plants per acre, and three species (shadblow, elderberry and highbush blueberry) are 1800 plants per acre or less. Coincidently, highbush blueberry was the best represented among all the species with 2,699 plants installed (2,327 plants per acre). In other words, were DOT to have installed only the 2,699 blueberries at Reservoir North, the densities would still have exceeded by 37% the upper limits recommended by the USDA.

TABLE 1

	Acreage	Woody Plantings	Herbaceous Plantings	Woody Plants/Ac.	Herbaceous Plants/Ac.	Feet on Center (woody plants only)	% Woody Plants	% Herbaceous Plants
Reservoir North	1.16	5,964	4,385	5,141	3,780	3.3	57.6	42.4
Reservoir South	0.28	360	6,560	1,286	23,429	6.6	5.2	94.8
White Oak	1.0	977	11,133	977	11,133	7.5	8.1	91.9
Central	0.09	275	2,148	3,056	23,867	4.3	11.3	88.7

Calculating only woody plantings in this way, the numbers for Reservoir South, White Oak, and Central are somewhat less striking. All three of these sites also have larger percentages of their total acreage as open water and/or emergent marsh, however, and consequently have much higher percentages of herbaceous plantings thus far unaccounted for in the calculations (see "% Herbaceous Plants" in Table 1 above). The higher these percentages, the more skewed these calculations become in terms of woody plant densities appearing to be less than what they truly are.

To illustrate this point, a separate calculation was employed utilizing conservative estimates of the portion of each site represented by open water and/or emergent marsh to determine approximate plant densities in the remaining acreage of wooded wetland (see Table 2 below). OEP used the following ratios of wooded wetland to combined emergent marsh/open water for these calculations: 2:1 for Reservoir North (0.77 acre wooded), 1:3 for White Oak (0.25 acre wooded) and 1:2 for Reservoir South (0.09 acre wooded) and Central (0.03 acre wooded). Using these estimates, the woody plant densities (plants per acre) in the remaining wooded wetlands

are as follows: 7,745 for Reservoir North, 4000 for Reservoir South, 3,908 for White Oak and 9,167 for Central. Even using conservative estimates of non-woody wetland acreage, the planting densities are striking. In the interest of transparency, it should be noted that the demarcating line between emergent marsh and shrub swamp is a bit blurred on the Central site and that a substantial number of woody plantings were installed within what is primarily emergent marsh. However, since the estimated acreages of combined open water and emergent marsh are conservative, and since this assertion is supported by the combined facts that much of the site is non-traversable year-round and that almost 90% of the plantings on this site were herbaceous, the calculations for this site are still considered useful.

TABLE 2

	Acreage	Estimated Ratio Wooded: non-wooded	Estimated Acreage Wooded	Woody Plantings	Estimated Woody Plants/ Wooded Ac.	Estimated Feet on Center (distance between stems) of woody plants in wooded wetland
Reservoir North	1.16	2:1	0.773	5,964	7,712	2.7
Reservoir South	0.28	1:2	0.093	360	3,857	3.8
White Oak	1.0	1:3	0.250	977	3,908	3.8
Central	0.09	1:2	0.030	275	9,167	2.5

In addition to masking the true planting densities of woody species, the substantial portions of each site planned as emergent marsh with little or no shrub cover also make it more difficult to meet the stated ACOE goal of 500 woody plants per acre since this standard does not appear to take into account wetland plant community types. In fact, OEP calculates as of the 2009 plant inventory that this goal would be met for all but the Reservoir North site if the amount of open water and emergent marsh were factored in to the calculations. That is, if the rough acreage of open water and emergent marsh was subtracted from the total acreage for each site before determining how many plants amount to 500 per acre for each site.

As stated above, between the recovery of some of the mowed plantings and the proliferation of volunteer species such as red maple, it is likely that most or all of the woody vegetation goals set forth by the Army Corps for the mitigation sites will eventually be met. Also as stated above, the percent survival requirements set forth by the DEP are not likely to be met due to the sheer numbers involved in the initial planting effort.

In addition to woody plantings, DEP requires monitoring of herbaceous species in the mitigation areas. The chart below is an inventory of all herbaceous species identified at the four mitigation sites in 2010. For each site, plants are listed by their common and scientific names with an assessment of their relative abundance. Relative abundance is broken into three categories: Dominant (D), Established (E) and Trace (T). A 'Dominant' label indicates that a species was among the most common in the subject mitigation area. This was determined by assessing whether the species represented at least 20% of the ground cover. Species designated as 'Established' had more than just a few individual plants but represented less than 20% of the ground cover. 'Trace' species had no more than a few individual plants identified. In order the facilitate review, additions/amendments since the 2009 end-of-year report are in bold face. Also in bold are invasive species for which an estimate of percent cover has been added at Army Corps' request.

Reservoir North Mitigation Wetland

Common name	**Scientific Name**	**Relative Abundance (% Cover)**
redtop	*Agrostis alba*	established
bentgrass	*Agrostis sp.*	established
northern water plaintain	*Alisma triviale*	established

swamp milkweed	Asclepias incarnate	trace
aster	*Aster sp.*	established
nodding bur marigold	*Bidens caernua*	established
devil's beggarticks	*Bidens frondosa*	established
lake sedge	*Carex lacustris*	established
lurid sedge	***Carex lurida***	**trace**
fox sedge	***Carex vulpinoidea***	**established**
deer-tongue grass	***Dichanthelium clandestinum***	**trace**
barnyard grass	*Echinochloa crusgalli*	dominant
American waterwort	*Elatine americana*	established
spike rush	*Eleocharis spp.*	established
fireweed	*Erechtites hieracifolia*	established
spotted joe-pye-weed	*Eupatoriadelphus maculatus*	established
soft rush	***Juncus effusus***	**established**
bush-clover	*Lespedeza sp.*	trace
bird'sfoot trefoil	*Lotus corniculatus*	established
purple loosestrife*	***Lythrum salicaria****	**trace (<3%)**
wild mint	*Mentha arvensis*	trace
arrow-arum	*Peltandra virginica*	established
ditch stonecrop	*Penthorum sedoides*	established
Timothy	*Phleum pratense*	established
tearthumb	*Polygonum sp.*	established
smartweed	***Polygonum sp.***	**trace**
big-leaved arrowhead	*Sagittaria latifolia*	established
little bluestem	*Schizachyrium scoparium*	established
wool-grass	*Scirpus cyperinus*	dominant
soft-stem bullrush	*Scirpus validus*	dominant
yellow foxtail	*Setaria glauca*	established
goldenrod	*Solidago sp.*	established
bur-reed	*Sparganium americanum*	trace
giant bur-reed	*Sparganium eurycarpum*	established
red clover	*Trifolium pretense*	trace
cattail**	***Typha latifolia***	**dominant (approx. 20%)**

Reservoir South Mitigation Wetland

Common name	**Scientific Name**	**Relative Abundance**
common yarrow	*Achillea millefolium*	established
water-plantain	*Alisma subcordatum*	trace
common burdock	*Arctium minus*	established
common milkweed	*Asclepias syriaca*	trace
swamp milkweed	*Asclepias incarnate*	trace
asters	*Aster spp.*	established
tussock sedge	***Carex stricta***	**trace**
wild sensitive plant	*Cassia nictitans*	trace (dominant in vicinity)
Asiatic bittersweet*	***Celastrus orbiculata****	**trace (<1%)**
umbrella-sedge	*Cyperus strigosus*	established
Queen Anne's lace	*Daucus carota*	trace
three way sedge	*Dulichium arundinaceu*	trace
barnyard grass	*Echinochloa crus-galli*	dominant

autumn olive*	***Elaeagnus umbellata****	**trace (<1%)**
spike-rush	*Eleocharis spp.*	established
fireweed	*Erechtites hieracifolia*	established
spotted joe-pye-weed	*Eupatoriadelphus maculatus*	established
common boneset	*Eupatorium perfoliatum*	trace
bedstraw	*Galium sp.*	established
spotted touch-me-not	*Impatiens capensis*	trace
soft rush	*Juncus effusus*	established
bird'sfoot trefoil	*Lotus orbiculatus*	established
purple loosestrife*	***Lythrum salicaria***	**established- control in progress (approx. 3%)**
arrow-arum	*Peltandra virginica*	established
common reed*	***Phragmites australis****	**trace (<3%)**
English plantain	*Plantago lanceolata*	established
tearthumb	*Polygonum sp.*	established
common cinquefoil	*Potentilla simplex*	established
common selfheal	*Prunella vulgaris*	trace
multiflora rose*	***Rosa multiflora****	**trace (<1%)**
blackberry	*Rubus sp.*	established
wineberry[P]	*Rubus phoenicolasius*[P]	**established (approx. 5%)**
big-leaved arrowhead	***Sagittaria latifolia***	**established**
dark green bulrush	*Scirpus atrovirens*	trace
wool-grass	*Scirpus cyperinus*	established
soft-stem bullrush	*Scirpus validus*	**established**
yellow foxtail	*Setaria glauca*	established
bladder campion	*Silene latifolia*	trace
Carolina horsenettle	*Solanum carolinense*	trace
goldenrod	*Solidago spp.*	established
bur-reed	*Sparganium americanum*	trace
cattail**	***Typha latifolia***	**dominant (approx. 40%)**
blue vervain	*Verbena hastata*	trace
summer grape	*Vitis aestivalis*	trace

