AN OVERVIEW OF WETLAND IMPACTS AND MITIGATION IN NORTHERN VIRGINIA

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ABSTRACT

Review of the wetland permit program in northern Virginia provides insight into the process of achieving "no net loss" of existing acreage and functions by the Virginia Water Protection Permit (VWPP) Program as administered by the Virginia Department of Environmental Quality (DEQ). This program was developed to protect wetlands and streams through permitting impacts and requiring compensation for those permitted impacts. An overview of wetland impacts and wetland mitigation as administered by DEQ Northern Virginia Regional Office (NVRO) provides a representative look at how wetland impacts and mitigation are handled in Virginia. Based upon the analysis of NVRO permitted wetland impacts and accepted compensation from 2000 to 2004, it appears NVRO is achieving the goal of "no net loss" in terms of acreage. In terms of functions, the analysis indicates that "no net loss" is potentially not being met. More research needs to be conducted to fully understand how to evaluate and quantify "no net loss" of functions and how certain types of mitigation options affect adequate compensation for lost functions. Until a standard is accepted for quantifying the quality of wetlands, it will be difficult to assess and therefore determine if "no net loss" of functions is being attained in Virginia.

DEDICATION

To Michael, for all the love and support you have shown me throughout this process.

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LISTS OF MULTIMEDIA OBJECTS

ABBREVIATIONS

Corps – U.S. Army Corps of Engineers

CWA – Clean Water Act

DEQ – Virginia Department of Environmental Quality

NVRO - Virginia Department of Environmental Quality, Northern Virginia Regional Office

NPR – No Permit Required

NWP – Nationwide Permit

PEM wetland – Palustrine Emergent Wetland

PFO wetland – Palustrine Forested Wetland

PSS wetland – Palustrine Scrub-Shrub Wetland

SPGP-01 - State Program General Permit

SWANCC - Solid Waste Agency of Northern Cook County

TNC - The Nature Conservancy

VAC – Virginia Administrative Code

VIMS – Virginia Institute of Marine Science

VWPP Program - Virginia Water Protection Permit Program

WP1 – Water Protection Permit One

WP2 – Water Protection Permit Two

WP3 – Water Protection Permit Three

WP4 – Water Protection Permit Four

1.0 INTRODUCTION

Review of the wetland permit program in northern Virginia provides insight into the process of achieving the "no net loss" goal of the Virginia Water Protection Permit (VWPP) Program as administered by the Virginia Department of Environmental Quality (DEQ). This program was developed to protect wetlands and streams through permitting the proposed impacts and requiring compensation for those permitted impacts. The statutory purpose of the program is to "ensure no net loss of wetlands through permitted impacts and to ensure that permits are only issued if the State Water Control Board determines that the cumulative impacts will not cause or contribute to a significant impairment of state waters or fish and wildlife resources" (Lawson 2004). The effectiveness of DEQ to implement the program determines the level of protection of Virginia's wetlands and streams. For permitted impacts to stream and wetlands, compensation must be provided to meet the goal of "no net loss." An overview of permitted impacts and accepted mitigation provides a benchmark for how well DEQ is implementing the program.

In Virginia, DEQ's 7 regional offices administer the VWPP Program within each office's respective region. The focus of this paper is solely on the wetland aspect of the VWPP Program and how the DEQ Northern Virginia Regional Office (NVRO) administers this program. NVRO administers the program in 14 counties and 6 cities (Figure 1).

The NVRO region portrays a representative picture of the overall VWPP Program in terms of permitting development activities since the region encompasses the largest population growth in Virginia. From 2000 to 2004, the northern Virginia region experienced a 12% population growth rate (UVA 2005).

The three counties with the highest population growth in Virginia during this same timeframe were in NVRO's region: Loudoun County (43%), Stafford County (24%) and Spotsylvania County (23%). While the region only encompasses 12.5% of all land in Virginia, it has 31% of the state's population. The population density in this region is 420.6 persons per square mile of land area versus 141.7 persons per square mile of land area in the rest of Virginia (excluding the localities within NVRO's jurisdiction) (UVA 2005). As population growth increases, so does development to provide infrastructure for the increased population. Due to the growth in this region, an analysis of the VWPP Program as administered by NVRO, provides an understanding of the statewide program in terms of permitting development activities.

Courtesy of DEQ, 2004 (DEQ 2004b).

Counties: Arlington, Caroline, Culpeper, Fairfax, Fauquier, King George, Loudoun, Louisa, Madison, Orange, Prince William, Rappahannock, Spotsylvania and Stafford.
Cities: Alexandria, Fairfax, Falls Church, Fredericksburg, Manassas and Manassas Park.

FIGURE 1. COUNTIES WITHIN NVRO'S REGION

2.0 THE VIRGINIA WATER PROTECTION PERMIT PROGRAM

2.1 Regulatory History of the Program

Legislation passed in May 1992 initiated Virginia's wetlands and streams protections program known as the VWPP Program. The Program's regulatory authority is granted from Section 401 of the federal Clean Water Act (CWA) and the State Water Control Law (*Code of Virginia* §§62.1-44.15 and 62.1-44.15J). Section 401 of the CWA requires that applicants seeking a federal permit to discharge fill into a wetland (Section 404 permit) must also obtain approval from the state, known as a 401 Certification. Section 404 solely regulates the discharge of fill or dredge material into waters of the United States. Virginia's law originally only allowed DEQ to regulate wetlands "…to the extent necessary to carry out its responsibility under § 401 of the Clean Water Act" (Earley 1999). Virginia could only permit discharge or dredge activities in wetlands if the United States Army Corps of Engineers (Corps) also took action upon the activity. In Virginia from 1992 to 2000 under the state's 401 certification procedures, applicants were required to submit an application to the state. DEQ could either issue a permit, waive the requirement to obtain a state permit, issue a letter stating, "no permit required," otherwise known as NPR, or deny the application for a permit (DEQ 2004c).

In July 2000, the Virginia General Assembly amended §62.1-44.15 *et seq.* of the *Code of the Virginia* to expand the VWPP Program and reduce its dependence upon the Corps wetland and stream permit program, as governed by Section 404. The three key items of the amendments were (DEQ 2003):

1. Regulation of excavation in wetlands,
2. Regulation of filling or dumping, permanent flooding or impounding or new activities that cause significant alteration or degradation of existing wetland (including isolated wetlands) acreage or function, and
3. An increase in the individual permit term from five years to the length of the project, not to exceed 15 years.

The expansion of the VWPP Program's authority in permitting impacts to wetlands came at an opportune time. In October 2000, U.S. Supreme Court heard arguments in the Solid Waste Agency of Northern Cook County v. Army Corps of Engineers (531 U.S. 159, 2001), more commonly known as the "SWANCC" case. The case involved a question about whether the Corps' has authority to regulate

isolated, intrastate wetlands under CWA. The Corps argued that it had authority to regulate these wetlands because the Commerce Clause (Tenth Amendment) of the Constitution gives Congress authority to regulate interstate and foreign commerce (Kusler 2003). The Corps stated that the reason the Commerce clause applies to isolated, intrastate wetlands is that migratory birds, which fly intrastate, use the wetlands (Ducks Unlimited 2001). In a five to four decision in favor of SWANCC, the Supreme Court decided that Section 404 of the CWA does not provide authority for the Corps to regulate isolated, intrastate wetlands. As a result of this ruling, state wetland permit programs, such as Virginia's, could exert jurisdiction over these wetlands without interference from the Corps.

