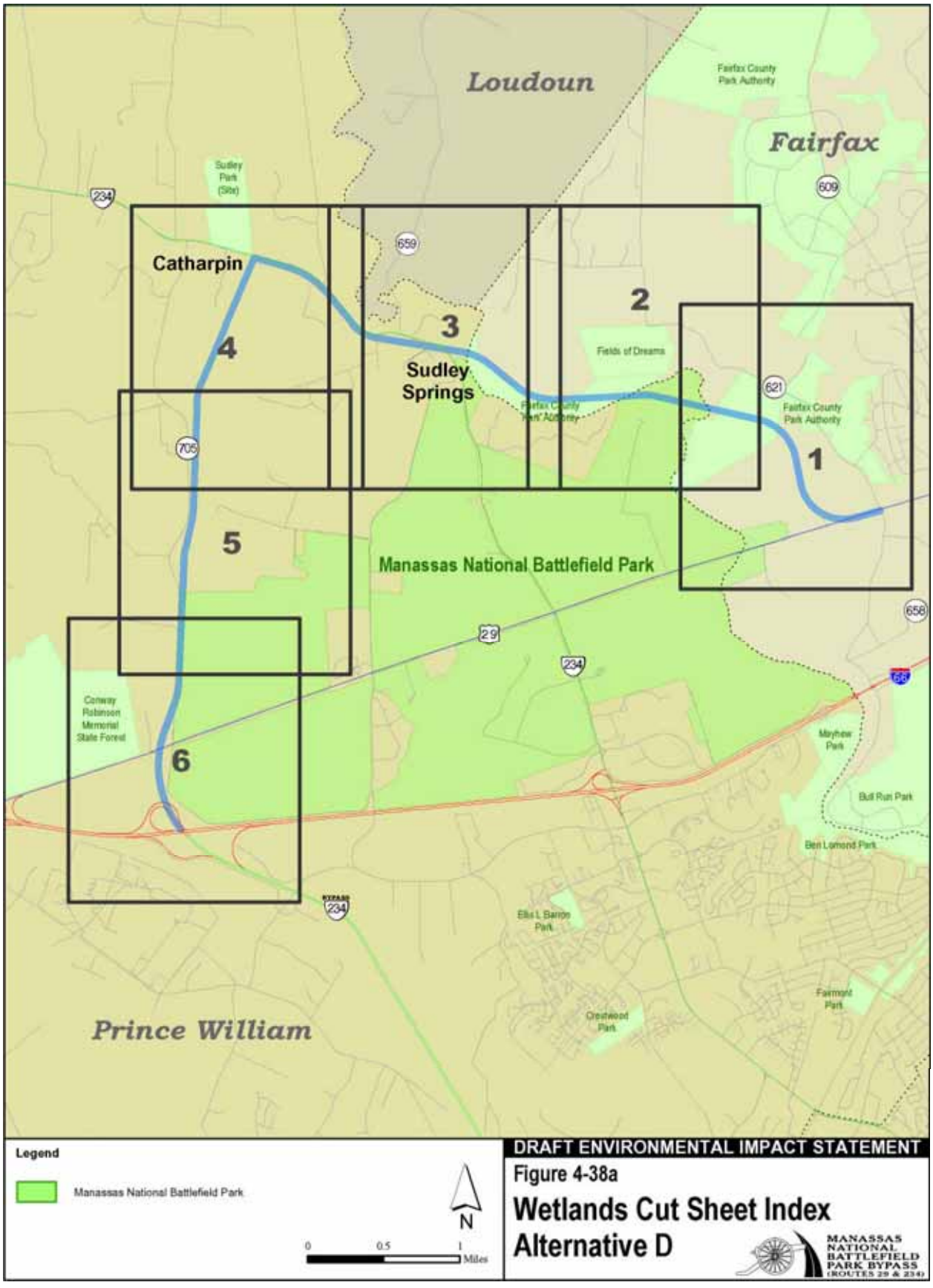
TABLE 4-35: IMPACTED WETLANDS, ALTERNATIVE D

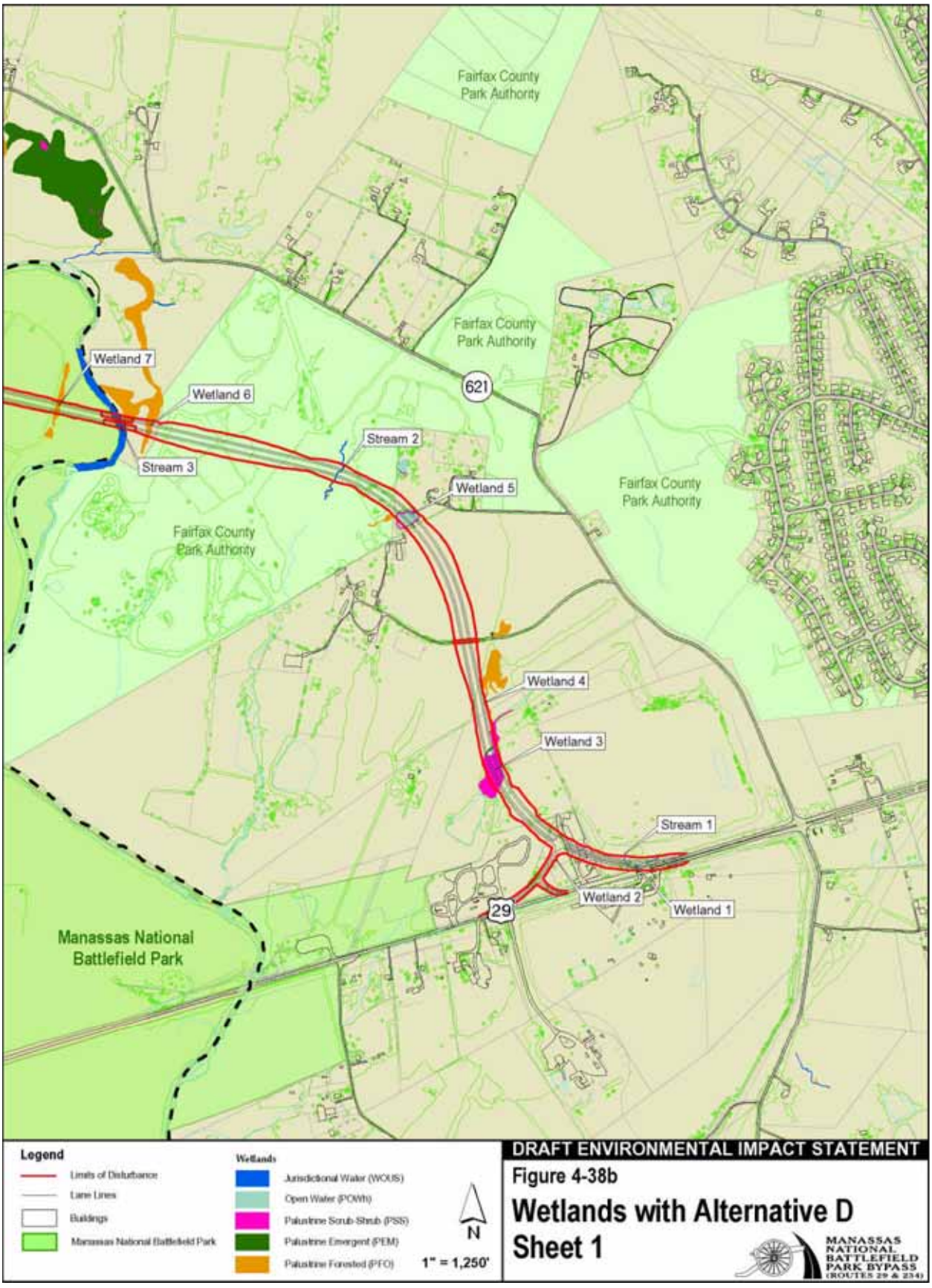
ID No.	Cowardin Class	Principal Functions and Values								Total Area (Acres)
		Floodflow Alteration	Groundwater Interchange	Nutrient Removal	Production Export	Sediment/ Toxicant Retention	Sediment Stabilization	Fish and Shellfish Habitat	Wildlife Habitat	
1	PEM			X			X			0.01
2	PEM					X				0.01
3	PSS PEM			X	X	X	 X		X	0.98 0.03
4	PFO			X		X				0.03
5	**POW** **PSS** **PEM**				X X	X X	 X	X	X X	**0.40** **0.07** **0.02**
6	PFO		X	X	X				X	0.29
7	**PFO**		X			X			X	**0.10**
8	PFO	X		X	X	X			X	0.13
9	PFO			X						0.01
10	PFO			X		X	X			0.01
11	**PFO**	X		X		X			X	**1.05**
12	PFO		X	X		X				0.22
13	PFO		X	X						0.04
14	**PEM** **PFO** **PSS**			X		X X X	 X X		X X X	**0.35** **0.10** **0.01**
15	PEM			X		X				0.01
16	PEM PSS			X		X X			 X	0.09 0.06
17	PSS			X					X	0.06

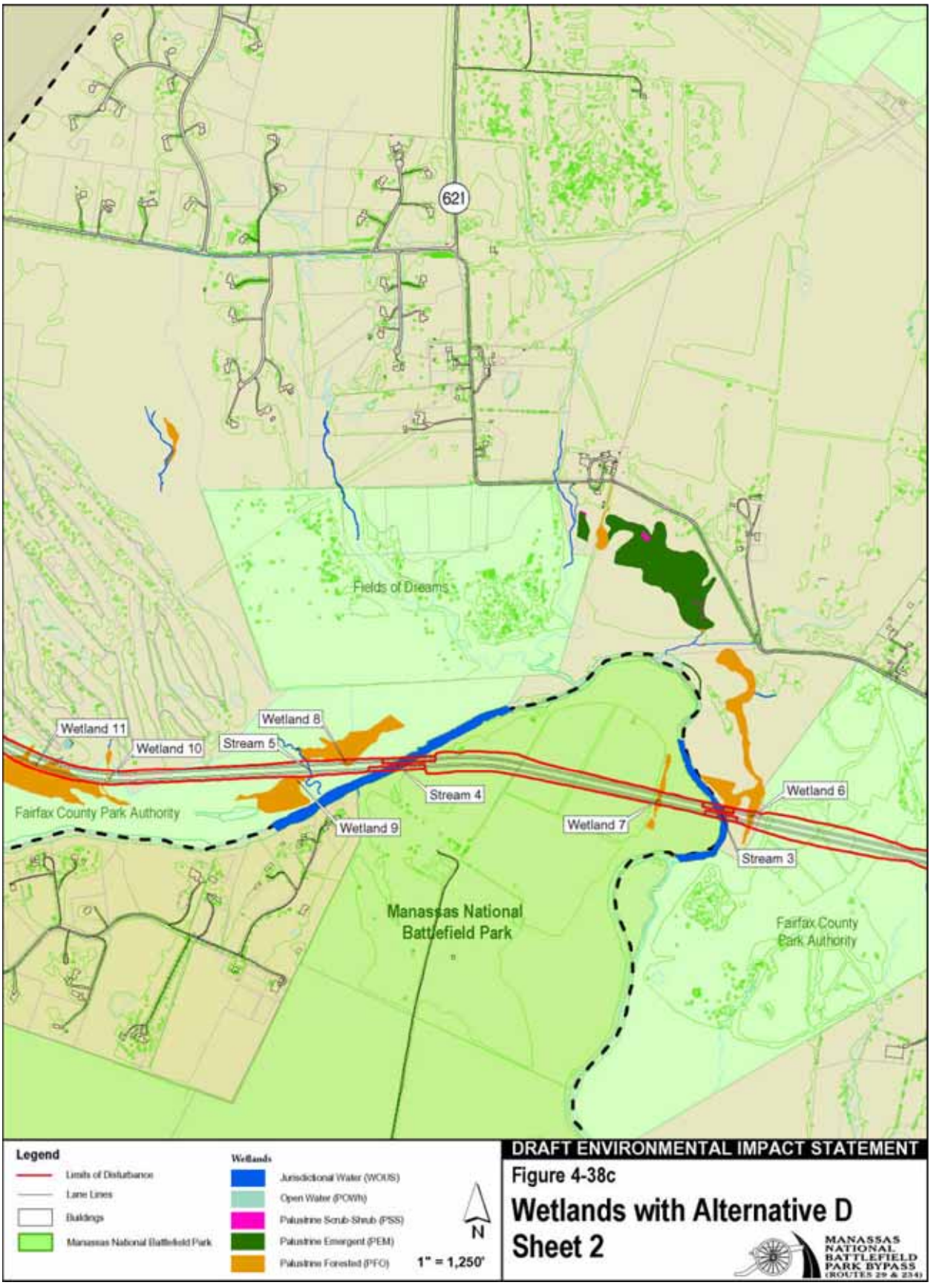
TABLE 4-35: IMPACTED WETLANDS, ALTERNATIVE D