White Oak Mitigation Wetland

Common name	Scientific Name	Relative Abundance
red maple	*Acer rubrum*	established
common yarrow	*Achillea millefolium*	trace
bentgrass	*Agrostis sp.*	established
swamp milkweed	Asclepias incarnate	established
lurid sedge	***Carex lurida***	**trace**
tussock sedge	*Carex stricta*	established
wild sensitive plant	*Cassia nictitans*	trace
yellow nutsedge	*Cyperus esculentus*	established
umbrella-sedge	*Cyperus strigosus*	established
American waterwort	*Elatine americana*	established
spike rush	*Eleocharis spp.*	established
spotted joe-pye-weed	*Eupatoriadelphus maculatus*	established
common boneset	*Eupatorium perfoliatum*	established
common marsh bedstraw	***Galium palustre***	**established**
common St. John's-Wort	*Hypericum perforatum*	established

jewelweed	***Impatiens capensis***	**trace**
soft rush	***Juncus effusus***	**established**
toadflax	*Linaria vulgaris*	trace
bird's-foot trefoil	*Lotus orbiculatus*	established
purple loosestrife*	***Lythrum salicaria***	**established- control in progress (approx. 3%)**
square stem monkey flower	*Mimulus ringens*	**established**
sensitive fern	***Onoclea sensibilis***	**established**
arrow-arum	*Peltandra virginica*	dominant
Timothy	*Phleum pratense*	trace
common reed*	***Phragmites australis***	**trace- controlled (<3%)**
big-leaved arrowhead	***Sagittaria latifolia***	**established**
dark green bulrush	*Scirpus atrovireau*	established
wool-grass	*Scirpus cyperinus*	dominant
soft-stem bullrush	*Scirpus validus*	established
yellow foxtail	*Setaria glauca*	established
Carolina horsenettle	*Solanum carolinense*	established
goldenrod	*Solidago spp.*	established
bur-reed	*Sparganium americanum*	established
giant bur-reed	*Sparganium eurycarpum*	dominant
cattail**	***Typha latifolia***	**established (approx. 15%)**
common mullein	*Verbascum thapsus*	trace
blue vervain	*Verbena hastata*	**dominant**

Central Mitigation Wetland

Common name	Scientific Name	Relative Abundance
nodding bur marigold	*Bidens cernua*	established
lurid sedge	***Carex lurida***	**trace**
tussock sedge	***Carex stricta***	**established**
fox sedge	*Carex vulpinoidea*	dominant
barnyard grass	*Echinochloa crus-galli*	established
common marsh bedstraw	***Galium palustre***	**established**
common St. John's-Wort	***Hypericum perforatum***	**trace**
jewelweed	***Impatiens capensis***	**established**
soft rush	*Juncus effusus*	dominant
arrow-arum	*Peltandra virginica*	established
common reed*	***Phragmites australis****	**trace (<1%)**
arrowleaf tearthumb	*Polygonum sagittatum*	established
wool-grass	*Scirpus cyperinus*	established
soft-stem bullrush	*Scirpus validus*	established
yellow foxtail	*Setaria glauca*	established
goldenrod	*Solidago sp.*	established
bur-reed	*Sparganium americanum*	established
cattail**	***Typha latifolia***	**established (approx. 6%)**

* Denotes species listed on the 2004 Connecticut Invasive Plant List

** Denotes species listed as invasive in the ACOE permit, but not on the 2004 Connecticut Invasive Plant List

Dominant- Among most common species in mitigation area (i.e.20% or greater of any vegetative layer)

Established- Species is not dominant, but more than a few individuals present in impact/mitigation area

Trace- No more than a few individual plants present in impact/mitigation area

(2). ACOE requires that each mitigation site have at least 80% aerial cover, excluding planned open water or bare soil areas, by non-invasive species; that planned emergent areas on each mitigation site have at least 80% cover by noninvasive hydrophytes; and that planned scrub-shrub and forested cover types have at least 60% cover by noninvasive hydrophytes, of which at least 15% are woody species. For the purpose of this success standard, invasive species of hydrophytes are:

Cattails – *Typha latifolia, Typha angustifolia, Typha glauca*
Common Reed – *Phragmites australis*
Purple Loosestrife—*Lythrum salicaria*; and
Buckthorn—*Rhamnus frangula*

Reservoir North does appear to have 80% vegetative cover in non-planned open water areas, and at least 60% cover in scrub-shrub areas by non-invasive hydrophytes, with at least 15% of these being woody species. The one exception to this is the eastern portion of the site, discussed previously, where the plants did not survive. Purple loosestrife is present on the site in very small numbers, and control efforts undertaken thus far are described elsewhere in this report. The only invasive found in significant numbers on this site was cattail, which does appear to account for at least 20% of the planned emergent areas of the site. While cattail is well established on this site, it is of note that many other herbaceous species are also successful in this wetland.

Reservoir South has less than 80% aerial cover by non-invasive species in the non-planned open water areas and less than 80% aerial cover by non-invasive hydrophytes in the planned emergent marsh. The reason the site falls short of both of these standards is that cattail, purple loosestrife and common reed collectively represent greater than 20% of the total aerial cover of the site and of the emergent marsh as well. Cattail is far more abundant than purple loosestrife, and common reed is limited to only a few individuals. As with Reservoir North, a number of desirable native species are also abundant at this site, including arrow arum (*Peltandra virginica)*, barnyard grass (*Echinochloa crusgalli)*, and various sedges and rushes. With regard to purple loosestrife, efforts are underway (as described above) to use biological controls to manage the species in this area. Since purple loosestrife is dominant along much of the edge of the reservoir, a large seed bank exists immediately adjacent to the created wetland. It is therefore expected that purple loosestrife will be an ongoing concern for some time at this site. Now that mowing activities have ceased at Reservoir South, the site has over 60% aerial cover in scrub-shrub portions of the site, and the woody planting density is sufficient with at least 15% aerial cover by woody species.

The White Oak site has achieved over 80% aerial cover throughout the site by non-invasive hydrophytes, and in the planned scrub-shrub areas at least 15% of the vegetation is woody plantings. The site now also meets the criteria of 60% non-invasive plant cover criteria for scrub-shrub zones**.** Cattail, common reed, and purple loosestrife are present on the site; however, they collectively represent less than 20% of the plant cover in the emergent marsh. Of these three species, only the cattail is present in significant numbers. Additionally, many other submerged, emergent, and other herbaceous species are successfully established in the mitigation area, including blue vervain (*Verbena hastata*), joe-pye-weed (*Eupatorium maculatus*), arrow arum, tussock sedge (Carex stricta), giant burreed (*Sparganium eurycarpum*), soft stem bulrush, wool grass, and the volunteer species American Waterwort (*Elatine americana*) and Spike Rush (*Eleocharis spp.)*. Despite their small numbers on the site, common reed and purple loosestrife's status as very aggressive, non-native species makes monitoring and control of these species critical. In previous years, removal of common reed has been necessary within the mitigation site and the adjacent wetlands that were supporting a pre-existing infestation. Because of these efforts, common reed accounts for less than 3% of the emergent vegetative cover for this site. Purple loosestrife accounts for a similarly small percentage of the emergent vegetation because of the success of competing species and biological controls.

Central now meets the criteria of 80% vegetative coverage with non-invasive hydrophytes, since the relative abundance of cattail has been reduced by the proliferation of other native species. Many desirable submerged, emergent, and other herbaceous species are successfully established in the mitigation area, including a number of sedge (*Carex sp.*) species, soft rush (*Juncus effussus*), and nodding bur marigold (*Bidens cernua).* The scrub-shrub cover on this site is limited to a very narrow fringe around the emergent marsh. This site has a sufficient diversity and density of healthy native plantings and has no woody invasive species within the wetland itself. Further, it now meets the 60% aerial cover and 15% woody cover standards in planned scrub-shrub areas.

While OEP understands the Army Corps of Engineers' concerns about cattails' ability to form monocultures at the expense of other native species, the mitigation sites presently support a diverse and well-established emergent herbaceous vegetation community. Further, due to close proximity to the reservoir, the only available control option for cattail is mechanical removal. Removal will be completely ineffective without excavating the plants' underground root systems, which would necessarily affect all other established emergent species and their root systems as well. Accordingly, undertaking to mechanically remove the cattail would serve to knock back all the emergent species in the vicinity, with the likely result that the more sensitive desirable native species will suffer the greatest losses over time. Further, OEP is very concerned that two non-native invasive emergents in the area, purple loosestrife and common reed, are the most likely to supplant the cattail if control is in fact successful. Given that cattail is native and provides a benefit to native wildlife, OEP does not agree that control efforts for this species would have a positive outcome from an ecological standpoint.

(3). Invasive Species in Mitigation and Impact Areas:

- ACOE requires that Common Reed (*Phragmites australis*), Purple Loosestrife (*Lythrum salicaria),* Russian and Autumn Olive (*Elaeagnus* spp.), Buckthorn (*Rhamnus frangula*), and/or Multiflora rose (*Rosa multiflora*) at the mitigation sites be controlled.