The U.S. Supreme Court's ruling and the change in Virginia's regulations, allows the state to provide more protection independent of the federal government over isolated, intrastate wetlands. In addition, overall protection for wetlands is increased because both Virginia and the Corps require permits to impact wetlands and streams. As a result of these changes, the VWPP Program has developed into its current program.

2.2 The Current Program

In addition to expanding the breadth of permitted activities in wetlands, the 2000 legislation also expedited the VWPP Program's permit process. The General Assembly directed DEQ to develop a general permit program for projects proposing minimal impacts. As a result, today's VWPP Program consists of several permitting actions.

The activity and cumulative size of proposed impacts typically dictates the permit type an applicant can apply for under the VWPP Program. Upon review of the application, the agency can either issue an individual permit, authorize the use of the general permit, chose to take no action by issuing a letter stating "no permit required" (NPR) from DEQ or deny the application. The NPR action is available if the Virginia Marine Resources Commission (VMRC) asserts jurisdiction,[1] the application qualifies for Nationwide Permit (NWP) from the Corps, or no impacts to streams or wetlands are anticipated. NPR allows DEQ to not require a permit if the agency feels the VWP permit will duplicate the permitting effort of the VMRC and/or Corps. Conditions are placed upon certain NWPs to ensure VWPP regulations (such

[1] VMRC generally only asserts jurisdiction for projects in a watershed greater than five square miles or in tidal areas.

as impact thresholds for VWPP general permits) are not by-passed. NWP are general permits issued by the Corps for a variety of activities and pre-approved by Virginia by granting each 401 certification, conditional and unconditional. If the applicant qualifies for the NWP and meets the conditions of the 401 certification (if applicable), the applicant is not under obligation to notify DEQ (DEQ 2004c).

The focus of this paper is individual and general permits issued by the DEQ. The general distinction between the two types of permits is based upon permit threshold. An applicant qualifies for an individual permit if the impacts are greater than 2 acres (including the area of all temporary and permanent impacts), more than 500 linear feet of perennial stream channel or more than 1500 linear feet of intermittent stream channel (DEQ 2004c). The Virginia Administrative Code (VAC)[2] provides circumstances, such as when the activity may contribute significantly to pollution or upon the applicant's request, when the project can be elevated for processing under the individual permit regardless of the anticipated project impacts (9 VAC 25-210-130).

The purpose behind the general permit portion of the VWPP Program is to streamline the permitting process for projects with small wetland impacts (DEQ 2004c). Thus, projects with total impacts less than 2 acres, less than 500 linear feet of perennial stream or less than 1500 linear feet of intermittent stream, may qualify for authorization under a general permit (DEQ 2004c). The text of each general permit is written in the VAC and has been through the public review process, so no additional public notice is required for the authorization of a specific project under a general permit.

There are four activity specific categories of general permits, known as Water Protection One (WP1) Permit, Water Protection Two (WP2) Permit, Water Protection Three (WP3) Permit and Water Protection Four (WP4) Permit. Each type has slightly different impact thresholds designed for different project activities (Table 1).

The process is streamlined further for the applicant when the proposed project anticipates permanent impacts less than 0.10 acre. This is known as a "reporting only" application. In this situation, the application is processed similarly to an application for a general permit with impacts greater than 0.10

[2] The Virginia Administrative Code (VAC) contains the regulations of the VWPP Program.

TABLE 1. CATEGORIES OF THE VWPP PROGRAM GENERAL PERMIT

NAME	ACTIVITY TYPE	WETLANDS		STREAMS [1]		SECTION OF VAC
		MINIMUM THRESHOLD (ACRES)	MAXIMUM THRESHOLD (ACRES)	PERENNIAL MAXIMUM THRESHOLD (LINEAR FEET)	INTERMITTENT MAXIMUM THRESHOLD (LINEAR FEET)	
WP1	Not activity specific	0	0.5	125	1500	9 VAC 25-660-30
WP2	Utility Related	0	1	500	1500	9 VAC 25-670-30
WP3	Linear Transportation	0	2	500	1500	9 VAC 25-680-30
WP4	Development Activities	0	2	500	1500	9 VAC 25-690-30

Note:
(1) Streams only have a maximum threshold.

acre, but the applicant does not pay an application fee, and he or she is not required to provide compensatory mitigation or conduct construction monitoring (DEQ 2004c). However, the applicant is required to comply with the conditions of the general permit (Parts I and III) that pertain to aspects other than mitigation or monitoring. When an application is determined to be within the reporting only category of the general permits and the application review process is complete, DEQ issues a letter attesting to the "reporting only" status. These projects are allowed to forgo mitigation because the proposed small impacts are anticipated to have minimal adverse effects both individually and cumulatively on the environment.

2.3 Coordination with the Corps Wetland Permit Program

The 2000 legislation passed by the Virginia General Assembly directed DEQ to seek a general permit from the Corps to more efficiently use the resources of each agency (DEQ 2004c). The Corps Norfolk Regional District (Corps – Norfolk District) issued DEQ a State Program General Permit (SPGP-01), effective November 1, 2002, coordinating the permitting process between the two agencies for proposed projects that met certain thresholds and activity types. Once the SPGP-01 program was initiated, the Corps – Norfolk District withdrew two Nationwide Permits that permitted similar activities: Number 14 (Linear Transportation Projects) and Number 39 (Residential, Commercial and Institutional Developments). These actions gave DEQ the authority to issue permits on the Corps' behalf for impacts to wetlands that qualified for the SPGP-01 by activity and impact threshold (Corps 2003a).

DEQ coordinates with the Corps prior to issuing the SPGP-01 to obtain confirmation that the project qualifies for SPGP-01. The Corps determination is based upon project activity type, total impacts and database searches conducted for threatened and endangered species and historic resources on the project site. If the project falls into the appropriate activity category and thresholds and the database searches show no occurrences of either resource type on-site, then the Corps provides DEQ with confirmation that the project qualifies for SPGP-01. DEQ does not initiate coordination with the Corps if the project automatically does not qualify for SPGP-01 because it falls under for Activity 1, Category C within the SPGP-01 or if stream impacts are greater than 300 linear feet. In either case, or if the Corps finds occurrences of historic or threatened and endangered resources on-site, then both DEQ and Corps

will separately issue a permit on the proposed project. Below in Table 2, are impact and activity requirements for a project to be considered under SPGP-01 (Corps 2003a):

3.0 MITIGATION OF PERMITTED WETLAND IMPACTS

Mitigation is a three-tiered approach that involves avoidance, minimization and compensation for unavoidable impacts (DEQ 2004a). The VWPP regulations define mitigation as "…sequentially avoiding and minimizing impacts to the extent practicable, and then compensating for remaining unavoidable impacts of the proposed action" (9 VAC 25-210-10). The applicant is responsible for demonstrating in the application that the proposed impacts are unavoidable and are the "least environmentally damaging practical alternative" to obtain the overall project purpose (Lawson 2004). Once DEQ determines the applicant has avoided and minimized impacts to wetlands to the greatest degree reasonable, the applicant's proposed compensatory mitigation is reviewed.