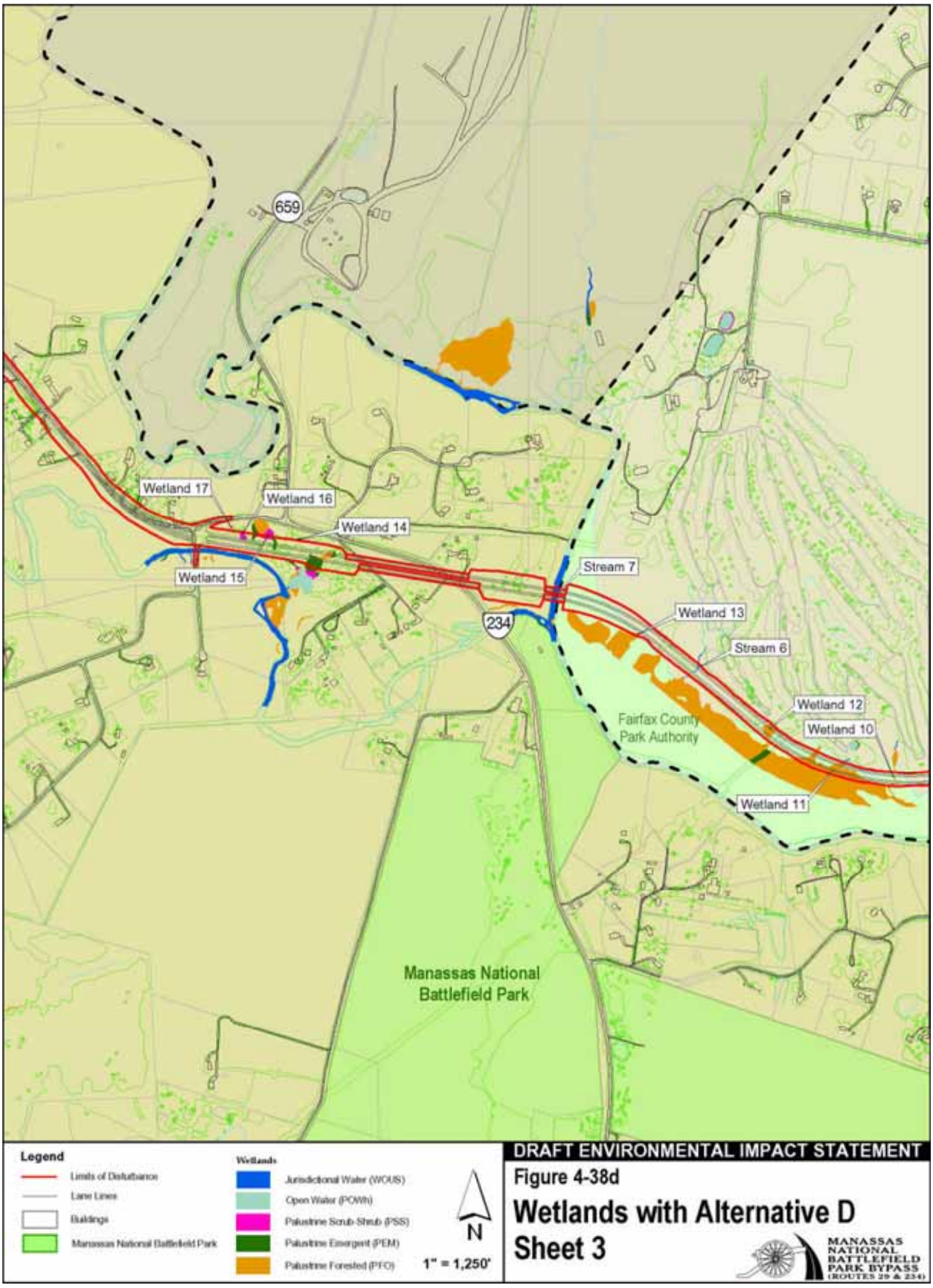
ID No.	Cowardin Class	Principal Functions and Values								Total Area (Acres)
		Floodflow Alteration	Groundwater Interchange	Nutrient Removal	Production Export	Sediment/ Toxicant Retention	Sediment Stabilization	Fish and Shellfish Habitat	Wildlife Habitat	
18	PFO			X		X	X			0.01
19	PEM		X	X			X			0.01
20	PFO		X	X			X		X	0.07
21	**PFO**	X	X	X		X			X	**0.60**
22	PFO		X	X		X				0.10
	PEM	X		X			X			0.02
23	PEM			X	X	X		X	X	0.09
	POW				X			X	X	0.04
	PSS			X			X		X	0.01
24	PSS			X			X			0.01
25	PFO		X	X		X			X	0.41
	PEM						X			0.02
	PSS			X			X			0.01
26	PFO					X			X	0.04
27	PEM		X		X					0.17
	PSS		X						X	0.13
	PFO		X	X		X				0.13
28	PEM		X				X			0.01
29	PEM			X		X				0.01
30	PFO	X	X	X		X	X	X	X	0.55
	PEM	X	X				X	X	X	0.47
Total Area										6.99

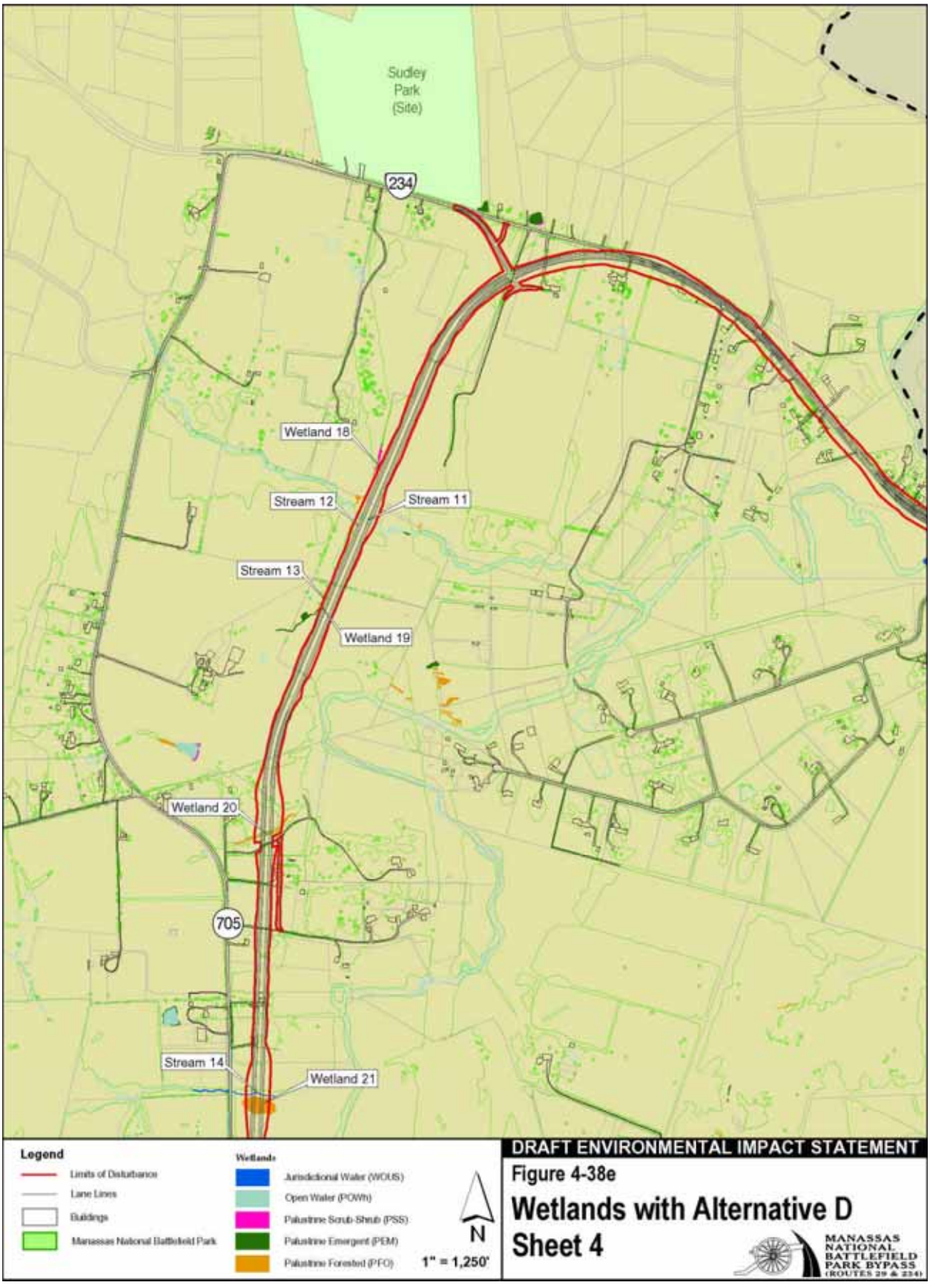
Note: **Bold type** denotes special wetland functions and values associated with indicated habitat.

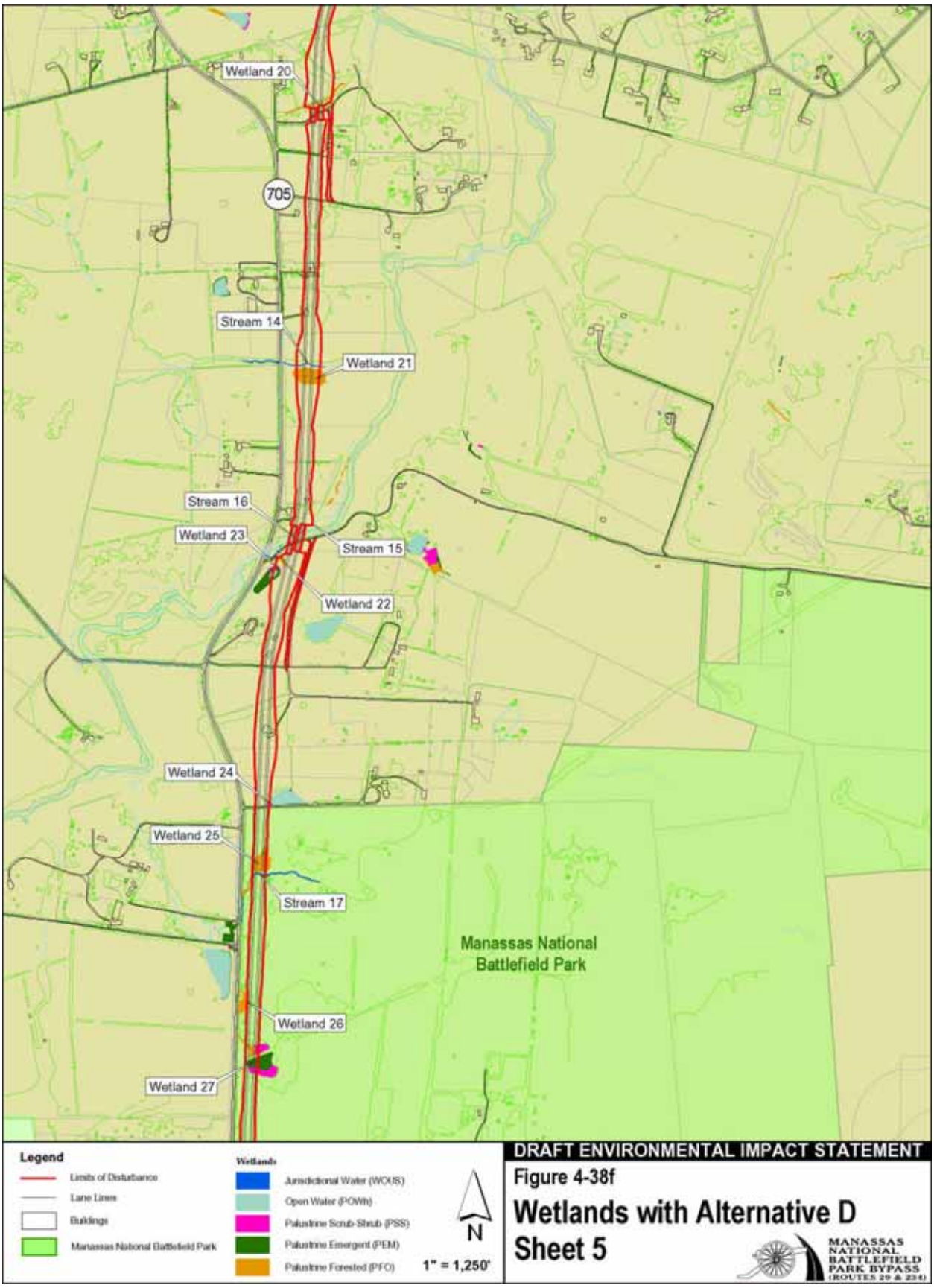

Loudoun
Fairfax
Prince William
Catharpin
Sudley Springs
Manassas National Battlefield Park
Fairfax County Park Authority
Fields of Dreams
Sudley Park (Site)
Conway Robinson Memorial State Forest
Mayhew Park
Bull Run Park
Ben Lomond Park
Ellis L. Barnes Park
Fairmont Park
Creekwood Park
1
2
3
4
5
6
234
609
659
621
705
29
658
66
Legend
Manassas National Battlefield Park
N
0
0.5
1
Miles
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-38a
Wetlands Cut Sheet Index
Alternative D
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS
(ROUTES 29 & 234)


Fairfax County Park Authority
Fairfax County Park Authority
Fairfax County Park Authority
Fairfax County Park Authority
Fairfax County Park Authority
Wetland 7
Wetland 6
Stream 2
Stream 3
Wetland 5
621
Wetland 4
Wetland 3
Stream 1
Wetland 2
Wetland 1
29
Manassas National Battlefield Park
Legend
Limits of Disturbance
Lane Lines
Buildings
Manassas National Battlefield Park
Wetlands
Jurisdictional Water (WOUS)
Open Water (POWh)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Forested (PFO)
N
1" = 1,250'
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-38b
Wetlands with Alternative D
Sheet 1
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS
(ROUTES 29 & 234)


621
Fields of Dreams
Wetland 11
Wetland 10
Stream 5
Wetland 8
Stream 4
Wetland 9
Fairfax County Park Authority
Wetland 7
Wetland 6
Stream 3
Manassas National Battlefield Park
Fairfax County Park Authority
Legend
Limits of Disturbance
Lane Lines
Buildings
Manassas National Battlefield Park
Wetlands
Jurisdictional Water (WOUS)
Open Water (POWh)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Forested (PFO)
N
1" = 1,250'
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-38c
Wetlands with Alternative D
Sheet 2
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS
(ROUTES 29 & 234)


659
Wetland 17
Wetland 16
Wetland 14
Wetland 15
Stream 7
234
Wetland 13
Stream 6
Wetland 12
Wetland 10
Wetland 11
Fairfax County
Park Authority
Manassas National
Battlefield Park
Legend
Limits of Disturbance
Lane Lines
Buildings
Manassas National Battlefield Park
Wetlands
Jurisdictional Water (WOUS)
Open Water (POWh)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Forested (PFO)
N
1" = 1,250'
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-38d
Wetlands with Alternative D
Sheet 3
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS
(ROUTES 29 & 234)


Sudley
Park
(Site)
234
Wetland 18
Stream 12
Stream 11
Stream 13
Wetland 19
Wetland 20
705
Stream 14
Wetland 21
Legend
Limits of Disturbance
Lane Lines
Buildings
Manassas National Battlefield Park
Wetlands
Jurisdictional Water (WOUS)
Open Water (POWh)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Forested (PFO)
N
1" = 1,250'
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-38e
Wetlands with Alternative D
Sheet 4
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS
(ROUTES 29 & 234)


Wetland 20
705
Stream 14
Wetland 21
Stream 16
Wetland 23
Stream 15
Wetland 22
Wetland 24
Wetland 25
Stream 17
Manassas National Battlefield Park
Wetland 26
Wetland 27
Legend
Limits of Disturbance
Lane Lines
Buildings
Manassas National Battlefield Park
Wetlands
Jurisdictional Water (WOUS)
Open Water (POWh)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Forested (PFO)
N
1" = 1,250'
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-38f
Wetlands with Alternative D
Sheet 5
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS
(ROUTES 29 & 234)


Wetland 26
Wetland 27
Conway Robinson
Memorial
State Forest
Manassas National
Battlefield Park
705
29
Wetland 28
Wetland 29
Stream 18
Wetland 30
66
234
Legend
Limits of Disturbance
Lane Lines
Buildings
Manassas National Battlefield Park
Wetlands
Jurisdictional Water (WOUS)
Open Water (POWh)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Forested (PFO)
N
1" = 1,250'
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-38g
Wetlands with Alternative D
Sheet 6
MANASSAS
NATIONAL
BATTLEFIELD
PARK BYPASS
(ROUTES 29 & 234)