As noted above, all non-native invasive species in the mitigation areas are present in relatively small numbers. OEP has been and plans to continue spot removing and monitoring autumn olive and other invasive woody species so they do not spread, particularly now that mowing activities were curbed. With regard to purple loosestrife, it is OEP's intention to assess continually whether this species is expanding its range in any of the monitored sites and to assess whether *Galerucella* beetles continue to be an effective control mechanism. Common reed is presently limited to a few individuals in Reservoir South and a very small patch (less than 2% of emergent vegetation) in White Oak. Common reed is well established in the wetlands adjacent to White Oak, so its lack of resurgence since initial control efforts were undertaken is encouraging and suggests that other established species are keeping its numbers in check. Monitoring will continue to determine if additional control efforts are necessary. Since chemical control is not allowable in proximity to the reservoir, OEP will investigate the practicality of seed top removal at the appropriate time of year. If access to the small infestation is possible without equipment, OEP will undertake a removal effort. If this is not possible, it will be important to weigh the benefits of removal against any negative impacts to the now-established community of competing native vegetation.

During plant inventories, individual woody invasive plants small enough to remove by hand have been continuously pulled by OEP staff within both the mitigation and impact areas during inspections.

(4). ACOE requires that all slopes, soils, substrates, and constructed features within and adjacent to the mitigation sites be stabilized.

This requirement has been met. All soils, substrates, and constructed features within the four mitigation areas are stabilized, and all erosion and sediment control measures utilized during construction have been removed.

ADDITIONAL ITEMS FOR NARRATIVE DISCUSSION

- Soils data should be collected after construction and every alternate year for the monitoring period:

  Soils data sheets were completed for the four mitigation sites in July of 2009 and were included in the 2009 report. Data sheets were also completed in 2011 and these will be included in the 2011 end-of-year report.

- What fish and wildlife use the sites and what do they use it for?

  In Reservoir North, white-tailed deer (*Odocoileus virginianus*) sign were noted, and it is likely that the deer use the wetland as a food source. An adult killdeer (*Charadrius vociferous)* was observed feigning a broken wing during the May 2008 site inspection, a behavior that is typical of a parent protecting a nearby nest. In a previous year, a juvenile gray treefrog (*Hyla versicolor*) was observed, and it is likely that open water portions of Reservoir North serve as gray tree frog mating habitat.

  A large number of American toad (*Bufo americanus*) tadpoles are observed in the standing water portion of Reservoir South each spring. In both 2007 and 2008, an adult gray tree frog was found in the outlet structure of the water quality basin adjacent to Reservoir South; an indicator that this species likely also breeds in the open water sections of this wetland, and an adult painted turtle (*Chrysemys picta picta*) was observed sunning itself on the riprap channel that leads from the basin to the wetland itself. Canada goose (*Branta canadensis*) sign was also noted in this area, which likely serves as a food source and cover for this species.

  Numerous green frogs (*Rana clamitans melanota*) were noted in the White Oak wetland, as was sign of white-tailed deer and Canada goose. It is likely that these species use this wetland for food and cover. Snapping turtle (*Chelydra serpentina*), great blue heron (*Ardea herodias),* and red-tailed hawk (*Buteo jamaicensis*) have also been observed here in previous years.

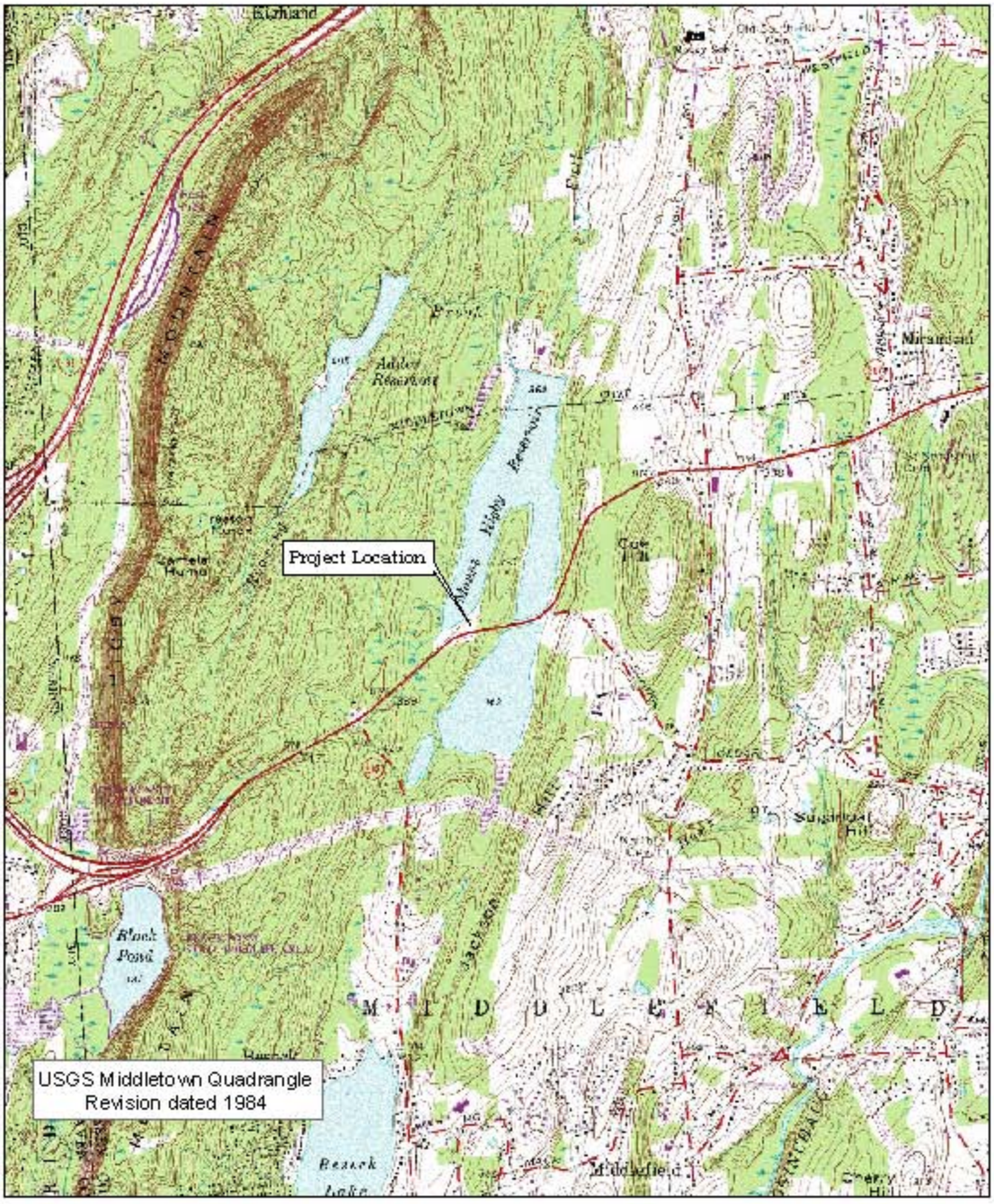
  Monarch butterflies are repeatedly noted in the Central wetland in the warmer months. Although Monarchs require milkweed in order to breed, they feed on the nectar of many different flower species. Therefore, it is likely that this wetland serves as a food source for these butterflies. Many other butterfly and moth species, as well as white-tail deer and Canada goose sign have also been observed on site.