3.1 The Goal of Compensatory Mitigation for Permitted Wetland Impacts

In terms of compensatory mitigation requirements, the goal for the VWPP Program is to "…achieve no net loss of existing wetlands acreage and functions…" (*Code of Virginia* §62.1-44.15:15D). One of the methods used to achieve "no net loss" of acreage and function is the establishment of mitigation to loss ratios for each Cowardin classification of wetlands located in Virginia (9 VAC 25-690-70, Cowardin et al. 1979). For the general permit, these ratios are set forth in the permit regulations for each type of wetland. These ratios are used as guidance for individual permits, although flexibility is allowed as long as there is "no net loss" of wetlands. The ratios are (9 VAC 25-690-70):

- Palustrine forested (PFO) wetland impacts: 2:1
- Palustrine scrub-shrub (PSS) wetland impacts: 1.5:1
- Palustrine emergent (PEM) wetland impacts: 1:1
- Conversion of PFO wetland to PEM wetland impacts: 1:1

If the applicant proposed to impact 1 acre of PFO wetland, then mitigation must be provided in the form of 2 acres of wetlands, preferably as in-kind mitigation, meaning in the form of 2 acres of PFO

TABLE 2. CATEGORIES OF THE STATE PROGRAM GENERAL PERMIT (SPGP-01)

CATEGORY	SUBCATEGORY	WETLANDS		STREAMS [1]
		MINIMUM THRESHOLD (ACRES)	MAXIMUM THRESHOLD (ACRES)	MAXIMUM THRESHOLD (LINEAR FEET)
Activity 1. Residential, Commercial and Insitutional Development Activities				
	Category A	0	0.1	300
	Category B	0.1	0.5	300
	Category C	0.5	1	2000
Activity 2. Linear Transportation Projects				
	Category A	0	0.1	No Limit
	Category B	0.1	0.33	No Limit

Note:
(1) SPGP-01 thresholds for stream impacts are not differenitated by type of stream (i.e. perennial or intermittent).

wetland. The difference in the ratios is indicative of the time required to replace that particular type of wetland and therefore its functions (9 VAC 25-210-115.C). For instance, PEM wetlands can regenerate quicker after being impacted or created because it consists of herbaceous plants, which typically grow faster than woody plants, such as trees. However, because PFO wetlands consists of trees adapted to wet conditions, a longer timeframe is required before this form of wetland, and therefore its functions are reestablished. Additionally, the ratio implies that DEQ places more value on one type of wetland over another. The conversion of PFO wetland to PEM wetland refers to a forested wetland altered to emergent wetland as a result of an impact. Since a wetland is still present after the impact occurs but wetland type dependent functions are altered or lost, a ratio of 1:1 is used to mitigate this form of impact.

Individual permits have more flexibility in the ratios used, but in general, the above ratios are used in compensatory mitigation and will be used as the standard for this analysis. The mitigation to loss ratios stated above are not the same for WP1 permit. An evaluation of possible on-site mitigation is not required for this category of general permit. Therefore, the mitigation to loss ratio of 2:1 for all wetland types is required (9 VAC 25-660).

3.2 Types of Compensatory Mitigation for Wetland Impacts

There are several forms of mitigation that may be used in compensating for wetland impacts. These are (DEQ 2004a):

- Wetland creation or restoration or enhancement
- Purchase or use of wetland mitigation bank credits at an approved mitigation bank
- Contribution to an approved in-lieu fee fund
- Preservation of existing wetland and upland buffers adjacent to wetlands, when utilized in conjunction with creation, restoration or bank credits

DEQ mitigation preferences are: restoration, creation, mitigation banking and in-lieu fee fund. In addition, DEQ values on-site mitigation over off-site mitigation (9 VAC 25-210-115). On-site mitigation refers to mitigation that occurs within the project limits of the permitted activity. This is valued more because lost acreage and functions are restored and/or preserved in the vicinity of where the impacts

occurred. However, on-site mitigation is not always possible due to constraints such as size of the project site and environmental conditions. Therefore, off-site mitigation options are also available.

Off-site mitigation can be in the form of creation, restoration, enhancement, or preservation on property outside of the project limits for which the applicant is seeking a permit. The land may be owned by the applicant or by a third party (DEQ 2004c). Off-site mitigation also includes the purchase of wetland mitigation bank credits or an in-lieu fee contribution to an approved trust fund.[3] The applicant may propose to use one or a combination of available forms of mitigation, both on-site and/or off-site, to fulfill the compensatory mitigation requirements of the project.

Off-site mitigation must be performed within the same hydrologic unit code (HUC) or an adjacent HUC within the same watershed (i.e. Potomac River, York River or Rappahannock River) as the project site (*Code of Virginia* § 62.1-44.15:5). Therefore, impacts occurring in northern Virginia could not be mitigated through a project located in southwestern Virginia. This requirement helps to ensure that acreage and functions are replaced within the same watershed as the impact site.

Additionally, there is flexibility to allow out-of-kind compensation on a case-by-case basis. For example, a mitigation proposal may include on-site creation to compensate for impacts to PFO wetlands and PEM wetlands. However, due to environmental constraints of the site where the on-site creation is proposed, it is only possible to create PFO wetlands. Therefore, the mitigation requirements for PEM wetland impacts may be compensated out-of-kind through the creation of PFO wetlands. Out-of-kind compensation may also include accepting wetland mitigation for stream impacts.[4]

3.3 Wetland Mitigation Banks

Twelve wetland mitigation banks service the DEQ's northern Virginia region, of which two banks are used solely to mitigate for impacts from Virginia Department of Transportation (VDOT) projects (Davis 2005). A mitigation bank is formed when a bank sponsor restores, enhances, creates and/or preserves wetlands on a piece of land, thereby generating mitigation credits. The bank sponsor may then sell these mitigation credits to recover his or her investment, to an applicant who needs to compensate for project

[3] In this analysis, the term off-site will be used to include the following mitigation types: creation, restoration, preservation, and enhancement.

[4] Wetland mitigation provided out-of-kind for stream impacts was not included in this analysis.

impacts. Credits used to offset wetland impacts are then debited from the bank. The DEQ states the purpose of the mitigation banks are to "…replace the biological, chemical and physical functions of wetland resources by quantifying the replaced function as a 'credit,' which can be purchased by third parties to compensate ('debit') for unavoidable wetland losses" (DEQ 2004a).

The advantage of mitigation banks is that there is a greater likelihood of environmental success because multiple mitigation projects (typically small and fragmented) are combined into one larger project (Gardner 2000). Additionally, the compensation occurs in advance of the mitigation because certain steps (including initial physical and biological improvements completed no later than the first growing season) must be completed prior the debiting of credits. A limited amount of credit may be available immediately based upon a percentage of the total projected credit. However, allowing all credit projected at the bank's maturity to be sold would "undermine the environmental justification for mitigation banking" (FR 1995). The advantages of the mitigation banks are (DEQ 2004a):

- Larger sites with potentially increased functions and values
- Economies of scale for financial resources, long-term monitoring and maintenance
- Compensation occurs in advance of the impact
- Potentially reduces permit review timeframes

On the other hand, the disadvantage of mitigation banks is that larger mitigation projects do not ensure a functional ecosystem and therefore a valuable wetland. As with small mitigation projects, there is the possibility that a mitigation bank could fail (Gardner 2000). Additionally, mitigation banks are generally large land parcels located in rural areas. Therefore, it is arguable that it is more important to retain or create urban wetlands to provide functions and values associated with urban wetlands.