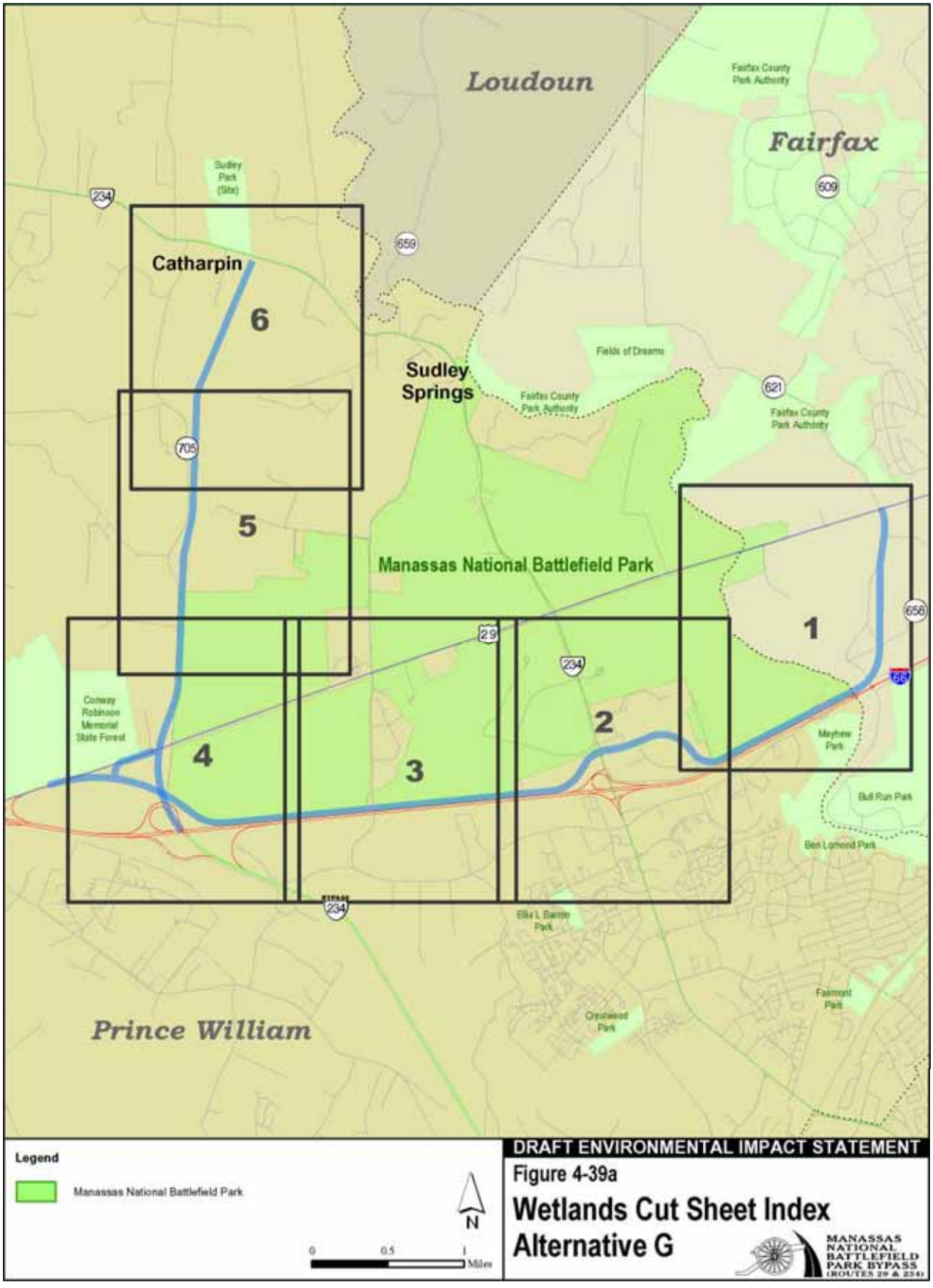
TABLE 3-36: IMPACTED WETLANDS, ALTERNATIVE G

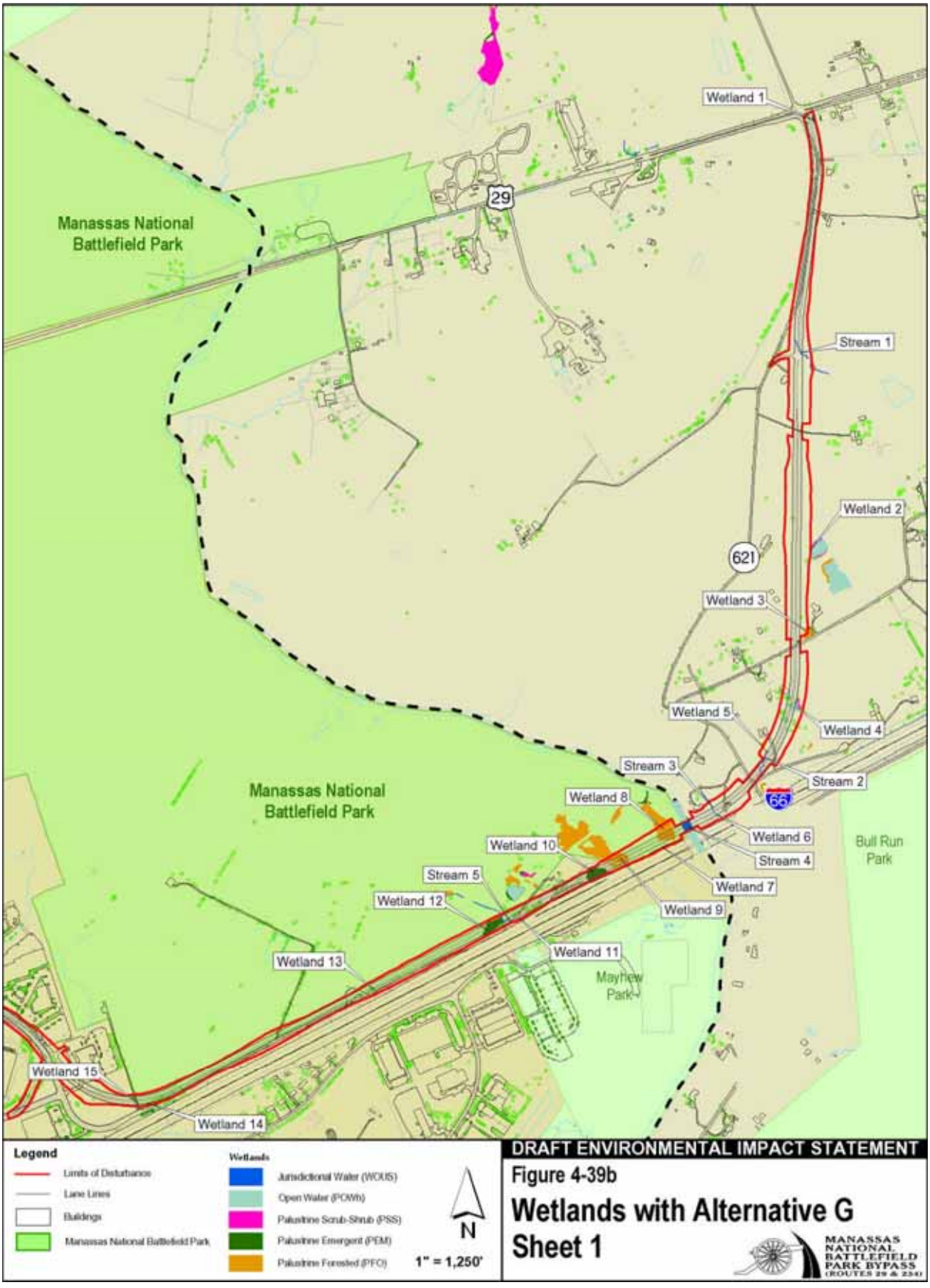
ID No.	Cowardin Class	Principal Functions and Values								Total Area Acres
		Floodflow Alteration	Groundwater Interchange	Nutrient Removal	Production Export	Sediment/ Toxicant Retention	Sediment Stabilization	Fish and Shellfish Habitat	Wildlife Habitat	
1	PEM					X	X			0.03
2	POW							X	X	0.01
	PSS			X		X	X		X	0.01
3	PFO		X	X		X			X	0.03
	PEM		X							0.01
4	POW							X	X	0.10
	PSS			X			X		X	0.02
	PEM			X						0.01
	PFO		X							0.01
5	PFO		X	X		X				0.01
6	POW			X	X	X				0.03
7	PEM			X		X	X			0.03
8	PFO	X	X	X	X	X			X	0.47
9	PFO			X	X	X			X	0.33
10	PEM			X		X				0.29
11	PEM			X		X	X			0.03
12	PEM			X	X	X			X	0.29
	PFO		X				X			0.04
13	PEM			X						0.01
14	PEM			X						0.01
15	PEM		X	X		X				0.01
16	POW	X			X	X		X	X	0.27
	PEM						X			0.01
17	PFO		X	X			X			0.01
18	POW			X		X		X	X	0.27
	PEM			X		X	X		X	0.01
19	PFO	X	X	X		X	X		X	0.07
20	PFO		X	X		X	X			0.07
21	PFO					X			X	0.01
22	PFO		X		X				X	0.33
23	PEM						X			0.01
24	PFO	X		X		X	X			0.06
25	PFO		X				X			0.01
26	PFO		X			X	X			0.02

TABLE 3-36: IMPACTED WETLANDS, ALTERNATIVE G

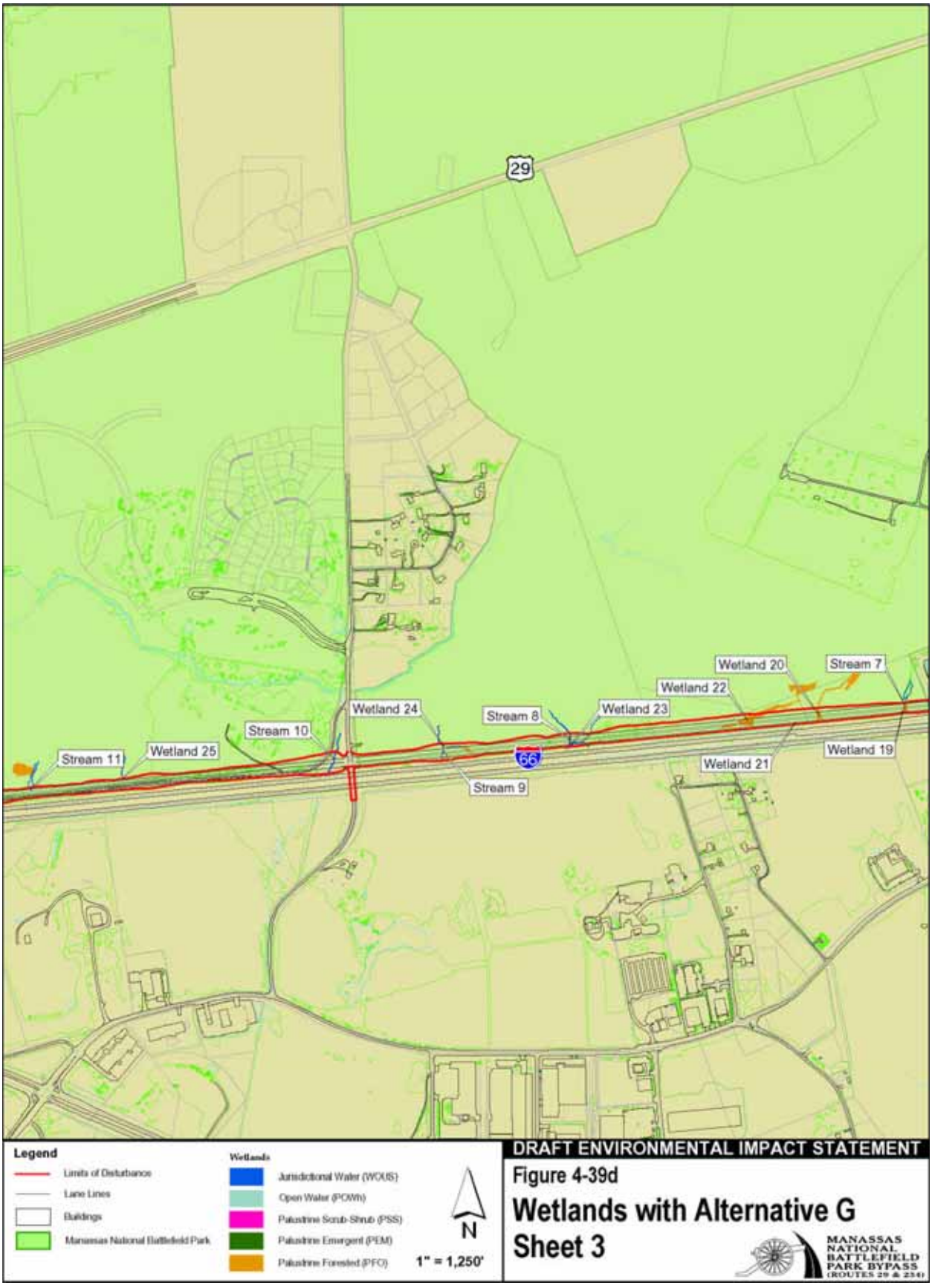
ID No.	Cowardin Class	Principal Functions and Values								Total Area Acres
		Floodflow Alteration	Groundwater Interchange	Nutrient Removal	Production Export	Sediment/ Toxicant Retention	Sediment Stabilization	Fish and Shellfish Habitat	Wildlife Habitat	
27	**PEM**	**X**		**X**		**X**	**X**		**X**	**0.03**
	PFO	**X**			**X**		**X**		**X**	**0.03**
28	**PEM**		**X**	**X**			**X**			**0.01**
29	**PFO**		**X**	**X**	**X**		**X**		**X**	**0.02**
30	**PEM**	**X**		**X**			**X**	**X**	**X**	**0.02**
31	**PEM**	**X**		**X**			**X**	**X**	**X**	**0.05**
32	**PFO**	**X**	**X**	**X**		**X**	**X**	**X**	**X**	**0.07**
33	**PFO**		**X**	**X**	**X**	**X**			**X**	**0.28**
34	**PFO**		**X**	**X**		**X**			**X**	**0.04**
35	**POW**	**X**		**X**	**X**			**X**	**X**	**0.09**
	PEM			**X**		**X**	**X**		**X**	**0.01**
36	**PFO**		**X**	**X**		**X**			**X**	**0.03**
37	**PEM**			**X**		**X**				**0.01**
38	**PEM**		**X**				**X**			**0.01**
39	**PEM**		**X**		**X**					**0.17**
	PSS		**X**						**X**	**0.13**
	PFO		**X**	**X**		**X**				**0.13**
40	**PFO**					**X**			**X**	**0.04**
41	**PFO**		**X**	**X**		**X**			**X**	**0.41**
	PEM						**X**			**0.02**
	PSS			**X**			**X**			**0.01**
42	**PSS**			**X**			**X**			**0.01**
43	**PEM**			**X**	**X**	**X**		**X**	**X**	**0.09**
	POW				**X**			**X**	**X**	**0.04**
	PSS			**X**			**X**		**X**	**0.01**
44	**PFO**		**X**	**X**		**X**				**0.10**
	PEM	**X**		**X**			**X**			**0.02**
45	**PFO**	**X**	**X**	**X**		**X**			**X**	**0.60**
46	**PFO**		**X**	**X**		**X**			**X**	**0.07**
47	**PEM**		**X**	**X**			**X**			**0.01**
48	**PFO**			**X**		**X**	**X**			**0.01**
Total Area (acres)										**5.50**

Note: **Bold type** denotes special wetland functions and values associated with indicated habitat.