iii. SUMMARY DATA

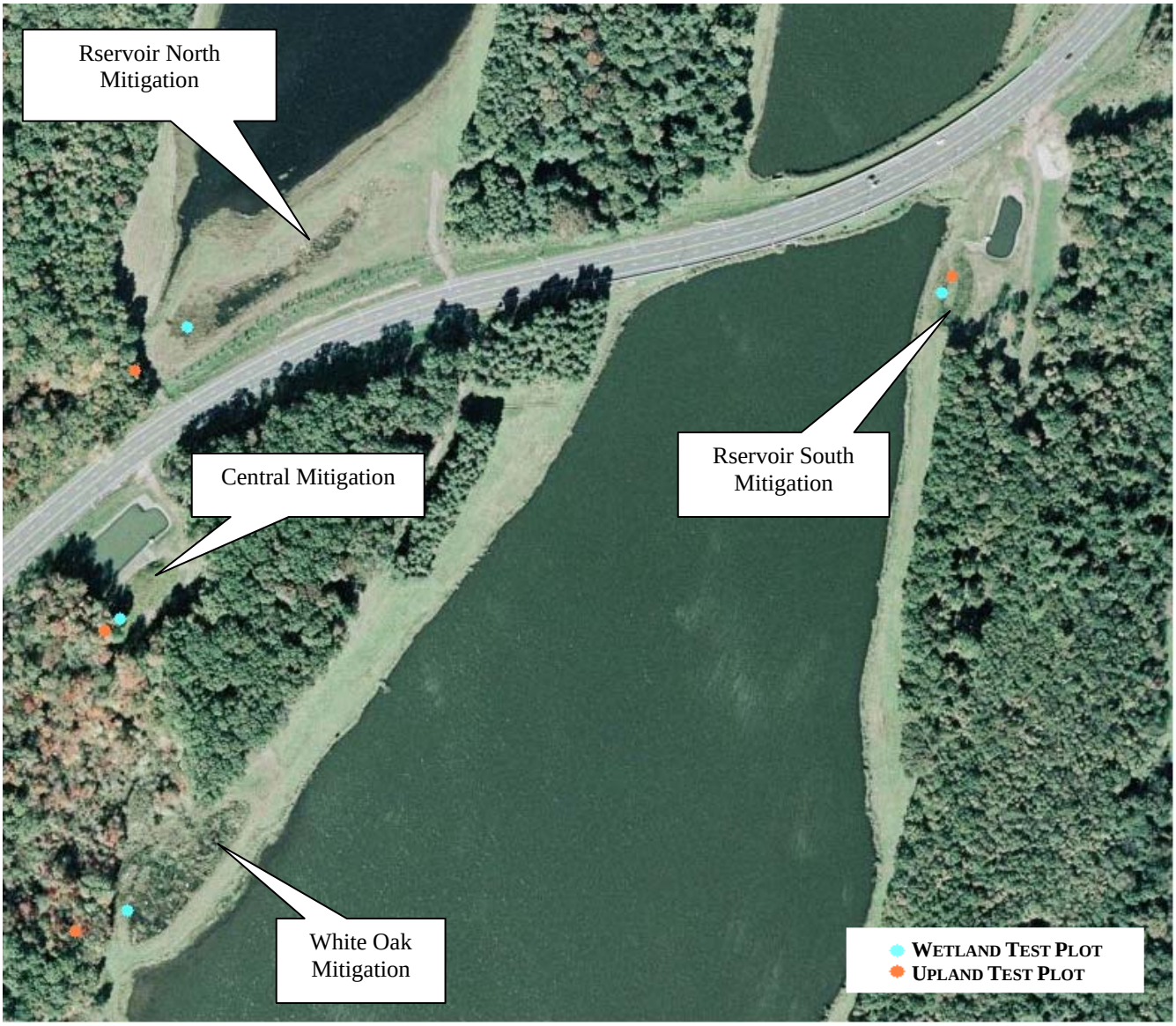
As noted above, all four mitigation wetlands have been impacted previously by mowing activities, a problem which OEP and City of Middletown Water and Sewer Department (MWS) staff have hopefully resolved for good. Now that mowing has ceased, many plantings are recovering and gaining some height, which likely means that planting densities will increase substantially for the total acreage within the next few years. While the mowed areas have always been a small portion of the mitigation sites, their locations in the higher areas of the mitigation sites has meant that percent survival and percent cover of woody vegetation has suffered unduly. Because these areas have not fully recovered (i.e. plantings and

volunteers reached a height that is “countable”), these portions of the mitigation sites still generally do not meet the density standards that have been set forth. The diversity standards for the sites have all been met. Soils will also continue to be monitored, as most but not all portions of the mitigation wetlands possess the required hydric soils. As with most mitigation projects, the presence of invasive species is one of the most challenging issues to date. All reasonable efforts are being made to minimize their numbers on site.

iv. MAPS


Project Location
USGS Middletown Quadrangle
Revision dated 1984
Middlefield

iv. MAPS



SOURCE: MICROSOFT VIRTUAL EARTH, 2008 MICROSOFT CORPORATION.
IMAGE COURTESY OF USGS

V. CONCLUSIONS

While the mitigation areas do not presently meet all the standards set forth in the mitigation guidance, the majority of all sites meet the majority of the criteria, and progress continues to be made. The health of plantings and native volunteer species, as well as the status of undesirable plant species will continue to be monitored, and appropriate actions will be devised and taken as necessary to ensure success. Particularly with respect to achieving the percent cover standards set forth, several years may be required to attain this goal as a result of the past mowing impacts that have set the growth of plantings back

REQUIRED APPENDICES

Appendix A: a copy of this permit's mitigation special conditions and Summary of the mitigation goals

Appendix B: an as-built planting plan showing the location and extent of the designed plant community types (e.g. shrub swamp). Within each community type the plan shall show the species planted. This is only needed in the first monitoring report unless there are additional plantings of different species in subsequent years.

Appendix C: A vegetative species list of volunteer species in each plant community type. The volunteer species list should, at a minimum, include those that cover at least 5% of their vegetative layer.

Appendix D: Representative photos for each mitigation site taken from the same location for each monitoring event.

Appendix E: Army Corps of Engineers Delineation Data Sheets (To Be Provided Every Other Year: Provided in 2009 and Will be Submitted Again in 2011)

APPENDIX A

DEPARTMENT OF THE ARMY PERMIT

Permittee CONNECTICUT DEPARTMENT OF TRANSPORTATION PO BOX 317546
2800 BERLIN TURNPIKE NEWINGTON CONNECTICUT 06131-7546

Permit No. 199201685

Issuing Office New England District

NOTE: The term "you" and its derivatives, as used in this permit, means the permittee or any future transferee. The term "this office" refers to the appropriate district or division office of the Corps of Engineers having jurisdiction over the permitted activity or the appropriate official of that office acting under the authority of the commanding officer.

You are authorized to perform work in accordance with the terms and conditions specified below.

Project Description:

to place fill in 1.67 acres of wetlands/waters (16 sites) in association with the reconstruction/widening of approximately 2.1 miles of State Route 66 in Middlefield, CT. This project involves realignment and widening of the existing Route 66 from its current two-lane roadway to four lanes. Local intersecting roads will be reconstructed as necessary to provide a safe and efficient intersection with the reconstructed/widened Route 66. The purpose of the project is to address safety improvement needs and traffic congestion on Route 66.

PROJECT DESCRIPTION CONTINUED ON PAGE 4

Project Location:
U.S. Route 66 from the terminus of I-691 to a point approximately 1200 LF east of Jackson Hill Road in Middlefield, Connecticut.

Permit Conditions:

General Conditions:

1. The time limit for completing the work authorized ends on December 31, 2008. If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least one month before the above date is reached.

2. You must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General Condition 4 below. Should you wish to cease to maintain the authorized activity or should you desire to abandon it without a good faith transfer, you must obtain a modification of this permit from this office, which may require restoration of the area.

3. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the Federal and state coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

4. If you sell the property associated with this permit, you must obtain the signature of the new owner in the space provided and forward a copy of the permit to this office to validate the transfer of this authorization.

5. If a conditioned water quality certification has been issued for your project, you must comply with the conditions specified in the certification as special conditions to this permit. For your convenience, a copy of the certification is attached if it contains such conditions.

6. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of your permit.

Special Conditions:

1. The permittee shall ensure that a copy of this permit is at the work site whenever work is being performed and that all personnel performing work at the site of the work authorized by this permit are fully aware of the terms and conditions of the permit. This permit, including its drawings and any appendices and other attachments, shall be made a part of any and all contracts and sub-contracts for work which affects areas of Corps of Engineers jurisdiction at the site of the work authorized by this permit. This shall be achieved by including the entire permit in the specifications for work.

(Special Conditions continued on Page 4)

Further Information:

1. Congressional Authorities: You have been authorized to undertake the activity described above pursuant to:

( ) Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403).

(X) Section 404 of the Clean Water Act (33 U.S.C. 1344).

( ) Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1413).

2. Limits of this authorization.

a. This permit does not obviate the need to obtain other Federal, state, or local authorizations required by law.

b. This permit does not grant any property rights or exclusive privileges.

c. This permit does not authorize any injury to the property or rights of others.

d. This permit does not authorize interference with any existing or proposed Federal project.

3. Limits of Federal Liability. In issuing this permit, the Federal Government does not assume any liability for the following:

a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.

b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.

c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

d. Design or construction deficiencies associated with the permitted work.

e. Damage claims associated with any future modification, suspension, or revocation of this permit.

4. Reliance on Applicant's Data: The determination of this office that issuance of this permit is not contrary to the public interest was made in reliance on the information you provided.

5. Reevaluation of Permit Decision. This office may reevaluate its decision on this permit at any time the circumstances warrant. Circumstances that could require a reevaluation include, but are not limited to, the following:

a. You fail to comply with the terms and conditions of this permit.

b. The information provided by you in support of your permit application proves to have been false, incomplete, or inaccurate (See 4 above).

c. Significant new information surfaces which this office did not consider in reaching the original public interest decision.

Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 CFR 325.7 or enforcement procedures such as those contained in 33 CFR 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an administrative order requiring you to comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measures ordered by this office, and if you fail to comply with such directive, this office may in certain situations (such as those specified in 33 CFR 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost.

6. Extensions. General condition 1 establishes a time limit for the completion of the activity authorized by this permit. Unless there are circumstances requiring either a prompt completion of the authorized activity or a reevaluation of the public interest decision, the Corps will normally give favorable consideration to a request for an extension of this time limit.

Your signature below, as permittee, indicates that you accept and agree to comply with the terms and conditions of this permit.

	3/12/2003
(PERMITTEE)	*(DATE)*

This permit becomes effective when the Federal official, designated to act for the Secretary of the Army, has signed below.

	1/24/03
(DISTRICT ENGINEER)	*(DATE)*

Thomas L. Koning
Colonel, Corps of Engineers

When the structures or work authorized by this permit are still in existence at the time the property is transferred, the terms and conditions of this permit will continue to be binding on the new owner(s) of the property. To validate the transfer of this permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.