The appeal of mitigation banks to applicants is that there is no long-term commitment to satisfy this mitigation condition of the permit and therefore probably less expensive (Gardner 2000). Following DEQ's approval of the proposed compensation, the applicant quickly satisfies the mitigation requirement by purchasing the necessary amount of credit from the mitigation bank. Therefore, the applicant need not spend time or money for mitigation monitoring and possible failed efforts, leading to noncompliance of permit conditions.

3.4 In-Lieu Fee

The purpose of the in-lieu fee is to establish an additional means for the applicant to provide compensatory mitigation for wetland impacts while "maximizing the mitigation benefit to the aquatic environment and public interest" (Corps 2003b). In Virginia, an in-lieu fee has been available as a form of compensation since 1995 (Corps 2003b). The permittee contributes a fee (the amount determined by the Corps – Norfolk District based upon location and size of the impact and mitigation banks available) to an in-lieu fee sponsor instead of or in addition to, completing project-specific mitigation or purchasing credit from an approved wetland mitigation bank. The in-lieu fee sponsor is a non-governmental organization or a public natural resources agency. The sponsor collects the fees, which are then used as a cumulative fund to create or restore wetland or stream resources (DEQ 2004a). Therefore, the mitigation action occurs after impacts are taken.

There is one fund available in Virginia, known as the Virginia Aquatic Resources Trust Fund (Trust Fund). The Nature Conservancy (TNC) manages this Trust Fund, which was approved in December 2001. As the in-lieu fee sponsor, TNC is tasked to use the fund to "restore and preserve as many aquatic resources, buffers and other beneficial lands in their natural condition as possible" (Corps 2003b). The Corps – Norfolk District reviews and has final authority over projects proposed by TNC (DEQ 2004a). TNC has three years from the date of receipt to allocate the funds. After that time, the Corps – Norfolk District may direct the funds to any project or proposal of its choosing or allow TNC an extension of the time limit (Corps 2003b).

The appeal of the Trust Fund for applicants is similar to wetland mitigation banks in that concerns of ecological failure for on-site or off-site mitigation, particularly small mitigation projects, are alleviated. Additionally, the Trust Fund provides an alternative compensatory mitigation option in watersheds where there is an absence or insufficient supply of mitigation bank credits. Although for the northern Virginia region, this is generally not the case because there is a sufficient supply of banks and bank credits for wetlands impacts.

4.0 COMPARISON DATA REVIEW

Data was collected from two sources for an understanding of the wetland permit program throughout Virginia and for a comparison with the research data presented in this paper. The Virginia Institute of Marine Science (VIMS) compiled the first data set used for comparison. VIMS collected Corps permit data on both tidal and nontidal wetlands from 1993 to 2002. For the purpose of the comparison, only nontidal VIMS data was used.[5] The full range of nontidal wetland data was assessed in addition to years corresponding with the research data (2000 to 2002) (Table 3). The nontidal wetland data included impacts and compensation from all permits issued by the Corps – Norfolk District from 1993 to 2002 (VIMS 2002). The VIMS data does not provide the closest comparison with the research data because information on the VWPP Program was not collected by VIMS. However, the comparison does shed light on the amount of wetland impacts permitted by the Corps, mitigation the Corps received and provides a comparison between the VWPP Program and Corps wetland permit program.

The VIMS data reported total nontidal wetland impacts for all of Virginia from 1993 to 2002 totaled 2516.8 acres. For the timeframe from 2000 to 2002 that overlaps with the data compiled from NVRO for this paper, the total was 757.9 acres. Mitigation accepted by the Corps for all permits issued during this timeframe totaled 7103.8 acres during 1993 to 2002 and 2918.9 acres during 2000 to 2002 (VIMS 2002). For localities within NVRO's region, the VIMS data reported that 610.6 acres were impacted from 1993 to 2002 and 323.4 were impacted from 2000 to 2002. These impacts were mitigated with 1418.8 and 722.5 acres, respectively. VIMS data did not report the number of permits from which the data was obtained.

The SPGP-01 data, which covered all of Virginia, provided separate datasets from DEQ and Corps on the SPGP-01 Program. Of the permits issued by DEQ under SPGP-01, Activity 1 was the primary comparison because NVRO mostly permits projects with similar activities (residential, commercial and institutional activities). DEQ regional offices do not permit Virginia Department of Transportation (VDOT) projects, which typically fall under the linear transportation permit category (WP3 and therefore

[5] The research data contained only 0.17 acre of tidal wetlands permitted under one individual permit of the VWPP program. Therefore, the best comparison would occur through the use of the nontidal wetland data.

TABLE 3. U.S. ARMY CORPS OF ENGINEERS' NONTIDAL WETLAND DATA COMPILED BY THE VIRGINIA INSTITUTE OF MARINE SCIENCE (VIMS) [1,2]

YEAR ISSUED	LOCALITIES OF ISSUANCE [3]	IMPACTS TOTAL (ACRES)	MITIGATION [4] TOTAL (ACRES)
1993-2002	All in dataset	2,516.80	7,103.80
1993-2002	NVRO	610.6	1,418.80
2000-2002	All in dataset	757.9	2,918.90
2000-2002	NVRO	323.4	722.5

Notes:

(1) Data source: Virginia Institute of Marine Science Wetlands Program (2002). Virginia Nontidal Wet Impacts Data Home Page [Online]. Available: http://www.vims.edu/rmap/wetlands.

(2) The data reported by VIMS were collected from the U.S. Army Corps of Engineers (Corps) Norfolk District's wetland permitting program for nontidal wetland impacts and mitigation. All permits issued under this program were included.

(3) VIMS data provided nontidal wetland permit data on localities throughout Virginia. However, not all localities throughout the state or for NVRO, were listed.

(4) VIMS mitigation data included combined acres from on-site and off-site creation, enhancement, preservation, restoration, and wetland bank credits. Estimates for in-lieu fee were not included.

Activity 2 of SPGP-01). The Central Office of the DEQ in Richmond, Virginia permits VDOT projects (DEQ 2004c). Additionally, the SPGP-01, Activity 2 data were not used for comparison of number of permits issued because the data does not provide a distinction between wetland and stream impacts. It can be assumed that because total stream impacts permitted were 32,431 linear feet and wetland impacts were 3.5 acres, many of the permits were solely permitted for stream impacts (Corps 2004a, 2004b). As a result, an accurate number of permits issued for wetland impacts under SPGP-01 (both Activity 1 and 2) by the state, is not available for comparison. Due to these reasons, the analysis focused on the SPGP-01, Activity 1 data because this data corresponded with the majority of the research data.

The SPGP-01 data reported that DEQ issued 327 permits statewide under the SPGP-01, Activity 1 permit (Table 4). For those permits, a total of 65.2 acres were authorized with impacts distributed among 42.7 acres of PFO wetland, 4.3 acres of PSS wetland and 18.3 acres of PEM wetland. The mitigation accepted totaled 125.7 acres, with 98.7 acres of PFO wetland, 6.4 acres of PSS wetland and 20.6 acres of PEM wetland. Under SPGP-01, Activity 2, DEQ issued 881 permits for impacts to wetlands and streams. For permits issued under SPGP-01, Activity 2, a total of 3.5 wetland acres were authorized with impacts distributed among 1.6 acres of PFO wetland and 1.9 acres of PEM wetland. Mitigation received for these impacts totaled 4.1 acres, with 2.5 acres of PFO wetland and 1.6 acres of PEM wetland (Corps 2004a, 2004b).