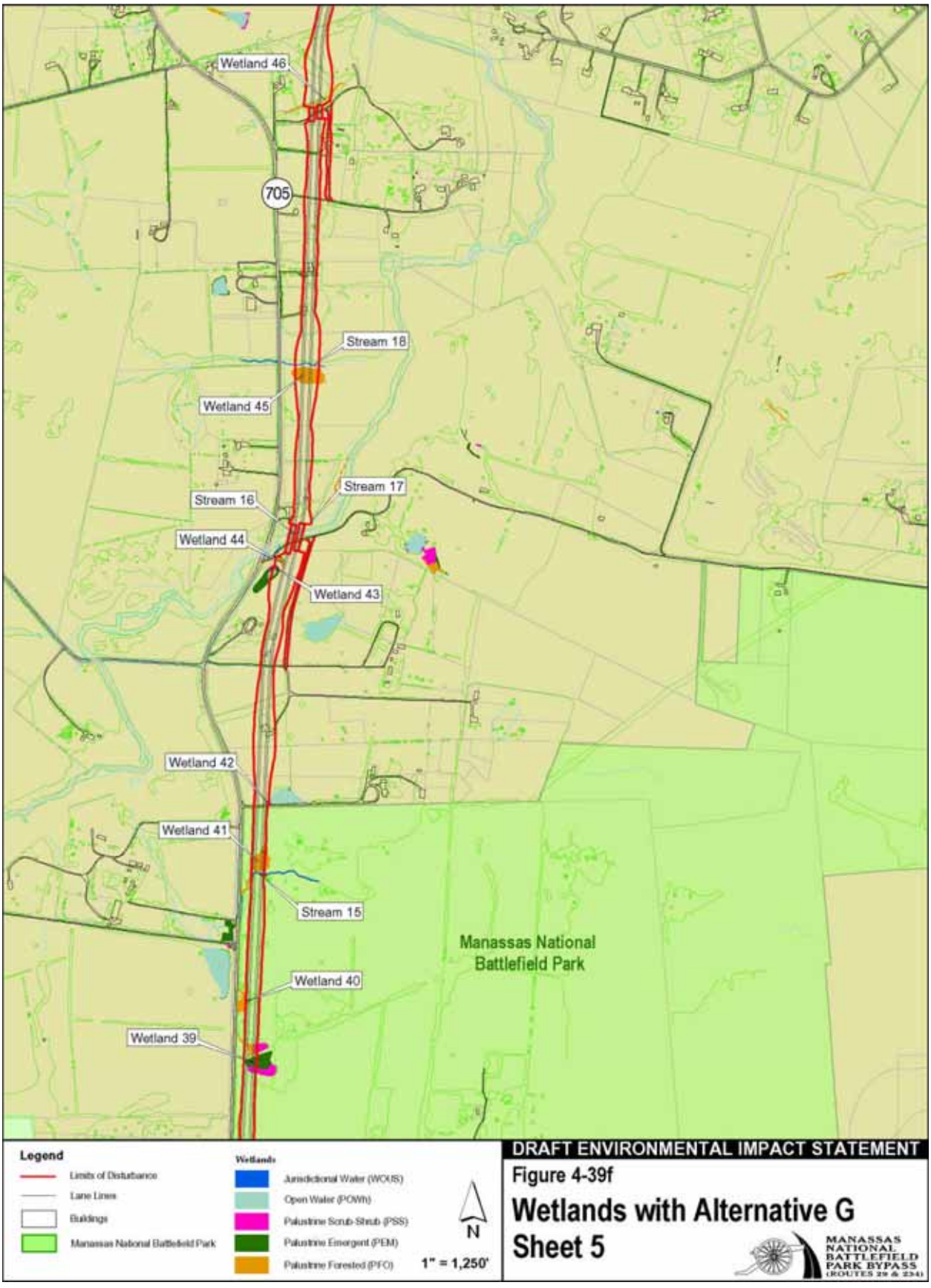

Loudoun
Fairfax
Prince William
Catharpin
Sudley Springs
Manassas National Battlefield Park
Fairfax County Park Authority
Sudley Park (Site)
Fields of Dreams
Conway Robinson Memorial State Forest
Mayhew Park
Bull Run Park
Ben Lomond Park
Ella L. Barrett Park
Fairmont Park
Creekwood Park
1
2
3
4
5
6
234
659
609
621
705
29
66
656
Legend
Manassas National Battlefield Park
N
0
0.5
1
Miles
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-39a
Wetlands Cut Sheet Index
Alternative G
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS
(ROUTES 29 & 234)


Wetland 1
29
Manassas National Battlefield Park
Stream 1
Wetland 2
621
Wetland 3
Wetland 5
Wetland 4
Stream 3
Stream 2
Manassas National Battlefield Park
Wetland 8
66
Wetland 6
Wetland 10
Stream 4
Bull Run Park
Stream 5
Wetland 7
Wetland 12
Wetland 9
Wetland 11
Wetland 13
Mayhew Park
Wetland 15
Wetland 14
Legend
Limits of Disturbance
Lane Lines
Buildings
Manassas National Battlefield Park
Wetlands
Jurisdictional Water (WOUS)
Open Water (POWh)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Forested (PFO)
N
1" = 1,250'
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-39b
Wetlands with Alternative G
Sheet 1
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS
(ROUTES 29 & 234)


Manassas National Battlefield Park
Wetland 16
Stream 6
Wetland 17
Wetland 15
Wetland 14
Stream 7
Wetland 18
66
Wetland 19
234
Legend
Limits of Disturbance
Lane Lines
Buildings
Manassas National Battlefield Park
Wetlands
Jurisdictional Water (WOUS)
Open Water (POWh)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Forested (PFO)
N
1" = 1,250'
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-39c
Wetlands with Alternative G
Sheet 2
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS
(ROUTES 29 & 234)


29
66
Wetland 20
Stream 7
Wetland 22
Wetland 24
Stream 8
Wetland 23
Stream 10
Stream 11
Wetland 25
Wetland 19
Wetland 21
Stream 9
Legend
Limits of Disturbance
Lane Lines
Buildings
Manassas National Battlefield Park
Wetlands
Jurisdictional Water (WOUS)
Open Water (POWh)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Forested (PFO)
N
1" = 1,250'
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-39d
Wetlands with Alternative G
Sheet 3
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS
(ROUTES 29 & 234)


Manassas National Battlefield Park
Wetland 40
Wetland 39
Conway Robinson Memorial State Forest
705
29
Wetland 38
Wetland 37
Wetland 36
Wetland 34
Wetland 35
Wetland 30
Wetland 33
Stream 14
Wetland 32
Stream 13
Wetland 31
Wetland 29
Wetland 28
Stream 11
Stream 12
Wetland 27
Wetland 26
66
234
Legend
Limits of Disturbance
Lane Lines
Buildings
Manassas National Battlefield Park
Wetlands
Jurisdictional Water (WOUS)
Open Water (POWh)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Forested (PFO)
N
1" = 1,250'
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-39e
Wetlands with Alternative G
Sheet 4
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS
(ROUTES 29 & 234)


Wetland 46
705
Stream 18
Wetland 45
Stream 17
Stream 16
Wetland 44
Wetland 43
Wetland 42
Wetland 41
Stream 15
Manassas National Battlefield Park
Wetland 40
Wetland 39
Legend
Limits of Disturbance
Lane Lines
Buildings
Manassas National Battlefield Park
Wetlands
Jurisdictional Water (WOUS)
Open Water (POWh)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Forested (PFO)
N
1" = 1,250'
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-39f
Wetlands with Alternative G
Sheet 5
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS
(ROUTES 29 & 234)


Sudley
Park
(Site)
234
Wetland 48
Stream 20
Stream 21
Stream 19
Wetland 47
Wetland 46
705
Stream 18
Wetland 45
Legend
Limits of Disturbance
Lane Lines
Buildings
Manassas National Battlefield Park
Wetlands
Jurisdictional Water (WOUS)
Open Water (POWh)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Forested (PFO)
N
1" = 1,250'
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-39g
Wetlands with Alternative G
Sheet 6
MANASSAS
NATIONAL
BATTLEFIELD
PARK BYPASS
(ROUTES 29 & 234)

4.19.3 Mitigation

The final part of the federally-mandated mitigation sequencing process requires compensation for resources whose functions and values are lost as a result of the implementation of actions that are caused by the unavoidable direct and indirect impacts to waters of the U. S. Compensatory mitigation is typically accomplished through the restoration, enhancement, creation, or preservation of wetlands. The most common type of mitigation is permittee-provided mitigation, where the permittee assumes all responsibilities for ensuring the ecological and long-term success of the mitigation. Other mitigation options include mitigation banking and in-lieu-fee mitigation. Generally, a combination of these methods is often implemented to satisfy the requirements. As established by the Corps' 2002 Regulatory Guidance Letter 02-2, restoration should be the first option considered, followed by enhancement, then creation.

Mitigation banking is a market-oriented way to support wetlands permitting and improve the effectiveness of federal wetlands protection programs. Mitigation banks provide an opportunity to offset wetland impacts by purchasing credits of wetlands and streams restored or created by a third party. In-lieu-fee mitigation occurs in circumstances where a permittee provides funds to a third party to complete mitigation other than directly purchasing credits from a mitigation bank approved under the federal guidance.

Mitigation bank sponsors include State or local governmental agencies, non-profit organizations, or private entrepreneurs. In addition to the federal mitigation banking guidance, many states, including Virginia, now have statutes, regulations, or guidelines authorizing or encouraging the establishment of wetland mitigation banks. The 1998 Transportation Equity Act for the 21st Century (Public Law 105-178) established a preference for the use of mitigation banks for federal actions, including highway projects. On July 11, 2003, the FHWA issued its own guidance for applying the preference for wetlands mitigation banking mandated by the TEA-21 legislation, and updates the Final Rule for mitigation of impacts to wetlands and natural habitat published December 29, 2000 (65 *Federal Register* 251: 82913-82926) which apply equally to both TEA-21 and the Intermodal Surface Transportation Efficiency Act of 1991.

The anticipated wetland compensation required for implementation of each Candidate Build Alternative, and the No Action Alternative were estimated using standard mitigation ratios, multiplied by estimated impact acreages. Approximate compensation requirements are presented in **Table 4-37**. Alternative B would require approximately 18.6 acres of wetland compensation. Alternative A would require approximately 17.4 acres of wetland compensation. Alternative D would require approximately 12.93 acres of compensation for wetland impacts. Alternatives G and C would require the least amount of wetland compensation, approximately 8.3 and 6.0 acres, respectively. The No Action Alternative would require no mitigation since there are no impacts associated with its implementation.

Once an alternative is selected, advanced design and engineering techniques would be utilized to avoid aquatic resource encroachments or displacements to the maximum extent feasible taking into consideration cost, existing technology and logistics in light of overall project purposes (45 *Federal Register* 85346). Avoidance measures might include minor alignment shifts and use of bridging and flyovers rather than placement of fill or excavation. Minimization steps might also include span bridging versus fill approach aprons, flyovers and elevated ramps on piers, reductions in the size of encroachment footprints and implementation of retaining walls and steeper side slope grades, where feasible.

TABLE 4-37: SUMMARY OF WETLAND IMPACTS AND COMPENSATION REQUIREMENTS (WITHOUT AVOIDANCE AND MINIMIZATION)

Cowardin Classification (Compensation Ratio)	Wetland Area by Alternative (in Acres)					
	No Action	A	B	C	D	G
Palustrine Emergent (PEM)	0.00	3.65	3.81	0.44	1.32	1.20
(Compensation 1.0 to 1)	0.00	3.65	3.81	0.44	1.32	1.20
Palustrine Forested (PFO)	0.00	5.08	5.76	2.61	3.89	3.30
(Compensation 2 to 1)	0.00	10.16	11.52	5.22	7.78	6.60
Palustrine Scrub Shrub PSS)	0.00	1.39	1.51	1.24	1.34	0.19
(Compensation 1.5 to 1)	0.00	2.09	2.67	1.86	2.01	0.28
Pal. Open Water (PUB/POW)	0.00	1.46	0.58	0.79	0.44	0.81
(Compensation 1 to 1)	0.00	1.46	0.58	0.79	0.44	0.81
Total Habitat Displaced	0.00	11.58	11.66	5.08	6.99	5.50
Total Wetland Compensation	0.00	17.36	18.58	8.31	11.55	8.89

Notes: Estimated averages do not include avoidance and minimization, implementation of stormwater or drainage designs/improvements, utility access, right-of-way acquisition, etc. Estimated figures do not include potential areas of impact associated with the 234 Interchange, or isolated wetland determinations. All acreage calculations are subject to verification by the regulatory agencies. Final compensation will be determined during the permitting phase.

If water quality permits are issued for the proposed action, the COE and/or VDEQ would likely require compensatory mitigation for any remaining unavoidable aquatic resource impacts, in the form of purchased mitigation bank credits or cash payments through an in-lieu fee (ILF) program. Negotiated ILF arrangements are different from wetlands banking in that they do not typically provide compensatory mitigation in advance of project impacts, nor do they establish clear milestones for the initiation or completion of mitigation efforts. Agency coordination would be required to resolve this issue. FHWA/VDOT may also choose to mitigate for impacts through aquatic resource mitigation, implementing the preferred sequence of restoration, enhancement, creation and/or preservation. Mitigation banking is currently the preferred method of highway project impact mitigation in urban and suburban areas due to land costs and scarcity of affordable mitigation sites. A feasibility study to locate on-site and off-site compensation sites may be required, however, if suitable mitigation bank credits are not available. Single mitigation sites, if available, may not be of adequate size to accommodate compensation at a single location. Furthermore, a mitigation site or sites may not be available in the same watershed as where impacts occur. In accordance with RGL 02-2, the final level of appropriate mitigation, and the factors considered for replacing lost functions and values based on the Selected Alternative and its final design plans, will be determined through coordination with the Norfolk District Corps of Engineers in conjunction with input from other federal, state and local agencies.

Wetland Mitigation Banks and Compensation Sites. Wetland mitigation banks are areas of constructed or restored wetlands consisting of quantified stream credit units (SCUs) that can be purchased concurrently or in advance of anticipated losses due to construction activities. The value of these credits is estimated based on the physical and biological functions and human-use values of the wetlands which are unavoidably lost due to development.

In 2001, FHWA updated their regulations to conform to the wetland and natural habitat mitigation provisions contained in the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) and the Transportation Equity Act for the 21st Century (TEA-21). The revision establishes a policy preference for use of mitigation banks in the compensatory mitigation of unavoidable impacts to wetlands and other natural habitat and allows the expenditure of Federal-aid highway funds towards efforts to conserve, restore, enhance, and create wetlands.

The identified mitigation banks service the HUC watersheds within the MNBP Bypass study area (HUC 02070010 and HUC 02070008). Stream Credit Units that remain within these facilities change on a regular basis.