(TRANSFEREE)	*(DATE)*

☆U.S. GOVERNMENT PRINTING OFFICE: 1986 — 717-425

PROJECT DESCRIPTION CONTINUED FROM PAGE 1

A mitigation plan is proposed to compensate for the loss of wetlands functions and values that would result from construction of the Route 66 reconstruction and widening project. Four (4) sites, as identified below and located on the attached plans (sheets 36,37,38,39,40,41 of 41), have been identified for wetland creation and enhancement. Approximately 2.53 acres of wetlands areas will be established from the four sites.

- Reservoir North Mitigation Area
- Reservoir South Mitigation Area
- White Oak Mitigation Area
- Central Mitigation Area

This authorization is made in accordance with the attached project plans entitled:

"RECONSTRUCTION OF ROUTE 66 – MIDDLEFIELD, CT STATE PROJECT NO. 81-80" in forty-one (41) sheets, and dated as follows:

sheets 1,41 dated "JULY 19, 1996, revised 7/20/01, 3/5/02"
sheets 2 dated "JULY 19, 1996, revised 7/06/98, 7/20/01"
sheets 3,4,5,10,12,19,28,34,37,39 dated "JULY 19, 1996, revised 7/20/01"
sheets 6,7,8,9,11,13-21,23,24B,27,29,30,32,33,35,36,38,40 dated "JULY 19, 1996"
sheet 22 dated "JULY 19, 1996, revised 7/06/98, 8/5/98, 7/20/01"
sheets 24A dated "JULY 19, 1996, revised 7/06/98, 8/05/98"
sheets 25 dated "JULY 19, 1996, revised 7/06/98, 7/20/01, 9/02 "
sheets 26 dated "JULY 19, 1996, revised 7/06/98"
sheets 31A dated "JULY 19, 1996, revised 7/20/01, 9/20/02"
sheets 31B,31C,31D dated "7/20/01"

SPECIAL CONDITIONS CONTINUED FROM PAGE 2

special condition 1 cont'd:

If the permit is issued after the construction specifications but before receipt of bids or quotes, the entire permit shall be included as an addendum to the specifications. If the permit is issued after receipt of bids or quotes, the entire permit shall be included in the contract or sub-contract as a change order. The term "entire permit" includes permit amendments. Although the permittee may assign various aspects of the work to different contractors or sub-contractors, all contractors and sub-contractors shall be obligated by contract to comply with all environmental protection provisions of the entire permit, and no contract or sub-contract shall require or allow unauthorized work in areas of Corps jurisdiction.

2. Adequate sedimentation and erosion control devices, such as geotextile silt fences or other devices capable of filtering the fines involved, shall be installed and properly maintained to minimize adverse impacts on waters and wetlands during construction. These devices must be removed upon completion of work and stabilization of disturbed areas. The sediment collected by these devices must also be removed and placed upland, in a manner that will prevent its later erosion and transport to a waterway or wetland.

3. No temporary fill (e.g. access roads, cofferdams) in any waters or wetlands is authorized by this permit.

4. Mitigation shall be performed in accordance with a revised final mitigation plan which shall be submitted within 90 days of permit issuance and which shall not be implemented until the Corps of Engineers approves it in writing. The final mitigation plan shall be based on the draft mitigation plan entitled "MITIGATION PLAN Reconstruction of State Route 66 Middlefield, Connecticut (State Project # 80-81) (USACE File No. 199201685) prepared by the Connecticut Department of Transportation", and dated "December 12, 2002". The draft mitigation plan shall be modified to reflect changes necessary to ensure appropriate final design elevations at the constructed wetlands areas.

APPENDIX A

U.S. ARMY CORPS OF ENGINEERS, NEW ENGLAND DISTRICT
REGULATORY DIVISION

CHECKLIST FOR REVIEW OF MITIGATION PLAN

Project: CTDOT Rt. 66 reconstruction File No: 199201685 PM: Lee
City: Middlefield State: CT
Plan Title, Preparer, Date: "Mitigation Plan" dated 12/12/02 and prepared by CTDOT

NOTE: This mitigation was reviewed previously. New comments are in bold.

TABLE OF CONTENTS

A. General Information:

1. [**OK**] Mitigation plan is submitted as one complete document.

2. Site location:

   a. [**OK**] Map – Include a map depicting the geographic relationship between the impact site(s) and the proposed mitigation site(s), and a vicinity map of greater than or equal to a scale of 1 inch equals 2,000 feet.

   b. [**OK**] Latitude/Longitude of mitigation site(s) in decimal format (for GIS use).
   See p.8 of plan

3. Impact area:

a. [**OK**]Describe wetland acreage at each impact site and length of any streams at the impact sites.
1.67 ac (see Table 1 on p. 5 for area-by-area information) and 40 l.f. of stream.

b. [**OK**]Describe wetland classes (e.g., Cowardin, et. al. - see footnote 1 on page 4, HGM, etc.) at each impact site.
1.22 ac PFO, 0.05 ac PFO/ROW, 0.20 ac PSS/PFO, 0.12 ac PEM, and 0.05 ac PSS/PEM.

c. [**OK**]Describe both site specific and landscape level wetland functions and values at each impact site. For wildlife habitat, provide indicator species for the habitat type such as forest-dwelling migratory birds or mole salamanders and/or woodfrogs for a vernal pool.
Only landscape level functions were provided: wildlife habitat, production export, floodflow alteration, groundwater recharge/discharge, and stormwater conveyance were the principal functions. Other landscape level functions noted: sediment/toxicant/pathogen retention, finfish habitat, and nutrient removal/retention/transformation. Two values were noted: aesthetic and recreational.

The text states that the impact areas "have relatively insignificant functions and values due to their small size and/or limited diversity..." It is my experience that once a new toe of slope is established, the "relatively insignificant functions and values" migrates outward so the formerly decent wetlands are degraded to about what the current wetlands are like. Therefore, this should not be a reason to back off of efforts to 'reach higher' with the mitigation to get the landscape level functions. This would help reduce secondary and cumulative impacts.

d. [**OK**]Describe type and purpose of work at each impact site.
Roadway realignment (see Table 1).

4. Mitigation area:

a. [OK] Describe wetland acreage proposed at each mitigation site.
2.53 ac creation TOTAL
Reservoir North – 1.16 ac
In the previous checklist, concern was expressed about the location of this area close to the road. DOT noted that there is an 80-100' buffer. This is still very close to the road.
Reservoir South – 0.28 ac – NOTE: Plan shows a portion (very small) is actually enhancement

White Oaks – 1.0 ac – NOTE: Plan shows a portion (maybe 0.1 ac) is actually enhancement
Central – 0.09 ac

b. [ ] Describe wetland classes proposed at each mitigation site.
All 4 sites are proposed to be PEM/PSS with the rationale that, although the area impacted was more than 75% PFO, "it was determined that quick replacement of functions and values was needed, and establishment of PEM/PSS wetlands is much faster than for forested wetlands. The quick establishment of a thick ground cover is also thought to discourage the growth of invasive species. Also, the variable nature of the water table in the Reservoir North site would not be conducive to planting of trees."

This is contrary to recommendations from the National Research Council on mitigation. Since wetlands with a PFO goal will clearly not meet that designation for many years—probably decades, the goal should be PFO with the recognition that sites will, of necessity, begin as PEM, if evaluated strictly, then eventually become PSS (perhaps within 5 years), and finally to PFO long after the monitoring period is over. What is important is to establish appropriate conditions for PFO and to obtain a precursor to that wetland type.

Since the Reservoir North site probably cannot support PFO because of the hydrology, the other sites should be entirely geared towards PFO precursor conditions.

c. [OK] Describe both site specific and landscape level functions and values proposed at each mitigation site.
The Central site is apparently designed to treat/renovate stormwater but won't be maintained as a retention/detention basin would be. However, great emphasis was placed on pages 1 and 3 on measures to do that with the retention ponds. Although mitigation sites other than retention basins frequently can perform that function, the design should not have that as its focus when impacts affected other functions. This same comment applies to all four sites.

5. [**OK**] Design Constraints - Project, landscape features, or public issues that control or otherwise influence the design of the mitigation area. (State if none.)

6. [**OK**] The following language is included in the narrative portion of the mitigation plan:

➡ A wetland scientist will be on-site to monitor construction of the wetland mitigation areas to ensure compliance with the mitigation plan.

7. [**OK**] The following language is included in the narrative portion of the mitigation plan:

➡ Compensatory mitigation shall be initiated not later than 90 days after project initiation and completed not later than the completion of the permitted project

The plan explains why this cannot be the case. The explanation is acceptable assuming that in fact the mitigation construction would be completed before the permitted project is completed.

8. [**OK**] The party responsible for planning, accomplishing, and maintaining the mitigation project is specified.
Connecticut DOT is responsible for all aspects of the project.

B. Hydrology:

1. [ ] The expected seasonal depth, duration, and timing of both inundation and saturation must be described for each of the proposed habitat zones in the mitigation area (particularly related to root zone of the proposed plantings). If shallow monitoring wells are used to develop this rationale, the observations must be correlated to local soil morphologies, rooting depths, water marks or other local evidence of flooding, ponding or saturation, and reflect rainfall conditions during monitoring.
As stated previously, the well data is inadequate (just one year). However, if taken at its face value, I still have concerns about 2 of the 4 sites. See comments under "Grading."