5.0 RESEARCH DESIGN

5.1 The Objective

The purpose of this study was to analyze data compiled into a database to define VWPP Program activities in regard to wetland impact and mitigation, as administered by NVRO. Trends became apparent through the compilation of the information from VWPPs issued or authorized from 2000 to 2004, and the application of descriptive analysis. This information and analysis can support future studies on topics that investigate the success of wetland creation and the reason why this type of mitigation is chosen over the other forms. For this study, there were four hypotheses:

1. Permits to impact wetlands are most often sought for residential activities.

TABLE 4. U.S. ARMY CORPS OF ENGINEERS - NORFOLK DISTRICT STATE PROGRAM GENERAL PERMIT (SPGP-01) NONTIDAL WETLAND DATA [1]

PERMIT TYPE	NO. PERMITS ISSUED	IMPACTS				MITIGATION [2]			
		PFO (ACRES)	PSS (ACRES)	PEM (ACRES)	*TOTAL (ACRES)*	PFO (ACRES)	PSS (ACRES)	PEM (ACRES)	*TOTAL (ACRES)*
SPGP-01 Activity Type [3]									
1	327	42.7	4.3	18.3	***65.2***	98.7	6.4	20.6	***125.7***
2	881 [4]	1.6	0	1.9	***3.5***	2.5	0	1.6	***4.1***
Total	***1,208***	***44.3***	***4.3***	***20.2***	***68.7***	***101.2***	***6.4***	***22.2***	***129.8***

Notes:

(1) Data source: U.S. Army Corps of Engineers, Amended First Annual Review of the Norfolk District's State Progra February 2004; U.S. Army Corps of Engineers, Second Annual Review of the Norfolk District's State Program G December 2004.

(2) SPGP-01 data included combined acres from on-site and off-site creation, restoration, and wetland bank credits. were not included.

(3) SPGP-01 data from DEQ reported permits issued under SPGP-01 (Activity 1 and 2). Data for December 2003 a provided within the SPGP-01 Annual 1st and 2nd Reports.

(4) The permit number for projects permitted under SPGP-01 Activity 2 were not reported separately for wetland and stream impacts. Because wetland impacts in this category were small and the reported stream impacts were 32,431 linear feet of streambed, permits with wetlands impacts are probably significantly lower. Only seven individual projects proposed impacts over 300 linear feet of streambed.

2. The most frequently used form of wetland mitigation is the purchase of credits from wetland mitigation banks.
3. The amount of mitigation exceeds the amount of impacts permitted.
4. “No net loss” is maintained despite the mitigation exemption for projects with total permanent impacts less than 0.10 acre.

5.2 Data Source

Data were collected from permits issued or authorized by NVRO because the region is currently experiencing extensive and rapid development. The types of permits chosen for this study were individual permits and general permits. The subsection of general permits that do not require mitigation, known as reporting only general permits, were also included in this data in order to capture these impacts and investigate if the practice of not requiring mitigation for impacts less than 0.10 acre affect achieving the goal of “no net loss.”

The impacts reported to DEQ and upon which DEQ issued a NPR letter, were not included in the database. The Corps permits these impacts and therefore are not a part of the VWPP Program under review. Additionally, applicants are not required to notify DEQ of impacts satisfying NWP requirements and the conditional (if applicable) 401 certifications. Therefore, incorporating this type of information would create uncertainty in the data and would not accurately depict the VWPP Program under review.

Permits included in the database were those issued or authorized from 2000 to 2004. This timeframe was chosen because the VWPP Program was modified in 2000 to include the general permit portion of the program and initiated the mandate of “no net loss”. The inclusion of years prior to the 2000 legislation could skew the analysis because projects issued individual permits or projects that were waived, potentially could have qualified for general permits if the applications were submitted after the addition of the general permit program. Although the first general permit was not issued until 2001 (the general permit portion of the VWPP Program became effective October 1, 2001), the 2000 data was maintained to provide more data on individual permits. Two individual permits were issued in 2000, both with total impacts greater than the general permit threshold. However, it is possible that projects waived by DEQ in 2000, may have qualified for a general permit if submitted after October 1, 2001.

5.3 Variables Selected

To produce a picture of the wetland permit portion of the VWPP Program in NVRO, the following variables were selected for compilation and analysis:

1. Quantity (in acres) and type of wetland impacts
    a. PFO Wetland Impacts
    b. PSS Wetland Impacts
    c. PEM Wetland Impacts
    d. Conversion of PFO Wetland to PEM Wetland Impacts
2. Quantity (in acres) and type of mitigation accepted
    a. On-site Creation, Restoration, Preservation, Enhancement
    b. Off-Site Creation, Restoration, Preservation, Enhancement
    c. Mitigation Bank
    d. In-Lieu Fee (Trust Fund)
3. County of project location (Projects occurring within a locality such as townships, were included in the county where the locality is located.)
4. Permit Type
    a. Individual Permit
    b. General Permit (WP1, WP2, WP3, WP4)
    c. Reporting Only General Permit (WP1, WP2, WP3, WP4)
5. Project Type
    a. Commercial
    b. Industrial
    c. Residential
    d. Mixed (i.e. Residential and Commercial permitted under one permit)
    e. Municipal (i.e., schools, County/City projects)
    f. Recreational
    g. Road
    h. Other (i.e. Churches)

6. Year the permit was issued or authorized (2000 to 2004)

5.4 Data Compilation

In order to produce an adequate sample size, all permits issued within the selected timeframe from 2000-2004 were included in the database. Two systems were used to ensure all permits issued within the region were obtained. First, the Microsoft Access database used to track permits within NVRO was used as the initial compilation of permits issued from 2000 to 2004. Second, to ensure all permits were collected in the first method, electronic files were searched and compared to the list collected from the Microsoft Access database. Using the two system approach insured a permit was not overlooked despite possible human error.

Once a list of permits issued from 2000 to 2004 was compiled, cover pages of each permit were gathered to obtain the desired information. In instances when the permit cover pages did not provide complete information, permit files were accessed. This method of collecting data was repeated until the close of 2004.

To compare the research data with the data compiled by VIMS and the Corps, it was necessary to organize the research data in a way that facilitated the comparison. For comparison with the SPGP-01 data, the research data was compiled in terms of activities and thresholds that correspond with SPGP-01 categories. This meant that WP1 permits and WP4 permits with impacts less than 1 acre and authorized between 2002 and 2004, were sorted from the rest of the data to correspond with Activity 1. For comparison with Activity 2, WP2 permits were compiled that had less than 1 acre of impact and authorized between 2002 and 2004.[6] The SPGP-01 data were provided from November 1, 2002 (the effective date of the state permit) to November 1, 2004. Data for December 2003 and December 2004 were not reported (Corps 2004a, 2004b). Research data was provided from 2002 to 2004.[7]

Both of the comparison datasets (SPGP-01 and VIMS) provided mitigation accepted in acres. Included in the mitigation were creation, enhancement, preservation, restoration and wetland mitigation

[6] It is possible some permits included in the research data did not qualify for SPGP-01. Possible reasons why a permit might not have qualified for SPGP-01 were that the stream impacts were greater than 300 linear feet or there was a historic or threatened and endangered species issue on the project site.

[7] It is possible some permits were included in the research data that were not included in the SPGP-01 data because all of 2002 to 2004 data were included.

bank credits. The SPGP-01 mitigation data was further separated by Cowardin classification (PFO wetland, PSS wetland and PEM wetland). Although this course of action provides uncertainty as to what is actually occurring in terms of the mitigation acres for each Cowardin classification, mitigation bank credits in the research data were separated into Cowardin classifications for the purpose of the comparison. Mitigation received through the contribution to an in-lieu fee was not included in the comparison because it was not included in the comparison data.