- Bull Run Wetland Mitigation Bank in Prince William County, 26 acres of constructed wetlands, including forested, scrub/shrub, and emergent communities, and approximately 0.94 acres of preserved existing wetlands along Bull Run. Remaining credits are very limited.
- Cedar Run Wetlands Bank in southern Prince William County, 300 acres. Remaining credits are very limited.
- Northern Virginia Stream Restoration Bank in Fairfax County, 29 stream miles (under development). Some SCUs are likely available at this facility.
- Potomac River Wetland Mitigation Bank in Fauquier County, 2 sites: Pandora Farms, 125 acres; Licking Run Mitigation Site, 79 acres (under development). Some SCUs are likely available at this facility.
- Northern Virginia Regional Environmental Bank in Fauquier County, 2 sites: Miller Farm, 30 acres; Keaton Mitigation Bank Site, 50 acres (under development, offering wetland creation and upland buffer credits). Available SCUs at this facility are likely.
- Foggy Bottom Wetland Farm in Prince William County, 39 acres. Remaining credits may be available at this facility.
- Great Oaks Mitigation Bank in Fauquier County, 27 acres, exclusively for VDOT projects (under development). Remaining credits at this facility are likely.

Three additional banks, the Markham Wetland Bank, Tri-County Stream Mitigation Bank and Broad Run Wetlands and Stream Bank, offering more than 53 acres of compensatory wetland credits and 20,000 linear feet of stream are also currently proposed. The Julie J. Metz and North Fork Wetlands Banks in Prince William County are fully subscribed, and no credits are available at these facilities.

Should the Corps determine that stream mitigation is feasible within the study area, supplemental field studied would be required to identify and quantify available sites and their characteristics. This process should be accomplished during the permitting phase of the project.

4.20 FLOODPLAINS

4.20.1 Introduction

Executive Order 11988, *Floodplain Management*, prohibits federal support of incompatible floodplain development unless there is no practicable alternative. Practicable alternatives could include bridging floodplains versus the placement of fills, shifting alignments to minimize impacts, or other measures that reduce or minimize significant encroachments where such encroachments occur.

Potential impacts to the 100-year floodplain were assessed in accordance with Executive Order 11988 - Floodplain Management and FHWA's Program Manual 6-7-3-2, Location and Hydraulic Design for Encroachments on Floodplains.

Preliminary project designs sought to minimize and avoid impacts to floodplains by including floodplains as evaluation criteria in the early alternatives development process. To evaluate the initial concepts, digital constraints mapping was prepared for the project area that included the approximate 100-year floodplain boundaries. The boundaries were obtained from the National Flood Insurance Maps (FIRM) prepared by the Federal Emergency Management Agency (FEMA). Floodplain impacts were calculated by superimposing the alternative design footprints onto floodplain mapping and calculating the areas of encroachments. Where alternatives involve widening of existing roads, the extent of encroachment was determined by calculating the area between existing edge of pavement and the new cut and fill limits associated with each Candidate Build Alternative. This provides a slightly higher and more conservative estimate of floodplain encroachment than would just the increase in new impervious service (i.e., pavement).

4.20.2 Impacts

Each of the Candidate Build Alternatives would encroach upon 100-year floodplains designated by the Federal Emergency Management Agency. **Table 4-38** summarizes the floodplain encroachments and **Figure 4-40** depicts their locations.

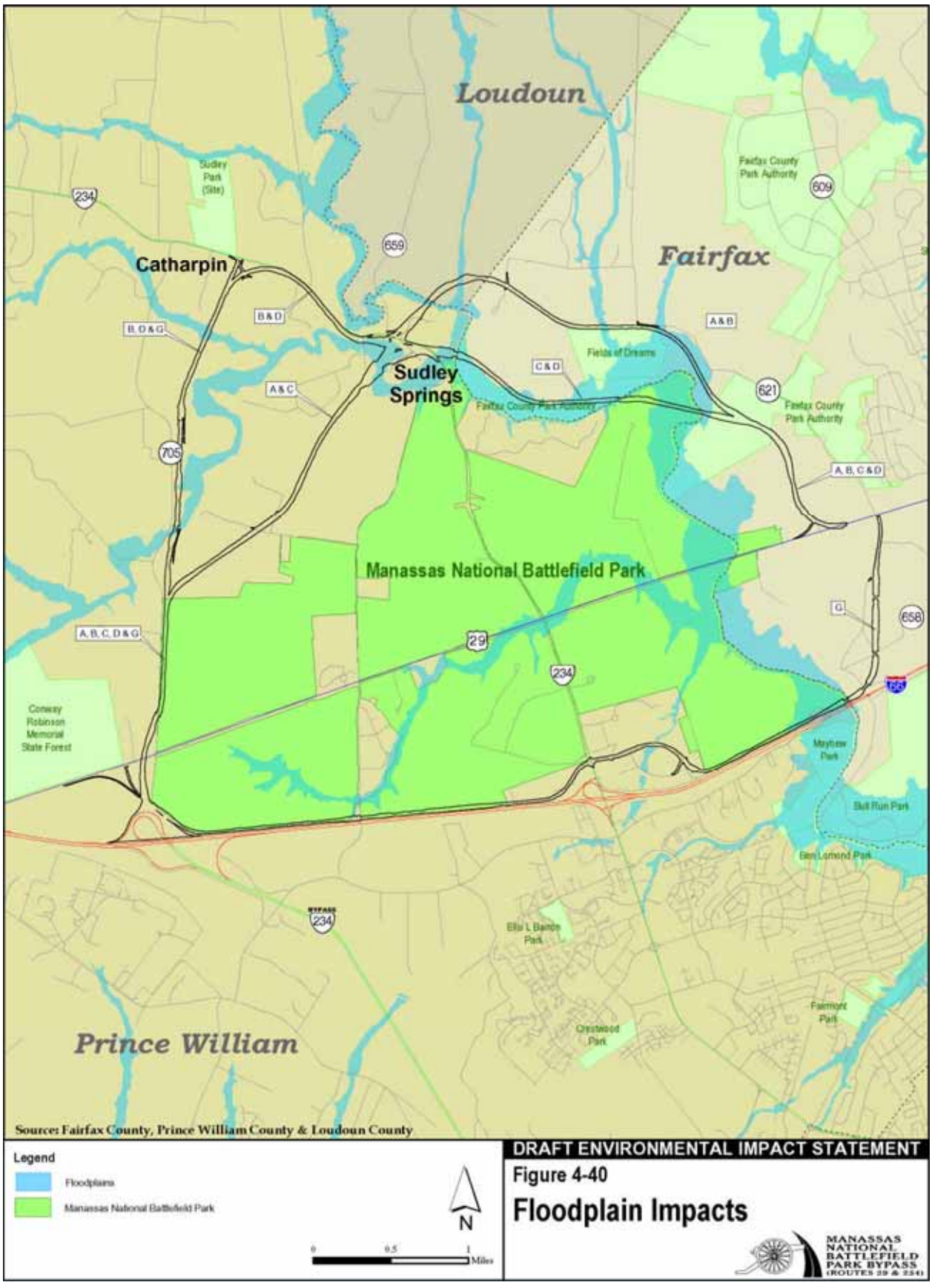
TABLE 4-38: SUMMARY OF FLOODPLAIN ENCROACHMENTS BY ALTERNATIVE

Area of Encroachment	No Action	A	B	C	D	G
Longitudinal (acres)	0	10.85	6.58	11.08	8.57	10.18
Latitudinal (acres)	0	7.82	10.67	18.26	22.31	0.00
Total (acres)	0	18.67	17.25	29.34	30.88	10.18

Alternative D would have the greatest encroachment on floodplains, 30.8 acres. Alternative C would have a similar encroachment, 29.3 acres. Alternative G would have the least encroachment, 10.2 acres. Alternative A would encroach on 18.6 acres of floodplains. Alternative B would encroach on 17.2 acres of floodplains. The No Action Alternative would have no floodplain encroachments.

In developing all of the Candidate Build Alternatives, floodplains have been avoided where practicable, taking into account other constraints such as parklands, existing developed residential areas, engineering design criteria, and road connectivity considerations. Because of the extent of floodplains in the study area, it is impossible to entirely avoid encroachments. Where possible, the alternatives cross floodplains perpendicularly.

Where longitudinal encroachments are unavoidable, the alternative alignments have been pushed as far as practicable to the outer fringes of the floodplain limits. There is no evidence that the encroachments associated with any of the alternatives would increase the probability of flooding or the potential for property loss and hazard to life during the service life of the road. Therefore, it is not expected that any of the alternatives would increase flooding risks.


Loudoun
Fairfax
Prince William
Catharpin
Sudley Springs
Manassas National Battlefield Park
Sudley Park (Site)
Fairfax County Park Authority
Fields of Dreams
Conway Robinson Memorial State Forest
Mayfaw Park
Bull Run Park
Ben Lomond Park
Ellis L Bandy Park
Fairmont Park
Crestwood Park
234
659
609
621
705
658
29
66
B&D
B,D&G
A&C
C&D
A&B
A,B,C&D
A,B,C,D&G
G
BYPASS
Source: Fairfax County, Prince William County & Loudoun County
Legend
Floodplains
Manassas National Battlefield Park
N
0
0.5
1
Miles
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-40
Floodplain Impacts
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS (ROUTES 29 & 234)

4.20.3 Mitigation

All drainage structures will be designed so the potential increases in flood levels will be minimal, thus minimizing effects on the ability of the floodplains to moderate floodwaters. Drainage structures also will be designed to minimize obstructions to aquatic wildlife movements. The project will not encourage, induce, allow, serve, support or otherwise facilitate additional or incompatible base floodplain development. Should any uneconomic remnants of land acquired during right of way purchases be later transferred to other entities, public or private, such transfer will be subject to restrictions prohibiting incompatible development within the floodplain. Wetland mitigation will be provided to replace the functions and values of wetlands within the floodplains that would be displaced by the alternatives.

4.21 BIOLOGICAL RESOURCES

4.21.1 Introduction

Federal statutes, regulations, executive orders, and administrative guidelines/policies applicable to terrestrial biological resources in the study area, excluding threatened and endangered species are listed below. Complete analyses and discussion of existing biological resources and potential environmental effects resulting from the proposed action with respect to regulatory issues and compliance are presented in the following sections.

- Migratory Bird Treaty Act (16 U.S.C. 703-711);
- Sustainable Fisheries Act of 1996 (Public Law 104-267);
- Bald and Golden Eagle Protection Acts (16 U.S.C. 668-668d);
- Fish and Wildlife Coordination Act (16 U.S.C. 661-666c);
- National Environmental Policy Act (of 1969 (42 U.S.C. 4321-4347);
- EO 13186 – "Responsibilities of Federal Agencies to Protect Migratory Birds;" and
- EO 12962 – "Recreational Fisheries";
- EO 13112 – "Invasive Species";
- 7 U.S.C. 4201-4209, Farmland Protection Policy Act of 1981.
- 16 U.S.C. 460, Land and Water Conservation Fund Act, Section 6(f).
- 16 U.S.C. 470aa-11, Archaeological Resources Protection Act.
- 16 U.S.C. 461 *et seq.*, 23 U.S.C. 305.Archaeological and Historic Preservation Act.
- 16 U.S.C. 469-469c, Archaeological and Historic Preservation Act (Moss-Bennett Act).
- 16 U.S.C. 470H-2, National Historic Preservation Act of 1966, Section 110.
- 16 U.S.C. 470f, National Historic Preservation Act of 1966, Section 106.
- 16 U.S.C. 431-433, Act for the Preservation of American Antiquities.
- 16 U.S.C. 661-666c, The Fish and Wildlife Coordination Act of 1958, as amended 1965.
- 16 U.S.C. 760c-760g, Migratory Bird Treaty Act.
- 23 U.S.C. 319B, Wildflower Use, Implementing Operation Wildflower under the Surface Transportation and Uniform Relocation Assistance Act of 1987.
- 16 U.S.C. 1271-1287, Wild and Scenic Rivers Act.
- 16 U.S.C. 3501-3510 and 42 U.S.C. 4128, Coastal Barriers Resources Act of 1982, as amended.

- 16 U.S.C. 145 *et seq.*, Coastal Zone Management Act of 1972, as amended in 1990 (Sections 303 and 307 per 23 CFR 650.211).
- 16 U.S.C. 1531-1543, Endangered Species Act of 1973, as amended per 7 CFR 355, 50 CFR 17, *et. seq*.
- 33 U.S.C. 1251 *et seq*., Clean Water Act of 1977, as amended.
- 33 U.S.C. 401 *et seq*, Rivers and Harbors Act of 1899, as amended and supplemented (Sections 9 and 10 per 23 CFR 650, Subparts D & H, 33 CFR 114-115).
- 42 U.S.C. 4001-4128, National Flood Insurance Act and Flood Disaster Protection Act.
- 16 U.S.C. 3921 Emergency Wetlands Resources Act of 1986.
- 16 U.S.C. 1301-1311 Water Bank Act.
- 42 U.S.C. 300(f) *et seq*., Safe Drinking Water Act of 1974, as amended.
- 42 U.S.C. 4371 *et seq*., Environmental Quality Improvement Act of 1970.
- 23 U.S.C. 103(i)13 and 23 U.S.C. 133(b)11 Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA): Wetlands Mitigation Banks, Sections 1006-1007.
- 16 U.S.C. 1241-1249 National Trails Systems Act.
- 16 U.S.C. 1261 National Recreation Trails Fund Act of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA).
- 23 U.S.C. 101(g) and 133(b)(e), Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), Section 1007, Transportation Enhancement Activities.
- 23 U.S.C. 100 *et seq*., Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), Section 1038, Recycled Paving Material.
- 23 U.S.C. 100 *et seq*., Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), Section 1047, Scenic Byways Program.
- 42 U.S.C. 4601 *et seq*., Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.
- 23 U.S.C. 109(j) and 42 U.S.C. 7521(s), Clean Air Act, as amended, including Transportation Conformity Rule and Sanctions for Noncompliance.
- 42 U.S.C. 2000d-d4, Title VI of the Civil Rights Act of 1964.
- 33 CFR 115 Bridge Locations and Clearances.
- Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds, dated January 10, 2001.
- Executive Order 13112, Invasive Species, dated February 3, 1999.
- FHWA Memorandum, Guidance Implementing Executive Order of Invasive Species, dated August 18, 1999.
- Executive Order 11514, Protection and Enhancement of Environmental Quality, as amended by Executive Order 11991, dated May 24, 1977.
- Executive Order 11593, Protection and Enhancement of the Cultural Environment, dated May 13, 1971, implemented by DOT Order 5650.1, dated, November 20, 1972.
- Executive Order 11988, Floodplain Management, dated May 24, 1977, implemented by DOT Order 5650.2, dated April 23, 1979, as amended by Executive Order 12148 (23 CFR 650, Subpart A, and 23 CFR 771).

- Executive Order 11990, Protection of Wetlands, dated May 24, 1977, implemented by DOT Order 5660.1A, dated August 24, 1978.
- FHWA Memorandum, Management of the Endangered Species Act (ESA) Environmental Analysis and Consultation Process, dated February 20, 2002.
- FHWA Memorandum, Guidelines for the Consideration of Highway Project Impacts on Fish and Wildlife Resources, dated October 30, 1989.
- FHWA Memorandum, Cooperative Agreement Between the Nature Conservancy and the FHWA Regarding Research on Biodiversity Conservation and Transportation Planning, dated July 8, 1997.
- FHWA Memorandum, Environmentally and Economically Beneficial Practices on Federal Landscaped Grounds, dated April 26, 1994.
- FHWA Memorandum, Guidance on Implementing Executive Memorandum on Landscaping, dated November 2, 1995.