2. [**OK**] Plan indicates if system is groundwater or surface water (provide source, e.g., overland flow, stream or river overflow) driven and provides substantiation (e.g., well data, adjacent wetland conditions, stream gauge data, precipitation data).
p. 8

3. [**N/A**] If vernal pool creation attempts are included as part of the mitigation plan, indicates evidence that adequate hydrology will be provided to support at least one obligate vernal pool species (mole salamanders, woodfrogs, or fairy shrimp).

C. Grading Plan:

1. Plan View:

a. [OK] Plan provides existing and proposed grading plans for mitigation area. Existing contours to at least 2' intervals. Proposed contours to 1' intervals in the wetlands portion of the mitigation with spot elevations for intermediate elevations. All other areas may have 2' contours.

b. [**OK**] Where microtopographic variation is planned, the proposed maximum differences in elevation should be specified. The plan does not need to show the locations of each pit and mound as long as a typical cross-section and approximate number of pits and mounds is given for each zone.

Detailed in Appendix D, Item #0949XXX-Wetland Microtopography. Only proposed for White Oak and North Reservoir sites. Plan proposes +/-6". See comments below under "Other" for comments on this.

c. [OK] The scale should be in the range of 1"=20' to 1"=100', depending on the size of the site.

d. [ ] All items on the plan must be legible (i.e., no smaller than a 9 font) **on 8 ½ x 11" sheets**. Large size sheets may be encouraged for clarity but only as a supplement to the letter-sized sheets.

Plans (8 ½ x 11") are barely legible. Need larger font which won't become illegible upon duplication.

2. Section View:

[ ] Plan provides representative cross sections showing the existing and proposed grading plan, expected range of shallow groundwater table elevations or surface water level consistently expected.

Not in 8 ½ x 11" package. They need to extend to the reservoir for all the sites except the Central site and into the existing wetland to the NW for the White Oaks site.

3. [ ] Other - Specific staff recommendations related to grading.

White Oak and Reservoir South sites: it seems unlikely that the species listed for planting—shrubs and herbaceous species—will all be able to survive in the same hydrology with just +/-6" microtopographic relief.

If the hydrology data is assumed to be adequate (the reservoir elevation data is good; the well data is for too short a period of time), the

following are comments on grading, taking into account the likely hydrology and the project impacts.

Reservoir North:

The reservoir varies from 363.0' to 363.4' during the April-June period in the years of 1991 through 1996 (after the elevation of the reservoir was changed). MW#4 (NE end of site) shows water table elevations from an average of 365.12' in April to 363.42' in June with a low point of 362.59' in September. MW#5 (SW end of site) shows water table elevations from an average of 364.23' in April to 362.95' in June with a low point of 362.32 in August.

The site will be VERY wet in the spring with water tables at the SW end above the surface so water will flow to the low spot, filling it several feet. The water will stay at least 2 ½' deep at the 361' proposed elevation at least through June.

Recommendations: Raise lowest elevation by 2', raise SW elevation currently at 364.0' to 364.5', raise 363' to 364' and 361' and 362' to 363.5'. Use pit and mound topography throughout with +/-6" at 364.5' and +/-12" for rest. Mounds should not be sculpted, just place topsoil very roughly so mounds vary from a few inches to a few feet in diameter. Plant trees and shrubs on tops of mounds and herbaceous species in pits between the mounds.

Reservoir South

The reservoir varies from 363.0' to 363.4' during the April-June period in the years of 1991 through 1996 (after the elevation of the reservoir was changed). MW#3 shows water table elevations averaging 365.74' in April to 362.80' in June with the lowest point at 361.49' in August. On the west side of the site, the highest elevation will be 364'. Therefore, water will be overflowing into the reservoir in April and May which will keep the maximum depth at 3'. Essentially the entire basin will be at least 2 ½' under water through June and the bottom will not be exposed until the end of the summer.

Recommendations: raise lowest bottom elevation to 364.0' and rest of bottom to 364.5'. Increase berm to 364.5'. Add microtopography of +/-6" throughout.

Central

There is no monitoring well data for this site but, since it is between Reservoir North and White Oak, the well data in combination with the

reservoir elevations are helpful. However, there is no mention of any adjacent wetlands and, if they exist nearby, what their elevations are. Grades are probably OK to support woody vegetation (if DOT adds microtopography) but it will essentially be a vegetated waterbody.

White Oak

The reservoir varies from 363.0' to 363.4' during the April-June period in the years of 1991 through 1996 (after the elevation of the reservoir was changed). MW#1, in the SW part of the site, shows water table elevations averaging 364.24' in April to 363.20' in June with the lowest point at 362.64' in August. MW#2, in the NE part of the site, shows water table elevations averaging 364.90' in April to 363.63' in June with the lowest point at 363.01 in August. This is a very stable water table. The proposed 364.0' elevation will be under 0.9' of water in April, 0.7' in May, and 0.4' above the water table in June.

Recommendation: The basic elevation for this site is acceptable if mounds (no pits) are added of 6-15" on which woody plants can be placed.

D. Topsoil:

1. [OK] Proposed source of topsoil in mitigation area.

2. [OK] Twelve inches of natural or manmade topsoil, depending on site conditions, in all wetland mitigation areas.

3. [**OK**] Natural topsoil proposed to be used for the creation/restoration/ enhancement of wetlands consists of at least 4-12%, with the percentage specified, organic carbon content (by weight) (or 9-20% organic matter content). Manmade topsoil used for the creation/restoration/ enhancement of wetlands consists of a mixture of equal volumes of organic and mineral materials. This may be accomplished by adding a specific depth of organic material and disking it in to twice that depth.
Excellent!

4. [OK] Plan identifies subsurface soil conditions (sand, clay, bedrock, etc.).

5. [**OK**] The following language is included in the mitigation plan, either in the drawings or in the narrative portion of the plan:

➡ At least 12 inches of natural or manmade topsoil shall be installed in wetland mitigation areas. Natural topsoil shall consist of at least [from

item D.3] organic carbon content (or organic matter content if that is the measure proposed) by weight.

Language on p. 9, Section D is acceptable.

E. Planting Plan:

Planting may or may not be appropriate for a mitigation site, as determined through consultation with the Corps. When planting is proposed as part of the plan, the guidelines noted below should be followed.

1. [OK] Plans use scientific names.

2. [OK] Plant materials are native and indigenous to the area of the site(s). Native planting stock from the immediate vicinity of the project is ideal. Whenever possible, plants should be salvaged from wetlands and uplands cleared by the project. In some circumstances, local "scavenging" of wetlands may be permitable, but care is necessary to avoid jeopardizing established natural habitats or to unintentionally transplant invasive species . Be aware that state or local permits may be required to "scavenge" natural wetlands for planting stock. No cultivars shall be used.

3. [**OK**] Vegetation community types or zones are classified in accordance with Cowardin, et al. (1979)[1] or other similar classification system.

4. [OK] Plan View – shows proposed locations of planted stock. This may be illustrated with areas of uniform species composition ("polygons" in GIS usage) and the number of plants or rate of seeding within the polygon. The scale should be in the range of 1"=20' to 1"=100', depending on the size of the site.

5. [OK] More than 50% of the plantings in each zone are structural determinants for the community type designated for that zone with emphasis on species unlikely to "volunteer".

6. [OK] Woody stock is proposed to be planted in densities not less than 600 trees and shrubs per acre, including at least 400 trees per acre in forested cover types.

7. [OK] Where uniform coverage is anticipated, herbaceous stock is proposed to be planted in densities not less than the equivalent of 3 feet on center for species which spread with underground roots; 2 feet for species which form clumps.

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[1] Cowardin, et. al. (1979) "Classification of wetlands and deepwater habitats of the United States," Office of Biological Services, FWS/OBS-79/31, December 1979.

8. [**OK**] Seed mix composition is provided. The list of species does not include any species in the attached list of invasives.

9. [OK] Section View – shows representative cross section plans showing vegetative community (e.g., forested, shrub swamp, etc.) zones. Show on same plan as C.2. information.

10. [**OK**] During the first few years, while the designed wetland vegetative zones become established, they are susceptible to colonization by invasive species. A number of plants are known to be especially troublesome in this regard. The following language is included in the mitigation plan, either in the plan view or in the narrative portion of the plan:

➡ To reduce the immediate threat and minimize the long-term potential of degradation, the species included on the invasive plant species list in the current Corps mitigation "Introduction: Performance Standards and Supplemental Information" are not included as planting stock in the overall project. Only plant materials native and indigenous to the region shall be used (with the exception of [specify]). Species not specified in the mitigation plan shall not be used without written approval from the Corps.

11. [**OK**] The following language is included in the mitigation plan, either in the drawings or in the narrative portion of the plan:

➡ During planting, a qualified wetland professional may relocate up to 50 percent of the plants in each community type if as-built site conditions would pose an unreasonable threat to the survival of plantings installed according to the mitigation plan. The plantings shall be relocated to locations with suitable hydrology and soils and where appropriate structural context with other plantings can be maintained.