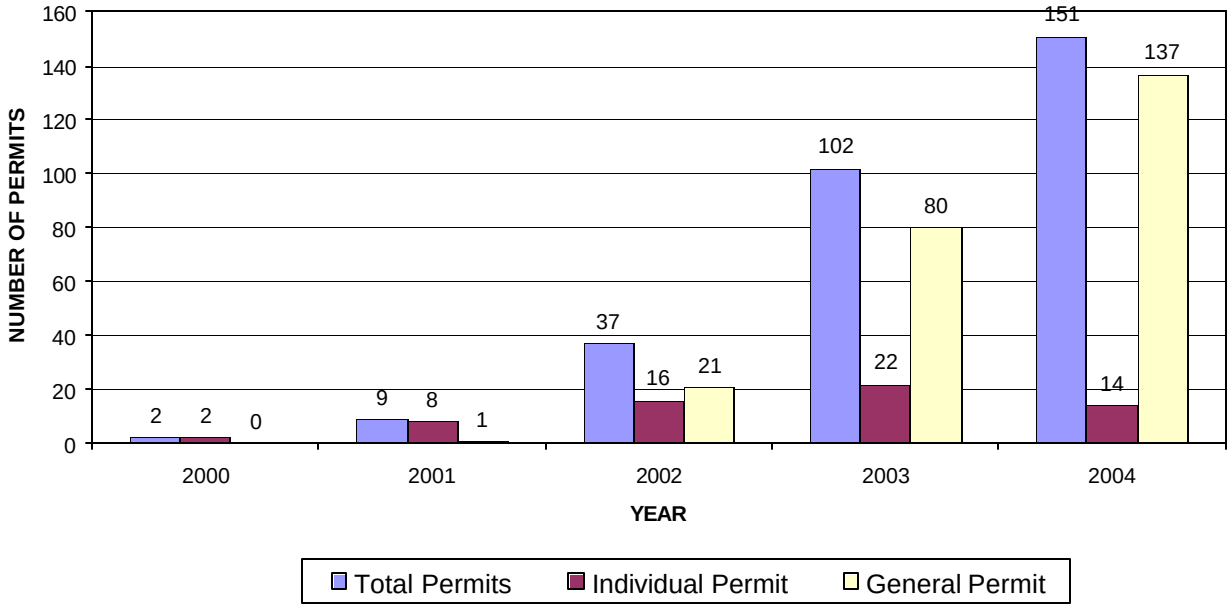
5.5 Analysis

Descriptive statistics were used to analyze the data. The sum, maximum and mean were determined for each variable. Impact and each type of mitigation data were used to determine mitigation ratios for comparisons. Percentages of each mitigation type were calculated in relation to total mitigation accepted. The frequencies for each variable were also recorded.

To better understand the association between variables, the Pearson chi-square statistic was employed. The phi coefficient helped to explain the degree of association between the dependent and independent variables. Specifically, relationships that appeared to be strong based upon percentages (for instance, between the location of permits issued or authorized and activities permitted) were analyzed with chi-square and phi coefficient to determine if the relationships were statistically significant. The data met the assumptions of chi-square and phi coefficient statistics. However, in some cases, the expected cell counts were low. In order to improve the accuracy of the analysis, the data of interest was collapsed into three categories (low, medium and high) based upon the range of the total impact data.

6.0 RESULTS AND ANALYSIS

The NVRO issued or authorized 301 permits between 2000 and 2004, of which 62 were individual permits and 239 were general permits. Over the 5 years, an increasing number of projects were permitted annually (Figure 2). This is attributed to the addition of the general permit portion of the program because out of the total 301 permits processed, 239 were general permits. The number of



Note: The general permit portion of the VWPP Program became effective October 1, 2001. It is possible that projects waived by DEQ in 2000, may have qualified for a general permit if submitted after the initiation of the general permit program.

FIGURE 2. PERMITS ISSUED OR AUTHORIZED BY NVRO FOR IMPACTS TO WETLANDS, 2000-2004

individual permits issued yearly remained relatively steady but general permits have increased from 0 permits authorized in 2000 to 137 permits authorized in 2004.

A total of 92 (38%) reporting only general permits (total impacts less than 0.10 acre and therefore mitigation was not required) were authorized out of the total 239 general permits. Therefore, 147 general permits were authorized with mitigation requirements.[8] Within the categories of general permits, WP2 permit and WP3 permit were used the least, with 1 and 18 permits authorized, respectively. WP1 permit was the second most used of the general permit categories with a total of 30 permits issued. WP4 permit was the general permit most frequently authorized, with 190 permits (Table 5).

Wetland permits were issued or authorized for projects located in 11 counties within the NVRO's region. Prince William County had the highest percent of permits issued (28.9%), followed by Loudoun County (23.6%) and Fairfax County (15.6%) (Figure 3). The activity permitted most frequently was residential projects, comprising 53.5% of all activities permitted in the northern Virginia region. The second most permitted activity, commercial, trailed far behind with 15.6% of all permits. The rest of the activities fell within 3% to 8% of all permits (Figure 4). The chi square results indicated that there was a relationship between the project type and the impacts that resulted from these projects. In addition, slightly positive relationship between activity type and total impacts was supported by phi coefficient (phi = 0.44, $p < 0.05$).

From 2000 to 2004, NVRO permitted impacts to 218.3 acres of wetland. The highest amount of wetland acres authorized for impact was in 2002 with 67.7 acres (Figure 5). The least amount of impacts permitted was in 2000 with 9.3 acres. When individual permits and general permits are considered separately, most of the 218.3 acres were permitted under individual permits (145.9 acres). Wetland impacts permitted under individual permits from 2000 to 2004 depicts a bell curve, while general permits have continually increased over the 5 years (Figure 6). Although general permits were issued more frequently than individual permits, the cumulative impacts of general permits were only 33% of all impacts permitted.

[8] Projects applying for general permits with total permanent impacts greater than 0.10 acre must provide compensation for proposed impacts.

TABLE 5. NUMBER OF GENERAL PERMITS AUTHORIZED BY CATEGORY OF ACTIVITY TYPE, 2000-2004

	WP1	**WP2**	**WP3**	**WP4**	***TOTAL***
> 1/10 acre	7	1	9	130	***147***
Reporting Only	23	0	9	60	***92***
Total	***30***	***1***	***18***	***190***	***239***