4.21.2 Impacts

Displacements of sections of stream bottom by any of the Build Alternatives would result in minor losses of benthic (bottom-dwelling) organisms. The water quality of streams that receive runoff from the area roadways, surrounding urban and suburban areas, and agricultural areas is already impaired, and the increase in pavement and replacement of natural stream channels with culverts or other structures has the potential to further degrade water quality and associated habitats. However, with proper stormwater controls, further degradation can be avoided or minimized. Given the lack of existing stormwater controls, it is possible that the overall water quality of receiving streams could actually improve following the installation of stormwater management facilities as part of the project.

Removal of vegetative cover would result in temporary impacts to wildlife, such as migration away from the disturbance. In accordance with Executive Order 13112, Invasive Species, construction of any alternative will minimize the potential for the establishment of invasive terrestrial or aquatic animal or plant species by following the VDOT Road and Bridge Specifications Manual. Activities related to establishing and maintaining the newly constructed right-of-way follow guidelines set forth in the manual under the following sections: Clearing and Grubbing (Section 301), Drainage Structures (Section 302), Earthwork (Section 303), Selective Tree Removal, Trimming, and Cleanup (Section 601), Topsoil (Section 602), Seeding (Section 603), Sodding (Section 604), Planting (Section 605), Soil Retention Covering (606), Herbicide Spraying (Section 607), and Mowing (Section 608). Contract bid packages must include special provisions for managing invasive species that relate to those sections of the manual listed above. While the right-of-way is vulnerable to the colonization of invasive plant species from adjacent properties, implementation of the stated construction specifications and special provisions will reduce the potential for the establishment and proliferation of invasive species in the right-of-way.

4.21.3 Mitigation

USFWS has recommended that negative impacts to migratory birds, other fish and wildlife resources, and wildlife-related recreation that would result from actions occurring in the general study area could be offset by habitat restoration/enhancement. Options suggested for such mitigation, in accordance with EO 13186, includes habitat/riparian/floodplain restoration/reforestation or establishment of vegetated buffers along field edges.

4.22 THREATENED AND ENDANGERED SPECIES

None of the candidate build alternatives are expected to have an impact on threatened or endangered species. USFWS has indicated that 14 federally listed endangered, threatened, or special concern species could be present within the study area. Of these, only a single transient sighting of bald eagle near I66-Groveton Road bridge has been documented. No nests or fledge sites are known or were observed during fieldwork. Habitat for Small Whorled Pogonia was assessed in March 2003 in the vicinity of Candidate Build Alternative G. The general opinion of USFWS-listed surveyor is that habitat is no better than moderate quality. A cursory inspection in July 2004 by surveyor confirmed low-to-moderate habitat quality and that presence of pogonia is not likely.

4.23 SPECIAL JURISDICTIONS

Impacts to special jurisdictions were evaluated for all alternatives and are summarized in **Table 4-39**. Special jurisdictions include Chesapeake Bay preservation areas, coastal zones, essential fish habitats, wild and scenic rivers, and agricultural and forestal districts. Fairfax and Prince William Counties established Resource Protection Areas (RPAs) to manage development activities in environmentally sensitive areas of the Chesapeake Bay watershed (see **Figure 4-41**). Impacts to RPAs would range from 4.7 acres (Alternative G) to 22.5 acres (Alternative D). None of the alternatives would impact any essential fish habitats, wild and scenic rivers, or agricultural and forestal districts.

TABLE 4-39: IMPACTS TO SPECIAL JURISDICTIONS

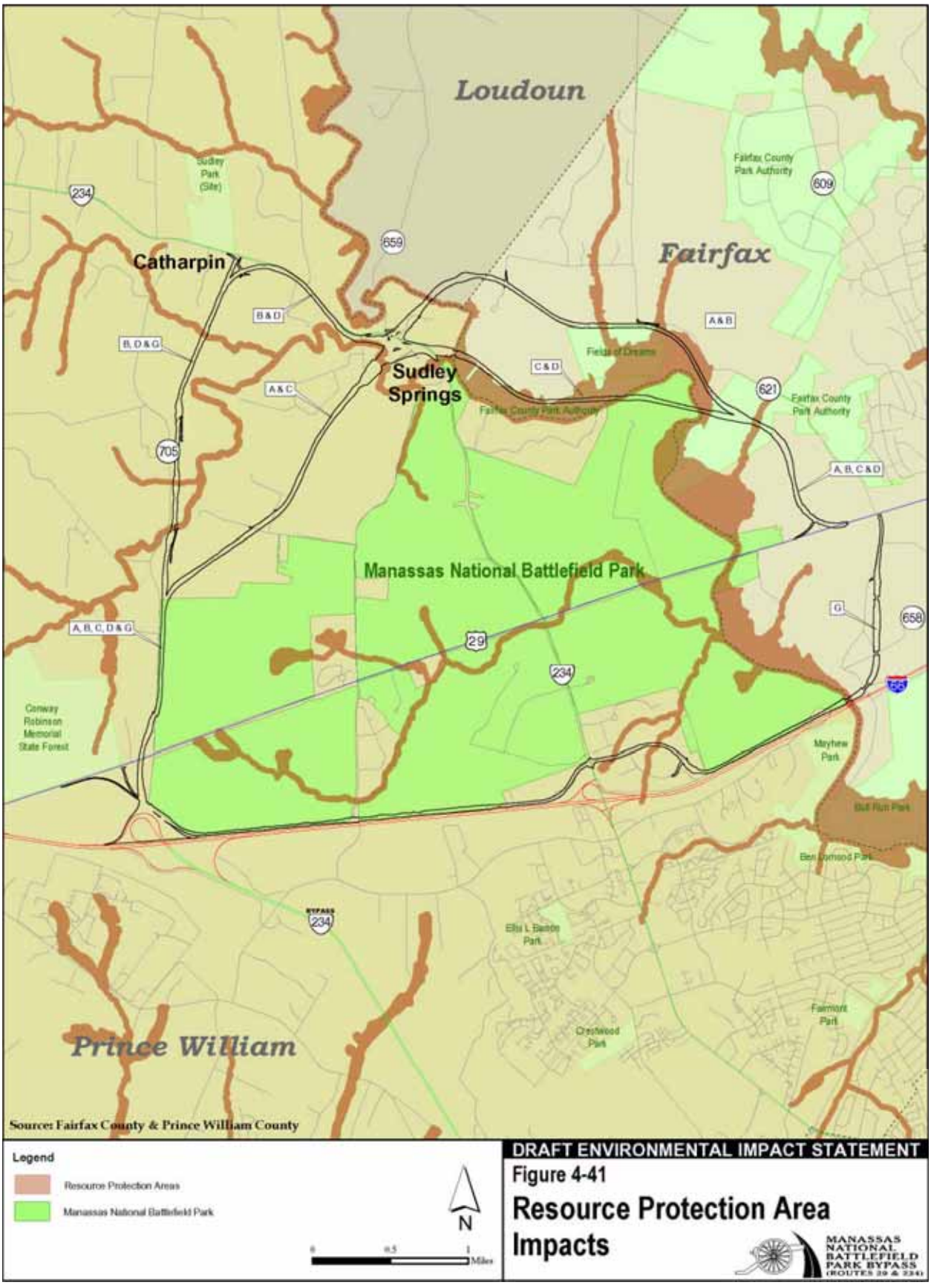
	No Action	A	B	C	D	G
RPA's (acres)	0	13.5	15.1	18.1	22.5	4.7
Essential Fish Habitats	0	0	0	0	0	0
Wild and Scenic Rivers	0	0	0	0	0	0
Agricultural and Forestal Districts (acres)	0	0	0	0	0	0

4.24 SECONDARY AND CUMULATIVE IMPACTS

The Council of Environmental Quality's (CEQ's) regulations implementing the National Environmental Policy Act (NEPA) divide environmental impacts into three categories: direct impacts, indirect or secondary impacts, and cumulative impacts. The regulations require that all three types of impacts be included in NEPA documents. Direct impacts are discussed throughout this environmental impact statement.

CEQ regulations require consideration of indirect (or secondary impacts), which are caused by the proposed action, but which are "later in time or further in distance" than the direct impacts discussed elsewhere in this document (40 CFR 1508.8). Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air, water, natural systems, or the human environment.

CEQ regulations also require that federal agencies preparing an environmental impact statement consider the cumulative effects of a proposed action and other actions. CEQ defines cumulative effects as an "impact on the environment which results from the incremental impact of the action when added to other past, present, and


Loudoun
Fairfax
Prince William
Catharpin
Sudley Springs
Manassas National Battlefield Park
Sudley Park (Site)
Fairfax County Park Authority
Field of Dreams
Conway Robinson Memorial State Forest
Mayhew Park
Bull Run Park
Ben Lomond Park
Ellis L. Bartin Park
Crestwood Park
Fairmont Park
234
659
609
621
705
658
29
B&D
B,D&G
A&C
C&D
A&B
A,B,C&D
A,B,C,D&G
G
BYPASS
Source: Fairfax County & Prince William County
Legend
Resource Protection Areas
Manassas National Battlefield Park
N
0
0.5
1
Miles
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-41
Resource Protection Area Impacts
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS
(ROUTES 29 & 234)

reasonably foreseeable future actions." CEQ's publication, *Considering Cumulative Effects Under the National Environmental Policy Act* (January 1997), provides a framework for addressing cumulative effects. This handbook outlines general principles about how to evaluate cumulative effects. It does not represent new legal requirements nor is it legally binding; rather, it clarifies a complex area of the NEPA process.

This analysis in this section focuses on three primary areas of concern:

- Determining the secondary effects associated with construction of the Build Alternatives and the induced development (also referred to in this Draft EIS as secondary development) that would be associated with the project;
- Describing the potential cumulative effects that would occur due to construction of the Build Alternatives in addition to past, present and future reasonably foreseeable projects within the same study area; and
- Suggesting mitigation measures that could reduce the potential for secondary and/or cumulative effects.

For the purposes of this DEIS, secondary and cumulative impacts have been separated into two categories: those relating to socioeconomic resources and those relating to natural resources.

4.24.1 Methodology for Secondary and Cumulative Effects

The development of this secondary and cumulative impact analysis used CEQ and EPA guidance as the basis for developing an approach that is responsive to project-related issues. Specific guidance has been provided by EPA's *Consideration of Cumulative Impacts in EPA Review of NEPA Documents*, 1999, the Council on Environmental Quality (CEQ) regulations 40 CFR §§1500–1508; FHWA's *Position Paper: Secondary and Cumulative Impact Assessment in the Highway Project Development Process*, 1992; and FHWA's 1997 manual, *Considering Cumulative Effects Under the National Environmental Policy Act*.

The process used to evaluate secondary and cumulative effects involves a multi-step process to identify and evaluate these effects. The first step in the process is the identification of sensitive resources to be analyzed for effects. These resources would include: those that are directly affected by the Build Alternatives, those affected with any secondary development that is associated with the Build Alternatives under consideration, and those resources that are particularly susceptible to cumulative effects (e.g. wetlands can experience multiple individual impacts from many projects over time, that when summed result in cumulative effects).

Sensitive resources were identified using the environmental information prepared for the various sections of this Draft EIS, as well as scoping comments received for the project.

The next step was determining the geographic and temporal boundaries to be analyzed. The geographic boundary for cumulative effects was determined by analyzing impacts to the areas of traffic influence, census tracts, and subwatersheds. As discussed in the traffic analysis in this chapter of the DEIS, most of the trips using Routes 29 and 234 within the Park are local trips and the analysis indicates that volumes on facilities are not generally affected south of I-66 regardless of the alternative. Growth in the census tracts and traffic analysis zones that border the Park were also analyzed as shown in Chapter 3 of this DEIS (Figure 3-10). As discussed in Section 4.10.1, the Alternatives are all located within Upper Bull Run / Little Bull Run subwatershed, although Cub Run and Broad Run/Kettle Run are in proximity as well. A temporal boundary was also determined for the project. According to CEQ guidelines, the design year is a good proxy to use for the evaluation of future

conditions and has been selected for this project, specifically year 2025. The use of 2025 also allows the analysis to be consistent with other sections of the DEIS, as they also use a future timeframe of 2025.

The next step in the process was to evaluate how the Build Alternatives would affect growth patterns within the study area. This is referred to as the secondary development analysis. The secondary development analysis assesses not only the potential for new growth associated with the project, but it also defines the impacts on sensitive resources due to that growth. According to CEQ guidance, this secondary development has to be directly attributable to the Build Alternatives. In other words, that growth would only occur due to the construction of the Build Alternative. General growth patterns are assessed in a more general fashion in the cumulative effects analysis which looks at how all past, present, and future reasonably foreseeable projects, only in relation to the Build Alternatives, affect the sensitive resources previously identified.

In order to determine cumulative effects, other projects within the study area have to be included as part of the evaluation. The following projects have been assessed in conjunction with the Build Alternatives, even though some of the projects are currently just studies and are not considered to be reasonably foreseeable at this time since no preferred alternative has been selected and there is little environmental impact information available to be used in the assessment of cumulative effects.

Impacts were then assessed for secondary or induced development projects associated with the Build Alternatives for socioeconomic and natural resources and then the cumulative impacts were assessed. Secondary development potential was assessed in conjunction with local planning agencies in the study area and the review of locally adopted comprehensive plans. Future development plans were assessed and recent and expected changes in development included.

The final step in the process is to suggest mitigation measures that might be appropriate for mitigating secondary and cumulative effects.

4.24.2 Resource Identification

Not all impacts tend to "accumulate" – that is, similar impacts from more than one project do not tend to add together and create a greater impact. Certain resources when they experience independent impacts may have minimal change, but when impacts are summed cumulatively, they may experience cumulative effects over time. These impacts may be the result of secondary effects such as induced development or they may be the result of other past, present, and future actions. For example, wetlands within the geographic boundary analyzed may experience a loss in acreage due to several individual actions that might include losses due to the Build Alternatives, future development, or any of the other projects identified in **Table 4-40**. Individual impacts may be negligible, but when the impacts are accumulated there may be a cumulative impact to the function or value of the watershed. An example of resources that do not accumulate impacts would be hazardous materials; these resources would experience only one direct, primary impact.

The effects that do accumulate and that are addressed in this document include the following:

- Neighborhoods, Community Services, and Cohesion Changes (due to proximity impacts, changes in access, or multiple displacements within the same neighborhood)
- Cultural Resources
- Parks and Recreation Facilities

- Geologic Resources
- Water Resources
- Vegetation and Wildlife

If the proposed project does not result in an impact to a certain resource, then it will not contribute to cumulative impacts to that resource. The Build Alternatives will not result in impacts to environmental justice populations, air quality, or energy as discussed in the previous sections of this chapter, even though these resources are sensitive to cumulative effects. Therefore, they are not included in this evaluation.