12. [ ] Other - Specific staff recommendations related to planting.
Concerns remain about the disconnect between impacts and proposed mitigation community types. Accepting that the Reservoir North site hydrology is not conducive to forested wetland, the remaining site should be all forested wetland precursors. That does not obviate the possibility of having emergent vegetation in the lower spaces in and around the woody species, just as it occurs in "natural" forested and scrub shrub wetlands. The desire for a 'quick fix' should not override the need to attempt in-kind compensation to the extent possible.

What does the first sentence in the third paragraph under E mean? (temporary....established)

See comments under Grading which, if addressed, would change the planting scheme.

Reservoir North:

Cephalanthus is proposed to be planted at elevation 361-362' and 364-365 (with Viburnum dentatum)'. That is quite a range! Although it is a lesser range Carex lacustris is proposed for 361' and 363'.

Consider a dense buffer planting at least 20' wide of evergreen and deciduous species between the road and the site.

Central:

Viburnum dentatum is proposed for an area which extended from the bottom of the basin (364') to about 367'. It is unlikely to tolerate that range in hydrology.

F. Coarse Woody Debris and Other Features:

[**OK**] Coarse woody debris includes such materials as logs, stumps, smaller branches, and standing snags. Placement of this material is inappropriate in tidal or floodplain environments. As much as possible, these materials will be in various stages of decomposition and salvaged from natural areas cleared for the other elements of the project. The following language is included in the mitigation plan, either in the drawings or in the narrative portion of the plan:

➡ A supply of dead and dying woody debris shall cover at least 2% of the ground throughout the mitigation sites after the completion of construction of the mitigation sites. These materials should not include species shown on the attached list of invasive species.

G. Erosion Controls:

[**OK**] The following language is included in the mitigation plan, either in the drawings or in the narrative portion of the plan:

➡ Temporary devices and structures to control erosion and sedimentation in and around mitigation sites shall be properly maintained at all times. The devices and structures shall be disassembled and properly disposed of no later than November 1 three full growing seasons after planting. Sediment collected by these devices will be removed and placed upland in a manner that prevents its erosion and transport to a waterway or wetland.

H. Invasive and Noxious Species:

Projects should avoid introducing or increasing the risk of invasion by unwanted plants (such as those listed in H.3. below) or animals (such as zebra mussels). Soils disturbed by projects are very susceptible to invasion by undesirable species. Be particularly alert to the risk of invasion on exposed mineral soils. Exposed mineral soils may result from excavation or filling. Noxious species often get a foothold along project drainage features where the dynamics of erosion and accretion prevail. Along saltmarshes, be especially alert to the project's influence on freshwater runoff. Frequently, *Phragmites australis* invasion is an unanticipated consequence of freshwater intrusion into the saltmarsh.

1. [**OK**] Risk -- the discussion includes an assessment of the potential for invasion of the wetland by the species listed in H.3 or other problematic species.
White Oak site* – Phragmites *present

2. [**OK**] Constraints - identifies regulatory and ecological constraints that influence the design of any plan to control invasive plants and animals by biological, mechanical, or chemical measures.
Near water supply reservoir so chemicals may be limited.

3. [**OK**] Control Plan - describes the strategy to control, or recognize and respond to the invasion of the mitigation site by Common Reed (*Phragmites australis*) and Purple Loosestrife (*Lythrum salicaria*). Any other species identified as a problem at the site should also have a control plan. Controls may be mechanical (pulling, mowing, or excavating on-site), chemical (herbiciding), and biological (planting fast-growing trees and shrubs for shading or releasing herbivorous insects).

I. Off-Road Vehicle Use:

1. [**OK**] No off-road vehicle use in immediate vicinity, or if so, control measures addressed.

2. [**N/A**] If there is a potential for off-road vehicle access at the site, the mitigation plan shows the locations of barriers placed at access points to the mitigation sites to prevent vehicles from damaging the sites.

J. Preservation:

[**N/A**] If preservation is part of the Corps mitigation package, the following language is included:
All sites are on CTDOT ROW or City of Middletown Water Department land. The latter are protected from development and access.

Compensatory mitigation sites that are to be set aside for conservation, shall be protected in perpetuity from future development. Before recording this document, a draft copy of the conservation easement or deed restriction must be sent to the Corps of Engineers. Once the Corps approves this document in writing, the permittee shall execute and record it with the Registry of Deeds for the Town of _____ and the State of _____ within 180 days of the date of permit issuance. A copy of the executed and recorded document must then be sent to the Corps of Engineers within 90 days of the date it was recorded. The conservation easement or deed restriction shall enable the site or sites to be protected in perpetuity from any future development. The conservation easement or deed restriction shall expressly allow for the creation, restoration, remediation and monitoring activities required by this permit on the site or sites. It shall prohibit all other filling, clearing and other disturbances (including vehicle access) on these sites except for activities explicitly authorized by the Corps of Engineers in these approved documents.

K. Monitoring Plan:

Once the final mitigation plan is incorporated into the permit, the permit will require full implementation of the mitigation plan, including remedial measures during the first five growing seasons to ensure success. Typically, sites proposed to be emergent-only wetlands will be monitored for five years and sites proposed to be scrub-shrub and/or forested wetlands will be monitored for five to ten years, as extended periods for monitoring may be appropriate in some cases. Unsuccessful mitigation does not, in and of itself, constitute permit non-compliance. Failure to implement the plan and remedial measures, however, does.

[**OK**] The following language is included in the narrative portion of the mitigation plan:
Note that the vernal pool language does not need to be included.

MONITORING

If mitigation construction is initiated in, or continues throughout the year, but is not completed by December 31 of any given year, the permittee will provide the Corps, Policy Analysis and Technical Support Branch, a letter providing the date mitigation work began and the work completed as of December 31. The letter should be sent no later than January 31 of the following year. The letter must include the Corps permit number.

For each of the first FIVE full growing seasons following construction of the mitigation site(s), the site(s) shall be monitored and monitoring reports shall be submitted to the Corps, Regulatory Division, Policy Analysis and Technical Support Branch, no later than December 15 of the year being monitored. Failure to submit monitoring reports constitutes permit non-compliance. Each report coversheet shall indicate the report number (Monitoring Report 1 of 5, for example). The reports shall answer the following four success-standard questions and shall address in narrative format the items listed after the four questions. The reports shall also include the four monitoring-report appendices listed below. The first year of monitoring shall be the first year that the site has been through a full growing season after completion of construction and planting. For these special conditions, a growing season starts no later than May 31. However, if there are problems that need to be addressed and if the measures to correct them require prior approval from the Corps, the permittee shall contact the Corps by phone (1-800-362-4367 in MA or 1-800-343-4789 in ME, VT, NH, CT, RI) or letter as soon as the need for corrective action is discovered.

Remedial measures shall be implemented to attain the four success standards described below within FIVE growing seasons after completion of construction of the mitigation site(s). Measures requiring earth movement or changes in hydrology shall not be implemented without written approval from the Corps.

1) Does the site have at least 500 trees and shrubs per acre, of which at least 350 per acre are trees for proposed forested cover types, that are healthy and vigorous and are at least 18" tall in 75% of each planned woody zone AND at least the following number of non-exotic species including planted and volunteer species? Volunteer species should support functions consistent with the design goals. To count a species, it must be well represented on the site (e.g., at least 50 individuals of that species per acre).

# species planted	minimum # species required (volunteer and planted)
2	2
3	3
4	3
5	4
6	4
7	5
8	5
9 or more	6

Vegetative zones consist of areas proposed for various types of wetlands (shrub swamp, forested swamp, etc.). The performance standards for density can be assessed using either total inventory or quadrat sampling methods, depending upon the size and complexity of the site.

2) Does each mitigation site have at least 80% areal cover, excluding planned open water areas or planned bare soil areas (such as for turtle nesting), by noninvasive species? Do planned emergent areas on each mitigation site have at least 80% cover by noninvasive hydrophytes? Do planned shrub-shrub and forested cover types have at least 60% cover by noninvasive hydrophytes, of which at least 15% are woody species? For the purpose of this success standard, invasive species of hydrophytes are:

Cattails -- *Typha latifolia, Typha angustifolia, Typha glauca*;
Common Reed -- *Phragmites australis*;
Purple Loosestrife -- *Lythrum salicaria*; and
Reed Canary Grass -- *Phalaris arundinacea*
Buckthorn – *Rhamnus frangula.*

3) Are Common Reed (*Phragmites australis*), Purple Loosestrife (*Lythrum salicaria*), Russian and Autumn Olive (*Eleagnus* spp.), Buckthorn (*Rhamnus frangula*), and/or Multiflora Rose (*Rosa multiflora*) plants at the mitigation site(s) being controlled?

4) Are all slopes, soils, substrates, and constructed features within and adjacent to the mitigation site(s) stabilized?

Items for narrative discussion:

Describe the monitoring inspections that occurred since the last report.

Soils data, commensurate with the requirements of the soils portion of the 1987 Delineation Manual New England District data form, should be collected after construction and every alternate year throughout the monitoring period. If monitoring wells or gauges were installed as part of the project, this hydrology data should be submitted annually.

Concisely describe remedial actions done during the monitoring year to meet the four success standards – actions such as removing debris, replanting, controlling invasive plant species (with biological, herbicidal, or mechanical methods), regrading the site, applying

additional topsoil or soil amendments, adjusting site hydrology, etc. Also describe any other remedial actions done at each site.