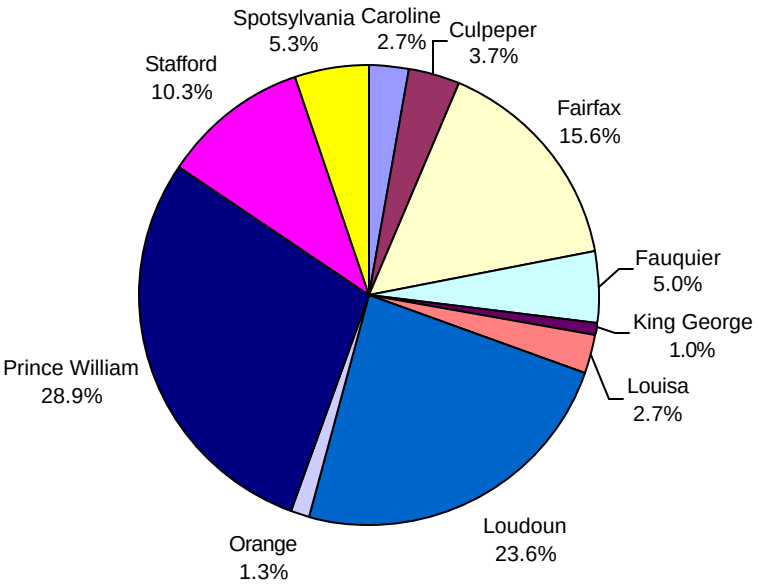


FIGURE 3. COUNTY LOCATIONS OF DEVELOPMENT PROJECTS PERMITTED BY NVRO TO IMPACT WETLANDS, 2000-2004

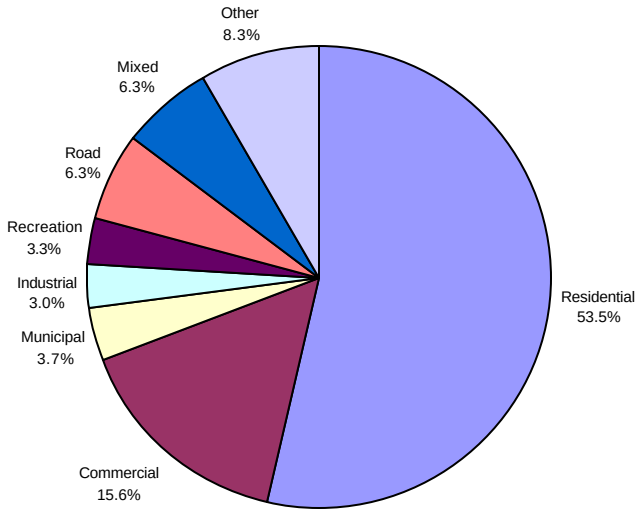


FIGURE 4. TYPES OF DEVELOPMENT PERMITTED BY DEQ-NVRO TO IMPACT WETLANDS, 2000-2004

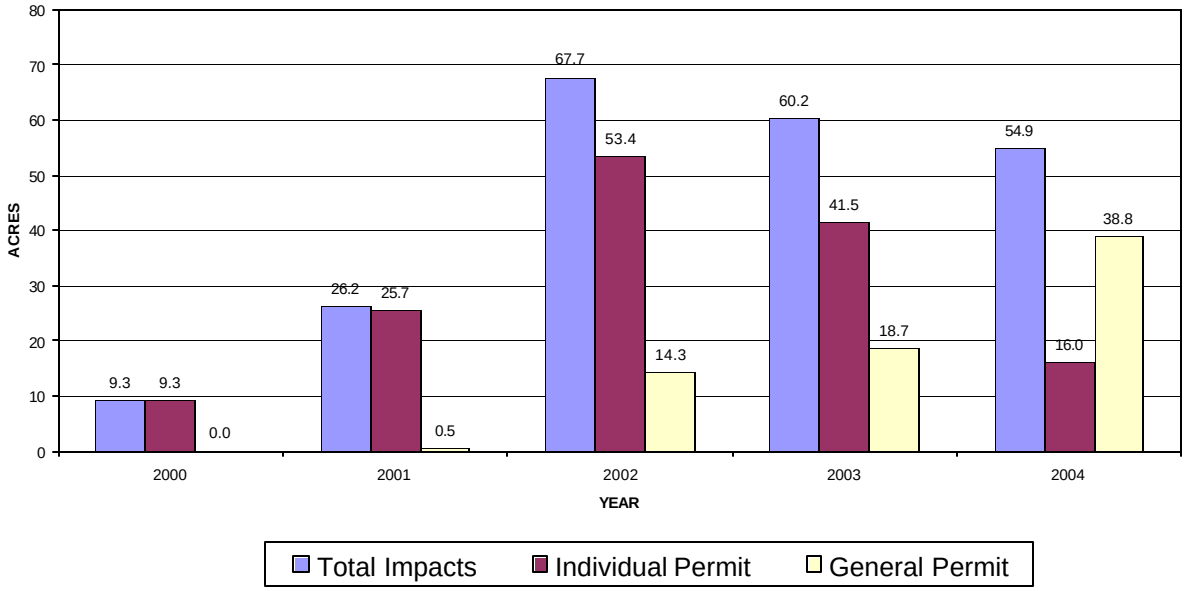


FIGURE 5. WETLAND IMPACTS PERMITTED BY NVRO EACH YEAR, 2000-2004

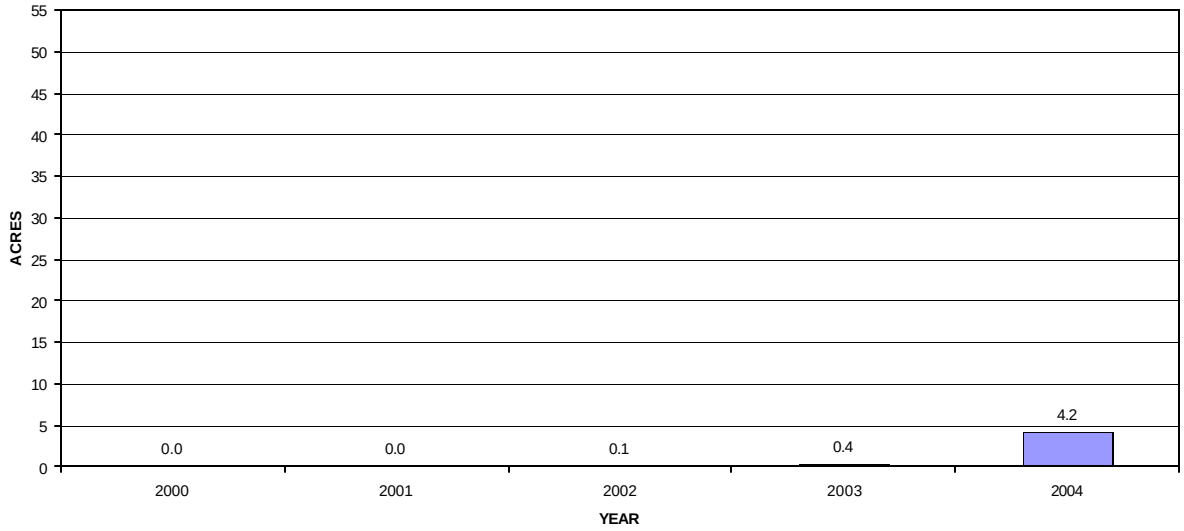


FIGURE 6. WETLAND IMPACTS PERMITTED UNDER REPORTING ONLY GENERAL PERMITS BY NVRO EACH YEAR, 2000-2004

Table 6 provides a summary of the permitted wetland impacts as classified by type of permit and Cowardin classification. The total acres permitted under reporting only general permits were 4.7 acres, of which 3.1 acres, 0.2 acres, 1.4 acres and 0.01 acres were to PFO wetland, PSS wetland, PEM wetland and PFO wetland to PEM wetland conversion, respectively. PFO wetlands were permitted for impacts 52.2% more often than PSS wetlands, PEM wetlands, or the conversion of PFO wetlands to PEM wetlands. The second most frequently impacted wetland was PEM wetlands (39.7%).