TABLE 4-40: OTHER PROJECTS INCLUDED IN THE CUMULATIVE EFFECTS ANALYSIS

Project	Description
Tri-County Parkway	Roadway construction project currently under evaluation. Included in the No-Action alternative, portions of the Build Alternatives could co-locate on this 4-lane facility depending on the alignment selected. Project currently in NEPA evaluation process.
Interstate 66 Improvements	Improvements planned from Centreville to Gainesville interchange, including provision of additional lanes and reversible HOV facility to Route 15 in Haymarket. Potential transit investment in corridor to Centreville. Improvements at Gainesville interchange also potential.
Manassas National Battlefield General Management Plan Update	Environmental impact statement being prepared by NPS to determine alternative management and operational improvements for the Park.
Route 234 Bypass North Extension	Roadway construction project proposed to be located to the west of the Park along Pageland Road corridor. Four-lane facility included in the No-Action Alternative since it is included in all local and regional plans for construction prior to design year for this study. Potential co-location opportunity for several of the Alternatives.
Western Transportation Corridor	Not considered reasonably foreseeable at this time. Previous NEPA study discontinued and no information available on mode of transportation, termini, or potential location.
Route 28 Improvements	Provision of additional capacity and grade-separation of interchanges. Included as an improvement in the No-Action Alternative.

4.24.3 Socioeconomic Resources – Secondary Impacts

The ability of a transportation facility to alter or to affect land use patterns is dependent on a number of factors, including the type of access it provides to land available for development, the development potential of the land, and the regulations in place that govern land use in proximity to the transportation facility. The transportation facility, in and of itself, does not create induced or secondary development. However, a transportation facility can encourage development by providing access to new growth locations as allowed by local jurisdictions. When a direct relationship can be proven to exist between a transportation facility and new growth that would occur due to the existence of that facility – this is referred to as secondary development that is associated with the transportation project. The effects of this new growth on sensitive resources are then included in this analysis.

Secondary development effects typically are perceived to include effects on human and natural systems resulting from changes in land use patterns or growth rate accelerations that are induced by the project. Quantifying these effects is often difficult due to the inability to foresee relationships between the project and future

development, as well as the interplay of factors besides transportation (e.g., overall economic conditions, availability of other infrastructure such as water and sewer systems, growth policies and plans of local governments, and inclinations of individual landowners). However, CEQ does provide guidance on the level of detail needed to assess potential impacts – primarily by assessing the potential level of change and location of that change that is directly induced by the project.

Before exploring the secondary development effects of the project, it may be useful to first look at how highway projects can affect development decisions by landowners. Transportation has two basic functions: access and mobility. Access enables landowners to develop or otherwise extract economic value from their properties. Direct access off of a highway enables customers to enter properties to transact business, and enables the landowner to export his products to markets beyond the bounds of the property. Mobility enables commerce and social interaction by providing for travel; the better the mobility, the greater the geographic range of interaction and the reach of commerce.

If a new highway is built into undeveloped lands, that highway provides new access that may, or may not, influence the landowner to build something on the property or extract natural resources from it. The provision of the new access, in and of itself, does not cause the development; rather, it facilitates the development when there are other factors in place that lead the landowner to a development decision (e.g., a growing population creates demand for additional housing; a market exists for the natural resources on the property; a robust and growing economy provides fertile conditions for new businesses; and other essential infrastructure and services, such as schools, water, sewer, and power, are available at reasonable cost).

Enhancements to mobility reduce travel time, thereby reducing the cost of goods transported and increasing the efficiency of commercial and social interaction. Producers can ship their goods greater distances for less cost, workers can commute greater distances in less time, and shoppers can travel farther for greater purchasing choices and opportunities. Again, however, the enhanced mobility, in and of itself, does not ensure expanded economic or social activity. Rather, it facilitates it when there are other factors in place enabling people to take advantage of it (e.g., a robust economy that supports a large and diverse labor pool, aggressive economic development policies aimed at recruiting new business and industry, and a population with time and money to take advantage of shopping and entertainment opportunities).

By comparing the conditions anticipated under the No-Action Alternative and Candidate Build Alternatives, the induced or secondary development impacts can be determined. Secondary impacts have been assessed for the following:

- The rate and character of development within the area of influence; and
- Sensitive cultural resources such as Manassas National Battlefield Park itself.

Rate and Character of Development

The Manassas Bypass Study is not a traditional transportation study that focuses on providing additional capacity within the study area so that future projected growth can be accommodated. As a Park preservation project the focus is on providing the best alternative means of transportation if Routes 29 and 234 are closed within the Park. As discussed in Chapter 1 of this DEIS, this need is based on current, existing conditions and not dependent or a result of future land development patterns.

However, continued growth is projected to occur in the three jurisdictions that surround the Park, Prince William, Fairfax, and Loudoun Counties, although there is limited new development projected by these jurisdictions in the zones that are immediately adjacent to the Park. New development is projected along Route 29 and Route 15 to the west of the Park in areas such as Heritage Hunt (located just west of Conway Robinson), Haymarket, and Gainesville and the regional projections reflect this planned growth. Planned and projected development within the Study Area would be the same for the No-Action and Build Alternatives. This conclusion is based on several arguments. First, as evidenced by all regional projections, long-range planning, and pending development projects that are already underway in the growth areas in Prince William, Fairfax, and Loudoun Counties, growth is anticipated within the area regardless of whether Routes 29 and 234 are closed and a bypass is constructed. This growth is already concentrated in specific areas such as along I-66 in Haymarket and Gainesville and is permitted under existing zoning and comprehensive plans. Second, any of the Build Alternatives would be a limited access facility providing access only at a few locations. The locations that do have access are all located within rural preservation areas and coordination with local planning authorities indicate that there are no pending development projects or proposals in any of the jurisdictions that are in any way linked to the construction of a bypass. Third, limited growth is planned for or allowed in direct proximity to any of the Build Alternatives. The land use controls of the localities currently indicate that only growth consistent with their rural preservation goals would be allowed. No mixed-use, commercial or dense development would be allowed along any of the alternatives and the land use and zoning controls allow only large-lot single-family residential development along any of the alternatives. Fourth, there are development constraints along the alternatives, including portions located within the Park itself, steep slopes, floodplains, and residential neighborhoods that would be difficult to consolidate into any major developments. The record of past performance indicates that the localities have been making efforts to limit growth in proximity to the Park and where any alternatives would be located. Residential re-zonings in proximity to the Park are neither common nor casual occurrences due to adherence to the comprehensive plans. Finally, none of the Build Alternatives are projected to change the pace of development in more remote areas not in proximity to the Park. As documented in the traffic analysis for this study, the Build Alternatives do not provide substantial travel time savings that would promote access to new land for development. In addition, they are not considered significant capacity enhancements in the region or local areas, since the capacity that already exists on both Routes 29 and 234 would be removed from the transportation network in exchange for the new facility.

Impacts on Manassas National Battlefield Park

Secondary impacts to historic and recreation resources relate to the residential and commercial development of the rural area surrounding the MNBP. According to the NPS, such development could threaten the integrity of the park, as well as the recreational experience of the park's visitors by altering the surrounding landscape. The only form of development permitted around the Park is low-density residential development of agricultural land near the Park under current zoning ordinances and under Prince William County and Fairfax County's comprehensive plans. The recent trend of population and household growth in the region has increased residential development within the larger study area, but not in direct proximity to the Park. In addition, local jurisdictions provide NPS staff with the opportunity to review and comment on all proposed development projects wither adjacent to or within close proximity to the Park. Existing growth trends, as limited by local zoning ordinances and comprehensive plans, indicate that the Build Alternatives would not induce additional acreage of residential growth in proximity to the Park.

There is potential for limited residential development of open space primarily west of the Park along Pageland Lane, that could alter the character of the area with or without the proposed bypass, however any development

would adhere to the requirements for the rural crescent in Prince William, thereby minimizing potential adverse effects. Such development could occur regardless of whether any of the Build Alternatives are constructed. In addition, the Build Alternatives are not anticipated to change the scale or character of this limited potential development. There are currently no plans for higher density development or any rezoning requests.

Stakeholders have expressed concern that increased traffic volumes would impact cultural and recreation resources within the Park as well as the associated battlefield historic district. The traffic analysis conducted indicates that the volumes on the proposed Build Alternatives would be similar to the volumes already occurring within the Park on Routes 29 and 234, with the exception of the potential co-located segments of the Tri-County Parkway and the Route 234 Bypass North Extension. However, under any of the Build Alternatives, the relocated raffic could potentially result in intrusions to what is currently and, to many, a solemn, quiet place largely surrounded by open space. These relocated corridors, would result in visual changes that occur in the vicinity of the proposed Alternatives, but this would not interfere with recreational opportunities currently offered at the Park. All of the Build Alternatives are projected to enhance the Park experience by removing the congestion that occurs within the center of the Park.

4.24.4 Socioeconomic Resources - Cumulative Effects

Cumulative effects are those incremental consequences of a proposed action that, when added the consequences of to past and reasonably foreseeable actions, affect the same resources. Other actions in the project area potentially impacted by cumulative effects include other highway projects and residential, commercial, and institutional development. Cumulative effects occur when there is an additive relationship between the various projects in relation to the resources being analyzed.

There are three primary proposed actions that have the greatest potential for cumulative effects to socioeconomic resources in the area of influence:

- Tri-County Parkway
- Routes 234 North Bypass Extension
- MNBP General Management Plan

As has been noted in the discussion of alternatives in Chapter 2 of this DEIS, both the Tri-County Parkway and the Route 234 North Bypass Extension are included in local and regional plans as part of the No-Action Alternative. In this sense, they may have impacts that result regardless of the closure of Routes 29 and 234 and any bypass alternative. However, since there has not been a formal location decision for either project, direct impacts for all of the Build Alternatives have been presented as full end-to-end alternatives, and the impacts do not separate out the impacts associated with construction of the TCP and Route 234 Bypass that might be built by others. This section will assess the cumulative impacts that could result from co-locating onto portions of these concepts. Three scenarios are analyzed:

- The TCP would be constructed to the east of the Park as coded in the regional models without any construction of the Route 234 Bypass North,
- The TCP is located to the west of the Park on the Route 234 Bypass North location, and
- The TCP is constructed to the east of the Park and Route 234 Bypass is constructed to the west.

The co-location effects are shown in **Table 4-41**.

TABLE 4-41: CO-LOCATION EFFECTS TO SOCIOECONOMIC RESOURCES

	Alternative	Impacts of Full Alternative - No TCP or Route 234 Bypass North	Reduction in Impacts Due to TCP East of Park	Reduction in Impacts Due to TCP West of MNBP on 234 Bypass Alignment	Impacts Unique to Bypass If Both TCP and 234 Bypass Constructed
Length (Miles)	Alternative A	7.9	2.2	1.6	4.1
	Alternative B	9.0	2.2	3.7	3.1
	Alternative C	7.4	0.8	1.6	5.0
	Alternative D	8.6	0.8	3.7	4.1
	Alternative G	10.3	1.5	3.9	4.9
Impacts to Rural / Undeveloped Land (acres)	Alternative A	128.3	24.9	46.7	56.7
	Alternative B	154.4	24.3	83.6	46.4
	Alternative C	124.0	4.1	46.7	73.2
	Alternative D	145.1	4.1	83.6	57.3
	Alternative G	136.1	17.8	85.9	32.3
Impacts to Residential Land (acres)	Alternative A	34.2	0.0	5.5	28.7
	Alternative B	19.6	0.0	7.0	12.6
	Alternative C	23.3	0.0	5.5	17.8
	Alternative D	13.5	0.0	7.0	6.5
	Alternative G	14.4	7.4	7.0	0
Impacts to Commercial Land (acres)	Alternative A	0	0	0	0
	Alternative B	0	0	0	0
	Alternative C	0	0	0	0
	Alternative D	0	0	0	0
	Alternative G	21.2	0	0	21.2
Residential Relocations	Alternative A	6	0	0	6
	Alternative B	13	0	7	6

TABLE 4-41: CO-LOCATION EFFECTS TO SOCIOECONOMIC RESOURCES

	Alternative	Impacts of Full Alternative - No TCP or Route 234 Bypass North	Reduction in Impacts Due to TCP East of Park	Reduction in Impacts Due to TCP West of MNBP on 234 Bypass Alignment	Impacts Unique to Bypass If Both TCP and 234 Bypass Constructed
	Alternative C	5	0	0	5
	Alternative D	13	0	7	6
	Alternative G	11	4	7	0
Commercial Relocations	Alternative A	1	1	0	0
	Alternative B	1	1	0	0
	Alternative C	1	1	0	0
	Alternative D	1	1	0	0
	Alternative G	2	0	0	2
Fairfax County Park Authority Land (acres)	Alternative A	8.5	8.5	0	0
	Alternative B	8.5	8.5	0	0
	Alternative C	20.5	0	0	20.5
	Alternative D	20.5	0	0	20.5
	Alternative G	0	0	0	0
MNBP Park Owned Land (acres)	Alternative A	11.2	0	10.8	0.4
	Alternative B	11.2	0	11.2	0
	Alternative C	19.2	0	10.8	8.4
	Alternative D	20.6	0	11.2	9.4
	Alternative G	42.3	2.5	11.2	28.7

The table illustrates the potential effects of constructing either the TCP or the Route 234 Bypass. For example, the full length of Alternative is 7.9 miles long from Route 29 east of the Park to I-66 west of the Park. If TCP was constructed east of the Park as part of the No-Action Alternative, then that would reduce the length of Alternative A by 2.2 miles. If Route 234 Bypass was constructed, that would reduce the length of the Alternative A by another 1.6 miles, meaning that 4.1 miles of Alternative A would be unique to the Manassas Bypass Study and not co-located with another facility.

In looking at the co-location effects, it shows the benefit of co-locating facilities in order to reduce cumulative effects. Alternative C is the shortest in overall length if built alone, but because it does not co-locate with TCP or Route 234 Bypass North, it has higher impacts to rural and residential land than Alternatives B and D. If co-locating segments are followed for Alternative G there would be no impacts to residential lands and no residential relocations, however it would still have the greatest impact to commercial land and the Park itself. The analysis indicates that the residential relocations are similar for all of the northern alternatives if the Route 234 Bypass was extended as part of the No-Action Alternative.

An analysis of the General Management Plan that is being prepared for the MNBP also indicates that other enhancements may be incorporated if a Build Alternative is selected. If the roads are closed, the NPS would gain approximately 76 acres of additional parkland. In all alternatives under consideration for the GMP, additional pedestrian and bicycle trails would be constructed along the closed portions of Route 29 and 234, greatly enhancing the experience of the Park. In addition, as part of a re-foresting program, any noise and visual impacts of the Build Alternatives on the edges of the Park could be buffered. Most importantly, the removal of the congestion from within the center of the Park will enhance the ability of all visitors to access cultural resource sites within the Park. Closure of the roads will remove a visually intrusive and noisy barrier that divides the Park into four quadrants and allow the Park to better achieve its' mission.

4.24.5 Natural Resources - Secondary and Cumulative Effects

Secondary and cumulative impacts have the potential to affect the landscapes and wildlife of the study area. Secondary impacts are the sum of the indirect impacts of the Build Alternatives combined with the impacts of induced development (i.e., development that is dependent on the construction of the proposed facility). The preceding discussion of secondary socioeconomic impacts served as the foundation upon which secondary impacts to natural resources have been based. Secondary impacts to natural resources are primarily reflected in:

- The induced development affecting impervious surface coverage within watersheds,
- The induced development interacting with wetlands and streams, and
- The induced development altering forest cover.