Report the status of all erosion control measures on the compensation site(s). Are they in place and functioning? If temporary measures are no longer needed, have they been removed?

Give visual estimates of (1) percent vegetative cover for each mitigation site and (2) percent cover of the invasive species listed under Success Standard No. 2, above, in each mitigation site.

What fish and wildlife use the site(s) and what do they use it for (nesting, feeding, shelter, etc.)?

By species planted, describe the general health and vigor of the surviving plants, the prognosis for their future survival and a diagnosis of the cause(s) of morbidity or mortality.

What remedial measures are recommended to achieve or maintain achievement of the four success standards and otherwise improve the extent to which the mitigation site(s) replace the functions and values lost because of project impacts?

IF MITIGATION INCLUDES VERNAL POOL CREATION ATTEMPT(S):

Does the vernal pool creation attempt(s) take into account the critical need for unobstructed access to and from the pool, as well as an adequate extent of upland habitat to ensure success?

Pool(s) are monitored for obligate and facultative vernal pool species weekly for four weeks from the beginning of the vernal pool activity in the spring (will vary throughout New England) and then biweekly until the end of July for the entire monitoring period. The period of monitoring is specified. Data identify frog species, salamander genera, and the presence/absence of fairy shrimp. Macroinvertebrates can be to the order.

In addition, photographs of the pool(s) taken monthly during the pool monitoring period (March/April-July) from a set location(s) will be included. Photographs will include panoramas of surrounding habitat.

Other data required: pH and temperature of water at beginning and end of each monitoring cycle; pool depth at deepest point(s) (or state if >3') to nearest inch or centimeter; substrate of pool(s) (dead leaves, herbaceous vegetation, bare soil—organic or mineral, etc.); plant species noted in and around the perimeter of the pool(s).

If the state has a vernal pool register, the pool(s) is registered prior to the final monitoring report submission.

MONITORING-REPORT APPENDICES:

Appendix A -- A copy of this permit's mitigation special conditions and summary of the mitigation goals.

Appendix B -- An as-built planting plan showing the location and extent of the designed plant community types (e.g., shrub swamp). Within each community type the plan shall show the species planted. This is only needed in the first monitoring report unless there are additional plantings of different species in subsequent years.

Appendix C – A vegetative species list of volunteer species in each plant community type. The volunteer species list should, at a minimum, include those that cover at least 5% of their vegetative layer.

Appendix D -- Representative photos of each mitigation site taken from the same locations for each monitoring event.

L. Assessment Plan:

[**OK**] The following language is included in the narrative portion of the mitigation plan:

ASSESSMENT

Following completion of the construction of the mitigation site(s), a post-construction assessment of the condition of the mitigation site(s) shall be performed after the first five growing seasons or by the end of the monitoring period, whichever is later. "Growing season" in this context begins no later than May 31st. To ensure objectivity, the person(s) who prepared the annual monitoring reports shall not perform this assessment without written approval from the Corps. The assessment report shall be submitted to the Corps by December 15 of the year the assessment is conducted.

The post-construction assessment shall include the four assessment appendices listed below and shall:

Summarize the original or modified mitigation goals and discuss the level of attainment of these goals at each mitigation site (include vernal pool creation if that is a component of the mitigation).

Describe significant problems and solutions during construction and maintenance (monitoring) of the mitigation site(s).

Identify agency procedures or policies that encumbered implementation of the mitigation plan. Specifically note procedures or policies that contributed to less success or less effectiveness than anticipated in the mitigation plan.

Recommend measures to improve the efficiency, reduce the cost, or improve the effectiveness of similar projects in the future.

ASSESSMENT APPENDICES:

Appendix A -- Summary of the results of a functions and values assessment of the mitigation site(s), using the same methodology used to determine the functions and values of the impacted wetlands.

Appendix B -- Calculation of the area of wetlands in each mitigation site using the 1987 Wetlands Delineation Manual (Technical Report Y-87-1). Supporting documents shall include (1) a scaled drawing showing the wetland boundaries and representative transects and (2) datasheets for corresponding data points along each transect.

Appendix C -- Comparison of the area and extent of delineated constructed wetlands (from Appendix B) with the area and extent of created wetlands proposed in the mitigation plan. This comparison shall be made on a scaled drawing or as an overlay on the as-built plan. This plan shall also show the major vegetation community types.

Appendix D -- Photos of each mitigation site taken from the same locations as the monitoring photos, including photos of vernal pools, if applicable.

M. Other Comments:

I still have some concerns about mitigation close (80-100') to a roadway, in this case the Reservoir North site especially, because of the inevitable degradation resulting from the proximity to the road.

As stated under Section A above, replacing forested wetlands with some open water, emergent marsh, and bit of scrub-shrub may address water quality functions, most of which are already addressed by the stormwater management plan but they do not address the wildlife habitat function since that function is closely tied to the wetland type lost. Admittedly the PFO lost is a degraded strip next to the highway but there will be new degradation occurring in higher quality (better

functioning) wetlands at the new toe of slope. The cumulative impact of long strips of wetland losses along roads can be substantial in a watershed even though the impact to the individual wetlands may seem minimal.

ERS Scientist: Ruth M. Ladd Date Plan Reviewed: ***January 21, 2003***

APPENDIX C: VOLUNTEER SPECIES LIST

*denotes undesirable species

Reservoir North Mitigation Wetland

Common name	Scientific Name
red maple	*Acer rubrum*
milkweed	*Asclepias* L.
aster	*Aster sp.*
devil's beggartick	*Bidens frondosa*
lurid sedge	*Carex lurida*
fox sedge	*Carex vulpinoidea*
deer-tongue grass	*Dichanthelium clandestinum*
fireweed	*Erechtites hieracifolia*
soft rush	*Juncus effusus*
* purple loosestrife	*Lythrum salicaria*
wild mint	*Mentha arvensis*
tearthumb	*Polygonum sp.*
smartweed	*Polygonum sp.*
* cattail	*Typha latifolia*
yellow foxtail	*Setaria glauca*
goldenrod	*Solidago sp.*
spike rush	*Eleocharis spp.*
bush-clover	*Lespedeza sp.*

White Oak Mitigation Wetland

Common name	Scientific Name
red maple	*Acer rubrum*
milkweed	*Asclepias* L.
wild sensitive plant	*Cassia nictitans*
lurid sedge	*Carex lurida*
American waterwort	*Elatine americana*
spike rush	*Eleocharis spp.*
common marsh bedstraw	*Galium palustre*
jewelweed	*Impatiens capensis*
soft rush	*Juncus effusus*
toadflax	*Linaria vulgaris*
* purple loosestrife	*Lythrum salicaria*
square stem monkey flower	*Mimulus ringens*
sensitive fern	*Onoclea sensibilis*
* common reed	*Phragmites australis*
big-leaved arrowhead	*Sagittaria latifolia*
yellow foxtail	*Setaria glauca*
Carolina horsenettle	*Solanum carolinense*
goldenrod	*Solidago spp.*
* cattail	*Typha latifolia*
common mullein	*Verbascum thapsus*

Reservoir South Mitigation Wetland

Common name	Scientific Name
red maple	*Acer rubrum*
common yarrow	*Achillea millefolium*
common burdock	*Arctium minus*
asters	*Aster spp.*
tussock sedge	*Carex stricta*
wild sensitive plant	*Cassia nictitans*
* Asiatic bittersweet	*Celastrus orbiculata*
Queen Anne's lace	*Daucus carota*
barnyard grass	*Echinochloa crus-galli*
* autumn olive	*Elaeagnus umbellata*
fireweed	*Erechtites hieracifolia*
bedstraw	*Galium sp.*
* purple loosestrife	*Lythrum salicaria*
* common reed	*Phragmites australis*
tearthumb	*Polygonum sp.*
common cinquefoil	*Potentilla simplex*
* multiflora rose	*Rosa multiflora*
big-leaved arrowhead	*Sagittaria latifolia*
yellow foxtail	*Setaria glauca*
Carolina horsenettle	*Solanum carolinense*
goldenrod	*Solidago spp.*
steeplebush	*Spiraea tomentosa*
* cattail	*Typha latifolia*

Central Mitigation Wetland

Common name	Scientific Name
red maple	*Acer rubrum*
lurid sedge	*Carex lurida*
tussock sedge	*Carex stricta*
barnyard grass	*Echinochloa crus-galli*
common marsh bedstraw	*Galium palustre*
common St. John's-Wort	*Hypericum perforatum*
jewelweed	*Impatiens capensis*
* common reed	*Phragmites australis*
arrowleaf tearthumb	*Polygonum sagittatum*
yellow foxtail	*Setaria glauca*
* cattail	*Typha latifolia*

APPENDIX D

RESERVOIR NORTH MITIGATION SITE- VIEW TO SOUTH

RESERVOIR NORTH- VIEW TO SE

APPENDIX D

RESERVOIR SOUTH MITIGATION SITE- VIEW TO SW

WHITE OAK MITIGATION SITE- VIEW TO NORTHWEST

APPENDIX D

WHITE OAK MITIGATION SITE- VIEW TO NORTHEAST

CENTRAL MITIGATION SITE- VIEW TO WEST