Cumulative impacts consider the incremental impact of the Alternative's direct and secondary impacts when they are added to the anticipated effects of all other planned and reasonably foreseeable major actions, including both public and private developments. This cumulative impact analysis therefore compares the No-Action Alternative impacts with the combination of direct impacts attributable to the Alternatives and the impacts derived in the secondary impact analysis. The No-Action Alternative includes all of the planned development within the study area that is anticipated to occur regardless of whether any bypass is constructed. Both direct and indirect impacts of the No-Action Alternative are accounted for in the cumulative impact analysis.

As noted in the analysis for socioeconomic resources the Build Alternatives are projected to have little influence on secondary development within the study area. Growth would occur within the Upper Bull Run / Little Bull Run subwatershed, and the Cub Run and Broad Run/Kettle Run watersheds with or without the closure of Routes 29 and 234. As noted previously, in the No-Action Alternative development is projected to occur within all of the watersheds in the study area. In the geographic areas that border the Park, this growth is projected to be minimal, with an increase of 588 single family homes in all of the zones immediately located around the Park from 2000 to 2025. This rate of growth is consistent with the rural preservation goals adopted by the localities. In addition, about 1,500 new jobs are anticipated to occur in the previously developed business park and commercial area along Business Route 234 just south of the Park. Other concentrations of

growth are projects in Haymarket, Gainesville, south of I-66 and north of the primary study area along Route 50 in Loudoun County.

As a result of this projected growth in the No-Action alternative, there would be additional impervious surface coverage in the study area. Such urbanization generally increases concentrations of non-point source pollutants in almost all categories associated with higher degrees of development and impervious surfaces. An increase in impervious surface, however, does not necessarily result in an increase in siltation or pollutants. With Best Management Practice (BMP) infrastructure in place, the downstream effects on water quality are mitigated to a great extent. Pollutants, including grease and oil, metals, nitrogen, and total suspended solids, are trapped and sequestered in stormwater basins for a short period, and eventually are trapped by bottom-settled sediments. BMPs may also offset increases in peak stormwater flows that would otherwise result from increases in impervious surface. Implementing BMPs for the periodical maintenance of control structures and dredging of stormwater basins is now a requisite activity that also improves and maintains water quality by reducing concentrations of harmful pollutants. As a result of BMP implementation, new construction has the potential to improve water quality.

Stormwater runoff delivers sediment and highway pollutants to streams and other surface waters, resulting in the secondary impact of water quality degradation. Accumulation of pollutants on highway pavement, medians, and adjoining rights-of-way occurs as a result of highway operation and maintenance and the aerial deposition of pollutants from other human-made sources. The effects of highway runoff on streams and other surface waters are variable and depend on the following factors: the time lapse between storm events, the loading of pollutants in the stormwater runoff, the volume of stormwater runoff, the volume of stream flow, the duration of the storm event, and traffic volume (Charbeneau, et al. 1993). Few substantial water quality effects are apparent from highway stormwater runoff for highways with less than 30,000 ADT (Dupuis, et al. 1984). Toxic effects, however, occur on and are limited to urban facilities with traffic greater than 50,000 ADT (Maestri, et al. 1981). These volumes are not projected on any of the sections of the Build Alternatives, including the co-located segments under analysis.

Secondary impacts to wetlands and streams may involve changing vegetation communities, erosion and sediment deposition, and/or altering water regimes and water quality. These impacts may result from road construction, long-term roadway operation, and/or induced development. The majority of secondary impacts anticipated would be temporary in nature. In addition, the severity of a majority of these impacts could be mitigated through BMPs including:

- Not using wetlands outside the construction limits for construction support activities (e.g., borrow sites, waste sites, storage, parking access, etc.).
- Placing heavy equipment working in wetlands on mats.
- Limiting wetland vegetation clearance to the minimum required for job completion.
- Protecting wetland water quality through erosion and sedimentation control practices.
- Locating stormwater facilities in a manner consistent with minimizing wetland impacts.

Federal, State, and local land use and resource protection plans would serve to minimize the potential effects of construction and induced development on water quality. The federal Clean Water Act serves to keep stream

impacts to a minimum level and the Chesapeake Bay Preservation Act serves to protect tributaries from degradation. Local land use plan features also serve to protect water quality.

Secondary effects to forest habitat would occur as a result of private residential and commercial development, as well as public projects. Although there is some loss of forest due to the proposed development, this will be minimized by the large lot restrictions in place for the rural crescent that surrounds the Park. In addition, most of the growth that is projected is located in previously approved growth centers along I-66 and Route 50 primarily. No forest fragmentation or edge effects are currently anticipated as a result of secondary development. In addition, as part of the update of the General Management Plan for MNBP, the NPS

Table 4-42 shows the co-location effects of the various other projects in the study area on natural resources assessed.

TABLE 4-42: CO-LOCATION EFFECTS TO NATURAL RESOURCES

	Alternative	Impacts of Full Alternative - No TCP or Route 234 Bypass North	Reduction in Impacts Due to TCP East of Park	Reduction in Impacts Due to TCP West of MNBP on 234 Bypass Alignment	Impacts Unique to Bypass If Both TCP and 234 Bypass Constructed
Total Length of Streams within Cut-Fill Limits (linear feet)	Alternative A	6200	2981	930	2289
	Alternative B	5147	1300	2854	993
	Alternative C	5866	670	930	4266
	Alternative D	4572	670	2854	1048
	Alternative G	6195	1301	2854	2040
Major Stream Crossings	Alternative A	2	0	0	2
	Alternative B	1	0	0	1
	Alternative C	4	0	0	4
	Alternative D	3	0	0	3
	Alternative G	1	0	0	1
Acres of 100-Year Floodplain within Corridor (acres)	Alternative A	18.67	7.8	0	10.9
	Alternative B	17.25	7.7	3.5	6.1
	Alternative C	29.3	0	0	29.3
	Alternative D	30.88	0	3.6	27.3
	Alternative G	10.18	3.5	3.6	3.1

TABLE 4-42: CO-LOCATION EFFECTS TO NATURAL RESOURCES

	Alternative	Impacts of Full Alternative - No TCP or Route 234 Bypass North	Reduction in Impacts Due to TCP East of Park	Reduction in Impacts Due to TCP West of MNBP on 234 Bypass Alignment	Impacts Unique to Bypass If Both TCP and 234 Bypass Constructed
Acreage of RPA Impacted (acres)	Alternative A	13.5	8.9	0	4.6
	Alternative B	15.1	8.7	2.7	3.6
	Alternative C	18.1	0	0	18.1
	Alternative D	22.5	0	2.7	19.8
	Alternative G	4.7	0.7	2.7	1.3
Prime and Unique Soils (acres)	Alternative A	40.8	6.1	14.8	19.9
	Alternative B	54.3	10.6	36.6	7.1
	Alternative C	46.2	0	14.8	31.4
	Alternative D	57.1	0	36.6	20.6
	Alternative G	43.5	0.6	35.6	7.2

4.24.6 Mitigation

In the Commonwealth of Virginia, mitigation for secondary and cumulative impacts is generally at the discretion of the local jurisdictions, which have land use authority. In addition, there are a variety of mitigation measures under consideration for this DEIS. These include context sensitive design elements such as habitat underpasses and equestrian trails, the use of landscape buffers, provision of bicycle and pedestrian trails, and water resource protection measures such as bridging of all river crossings.

4.25 CONSTRUCTION IMPACTS

Construction impacts are short-term environmental effects resulting from the process of building the project. Construction impacts can involve temporary changes in land use and community access, water quality, air quality, and noise levels.

4.25.1 Land Use and Access

Access to businesses could be temporarily disrupted at interchanges and cross roads due to temporary detours that are necessary to allow ample space for staging and construction. These temporary disruptions are unavoidable and will be minimized to the extent possible by carefully planning maintenance of traffic provisions and incorporating them into the design plans. This is most notable impacts would be within Battleview Business Park in Alternative G. Since this area of the existing roadway would be reconfigured, access to the

parking facilities for the businesses as well as traffic flow through the intersection at Route 234 would be disrupted by temporary changes needed for construction of the project.

In addition to those specific impacts associated with Alternative G, each of the alternatives is likely to impact access to The Park as well as the private inholdings within The Park. These impacts will be unavoidable results of detours in the vicinity of The Park and will be temporary and minimized to the extent possible.

4.25.2 Wildlife and Habitat

Temporary impacts to wildlife are related to the displacement of vegetated cover within the construction footprint of the selected build alternative. The mechanical removal of cover will cause animal migration away from the disturbance, resulting in a temporary decrease in habitat usage by edge-dwelling species. Construction activities may also cause direct mortality of wildlife unable to escape construction equipment. Opportunistic plant species are likely to have a greater competitive advantage during early construction activity, so temporary impacts could also be associated with slope stabilization effects that could temporarily reduce wildlife usage and foraging behaviors in disturbed areas.

4.25.3 Water Quality and Wetlands

Short-term water quality impacts may result from erosion following ground disturbance and earthmoving operations. After entering streams, the eroded material may increase turbidity levels and sedimentation downstream. Excessive quantities of suspended solids can harm fish and other aquatic life. Deposition of suspended solids may alter the substrate of streambeds, interfere with plant production and fish spawning, smother benthic fauna, and reduce substrate utilization. Eroded material may also contain organic matter and nutrients, such as nitrogen and phosphorus. High inputs of organic matter may result in an increase in biochemical oxygen demand, decreasing dissolved oxygen concentrations. Additionally, inputs of nutrients can increase both turbidity and eutrophication by increasing algae production. Erosion and sediment control measures will be implemented to minimize water quality impacts from increased levels of sedimentation and turbidity. Control measures may include berms, dikes, sediment basins, fiber mats, straw silt barriers, netting, mulch, temporary and permanent seeding, and other methods. Construction impacts to in-stream aquatic habitats may be minimized to the extent practicable by avoiding stream relocations and by crossing streams at right angles. To the extent possible, construction equipment will be restricted from fording and otherwise disrupting in-stream habitats.

4.25.4 Groundwater

Erosion and sediment controls would be implemented to minimize water quality impacts in accordance with the Virginia Pollutant Discharge Elimination System (VPDES) Permit Regulation (9 VAC 25-31-10 *et seq*.), and *Virginia Erosion and Sediment Control Handbook*. Control measures may include berms, dikes, grass swales, bioretention filters, sediment basins, fiber mats, straw silt barriers, netting, mulch, temporary and permanent seeding, and other methods. Construction impacts to in-stream aquatic habitats may be minimized to the extent practicable by avoiding stream relocations and by perpendicular crossings.

In accordance with the *Virginia Stormwater Management Handbook*, temporary and permanent stormwater management measures, including detention basins, vegetative controls, and other measures, would also be implemented on this project to minimize potential degradation of water quality. These measures would reduce or detain discharge volumes and remove pollutants. The requirements and special conditions of any required permits for work in and around surface waters would be incorporated into construction contract documents.

The construction contractor would be required to comply with those conditions and with pollution control measures specified in the approved construction plans.

Therefore, it is not likely that construction impacts using best management practices will impact a majority of groundwater well resources in the Fairfax portion of the study area. Particular construction management mitigation emphasis may be placed on any construction impacts occurring in low relief areas (stream valleys) where groundwater may be present at shallow depths below the surface. It is expected that geotechnical boring bogs will be studied in detail to determine the depth of subsurface water tables. Except within low relief areas along streams and other water bodies, water tables are generally going to be found at depths commensurate with the lowest depths of construction excavation. Therefore, little, if any, impacts are anticipated to groundwater resources at construction and excavation sites so long as their placement is not coincident with a large and potentially unstable shear zone.

The pollutant retention and neutralization potential of longer-term retention basins can be further enhanced by the biofiltration potential of vegetated swales and natural and constructed wetlands and basins. Vegetated filter strips are also effective in removing sediment, nitrogen and phosphorus before these constituents enter groundwater supplies. Forested riparian buffer strips are the most effective type, primarily because they remove much of the nitrate in groundwater before it enters receiving waters, and they provide for other simultaneous ecological services. Slope, soil and grass type and density are major factors in efficacy of grassed swales, and institutional researchers are leaders in BMP technology testing for transportation and agricultural land uses. Many of these BMPs could be designed on any Candidate Build Alternative, and could be implemented in construction plans for the Selected Alternative.

4.25.5 Air Quality

Construction impacts on air quality include exhaust emissions from construction equipment and dust generated by construction activities on disturbed earth. These impacts will be minimized by enforcement of construction specifications and adherence to VDEQ regulations.

The Virginia Department of Transportation's *Road and Bridge Specifications* regulate construction procedures on all projects. The *Specifications* require the contractor to comply with all applicable local, state, and federal laws, ordinances, regulations, orders, and decrees. This includes compliance with emissions standards for construction equipment and adherence to regulations for burning of materials from clearing and grubbing, demolition, or other operations. The *Specifications* were reviewed by the Virginia Department of Environmental Quality and were found to conform to the SIP. The *Specifications* prohibit burning of tires, asphalt materials, used crankcase oil, or similar materials that produce dense smoke. Provisions will be included in the contract for preventing dust from becoming airborne.

4.25.6 Noise

Noise receptors that would be sensitive to highway traffic noise would also be sensitive to noise from construction equipment while the project is being built. To minimize the effects of construction noise, the Virginia Department of Transportation's *Road and Bridge Specifications* contain noise control provisions, which include the following:

- Equipment shall in no way be altered so as to result in noise levels which are greater than those produced by the original equipment.

- The contractor's operations shall be performed such that the exterior noise levels measured at a noise-sensitive activity shall not exceed 80 dBA during periods of such activity.
- The Department reserves the right to prohibit or restrict to certain portions of the project any work that produces objectionable noise during normal sleeping hours, 10 p.m. to 6 a.m., unless other hours are established by local ordinance, in which case the local ordinance shall govern.

4.26 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Local short-term uses of the environment principally include the construction impacts described in Section 4.24 and the resources used in the construction of the proposed improvements, including materials, energy, and labor. The short-term environmental impacts and use of resources must be balanced against the long-term benefits of the project, both locally and regionally. Each of the Candidate Build Alternatives would provide long-term benefits, including improving transportation performance and park operations. The local short-term impacts and use of resources for the project are consistent with the maintenance and enhancement of long-term productivity.

4.27 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The implementation any of the Candidate Build Alternatives would require the commitment of natural, physical, human, and fiscal resources. Land used in the construction of the roadways is considered an irreversible commitment during the time period that the land is used for highway facilities. However, if a greater need arises for use of the land or if the roadways are no longer needed, the land can be converted to another use. At present, there is no reason to believe such a conversion will ever be necessary or desirable.

Considerable amounts of fossil fuels, labor, and highway construction materials, such as cement, aggregate, asphalt, and steel, would be expended. Additionally, large amounts of labor and natural resources would be used in the fabrication and preparation of construction materials. These materials are generally not retrievable; however, they are not in short supply and their use would not have an adverse effect on the continued availability of these resources. Any construction would also require a substantial one-time expenditure of local, state, and federal funds that are not retrievable.

The commitment of these resources is based on the concept that residents in the immediate area and the region will benefit from the improved quality of the transportation system and operations within the Manassas National Battlefield Park. These benefits would consist of improved accessibility and safety, timesavings, and enhancement of the Manassas NBP, which are anticipated to outweigh the commitment of these resources.