Total mitigation received was 660.8 acres, exceeding total wetland impacts of 218.3 acres. The chi-square analysis supports the relationship between total mitigation and total impacts with a strong degree of association between the two variables ($p = 0.86$, $p < 0.05$). A total mitigation to total impacts (loss) ratio of 3.03:1 was achieved. However, preservation provided a large percentage of the overall mitigation accepted (Table 7). If preservation is not included in the overall mitigation, then the mitigation received totals 319.4 acres with a mitigation to loss ratio of 1.46:1 (Table 8).

Preservation accounted for 51.7% or 341.3 acres of mitigation offered with a mitigation to loss ratio of 1.56:1 (Table 6). The rest of the mitigation accepted from creation, restoration and enhancement provided 138.81 acres while mitigation bank credits and in-lieu fee provided 166.9 acres and 13.7 acres, respectively. Preservation and total mitigation demonstrated a moderate association (phi = 0.56, $p < 0.05$), which correlates with this mitigation type resulting in the highest mitigation ratio. Of the 314.3 acres offered in preservation, PFO wetlands were the wetland classification with the most preserved acres (288.3 acres) (Figure 7).

In terms of frequency, the most utilized mitigation option was wetland mitigation banks at 56.0%. Creation was the second most frequently used form of mitigation at 21.6% (Figure 8). Over the 5 years, 166.9 wetland mitigation bank credits were purchased, with the most credits purchased in 2002 (60.8 credits). Since 2002, the amount of bank credits purchased yearly remained relatively steady. The majority of bank credits purchased were to mitigate for PFO wetland impacts (Figure 9).

The trends for in-lieu fee mitigation are similar to bank credits, although in-lieu fee was not utilized in 2000 and 2001 because the Trust Fund was not approved until December 2001. In-lieu fee contributions were most frequently sought to compensate for PFO wetland

TABLE 6. IMPACTED WETLAND ACRES PERMITTED BY NVRO, 2000-2004

PERMIT TYPE	PFO (ACRES)	PSS (ACRES)	PEM (ACRES)	PFO TO PEM CONVERSION (ACRES)	*TOTAL (ACRES)*
General Permit (> 1/10 acre)	39.4	5.6	22.0	0.7	***67.7***
General Permit Reporting Only	3.1	0.2	1.4	0.01	***4.7***
Subtotal	*42.5*	*5.8*	*23.4*	*0.7*	***72.4***
Individual Permit Impacts	71.4	8.5	63.3	2.6	***145.9***
Total Wetland Impacts	***113.9***	***14.3***	***86.7***	***3.4***	***218.3***

TABLE 7. ANALYSIS OF ACCEPTED TOTAL MITIGATION BY NVRO FOR EACH MITIGATION TYPE, 2000-2004

COWARDIN CLASSIFICATION	TOTAL IMPACTS (ACRES)	TOTAL MITIGATION		TOTAL ON-SITE & OFF-SITE CREATION			TOTAL ON-SITE & OFF-SITE RESTORATION			TOTAL ON-SITE & OFF-SITE PRESERVATION			TOTAL ON-SITE & OFF-SITE ENHANCEMENT		
		(ACRES)	(RATIO)	(ACRES)	(RATIO)	(%) [1]	(ACRES)	(RATIO)	(%) [1]	(ACRES)	(RATIO)	(%) [1]	(ACRES)	(RATIO)	(%) [1]
PFO	113.9	389.81	3.42	95.93	0.84	24.61	1.53	0.01	0.39	288.3	2.53	73.96	4.05	0.04	1.04
PSS	14.29	34.83	2.44	8.51	0.6	24.43	1.61	0.11	4.62	24.71	1.73	70.94	0	0	0
PEM	86.69	55.5	0.64	27.15	0.31	48.92	0.03	0	0.05	28.32	0.33	51.03	0	0	0
PFO Conversion [2]	3.39	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mixed [3]	N/A	180.61	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TOTAL	***218.27***	***660.75***	***3.03***	***131.59***	***0.6***	***19.92***	***3.17***	***0.01***	***0.48***	***341.33***	***1.56***	***51.66***	***4.05***	***0.02***	***0.61***

Notes:

(1) Percent of total mitigation.

(2) Mitigation for PFO wetland to PEM wetland conversion impacts was provided by mitigation wetland bank and in-lieu fee.

(3) This category was used in order to capture acres mitigated through use of mitigation wetland banks and in-lieu fee.

TABLE 7. (CONTINUED)

COWARDIN CLASSIFICATION	TOTAL ON-SITE & OFF-SITE MITIGATION			BANK			IN-LIEU FEE		
	(ACRES)	(RATIO)	(%) [1]	(ACRES)	(RATIO)	(%) [1]	(ACRES)	(RATIO)	(%) [1]
PFO	6	7.13	24.39	N/A	N/A	N/A	N/A	N/A	N/A
PSS	4.28	7.19	17.51	N/A	N/A	N/A	N/A	N/A	N/A
PEM	0.97	3.09	1.98	N/A	N/A	N/A	N/A	N/A	N/A
PFO Conversion [2]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mixed [3]	N/A	N/A	N/A	166.89	0.76	92.4	13.72	0.06	7.6
TOTAL	***11.25***	***18.66***	***56.48***	***166.89***	***0.76***	***25.26***	***13.72***	***0.06***	***2.08***

TABLE 8. ANALYSIS OF ACCEPTED OF TOTAL MITIGATION BY NVRO FOR EACH MITIGATION TYPE, EXCLUDING PRESERVATION, 2000-2004

COWARDIN CLASSIFICATION	TOTAL IMPACTS (ACRE)	TOTAL MITIGATION		TOTAL ON-SITE & OFF-SITE CREATION			TOTAL ON-SITE & OFF-SITE RESTORATION			TOTAL ON-SITE & OFF-SITE ENHANCEMENT		
		(ACRE)	(RATIO)	(ACRE)	(RATIO)	(%) [1]	(ACRE)	(RATIO)	(%) [1]	(ACRE)	(RATIO)	(%) [1]
PFO	113.9	101.51	3.42	95.93	0.84	94.5	1.53	0.01	1.51	4.05	0.04	3.99
PSS	14.29	10.12	2.44	8.51	0.6	84.09	1.61	0.11	15.91	0	0	0
PEM	86.69	27.18	0.64	27.15	0.31	99.89	0.03	0	0.11	0	0	0
PFO Conversion [2]	3.39	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mixed [3]	N/A	180.61	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TOTAL	***218.27***	***319.42***	***1.46***	***131.59***	***0.6***	***41.2***	***3.17***	***0.01***	***0.99***	***4.05***	***0.02***	***1.27***

Notes:

(1) Percent of total mitigation.

(2) Mitigation for PFO wetland to PEM wetland conversion impacts was provided by mitigation wetland bank and in-lieu fee.

(3) This category was used in order to capture acres mitigated through use of mitigation wetland banks and in-lieu fee.

TABLE 8. (CONTINUED)

COWARDIN CLASSIFICATION	TOTAL ON-SITE & OFF-SITE MITIGATION			BANK			IN-LIEU FEE		
	(ACRE)	(RATIO)	(%) [1]	(ACRE)	(RATIO)	(%) [1]	(ACRE)	(RATIO)	(%) [1]
PFO	101.51	0.89	100	N/A	N/A	N/A	N/A	N/A	N/A
PSS	10.12	0.71	100	N/A	N/A	N/A	N/A	N/A	N/A
PEM	27.18	0.31	100	N/A	N/A	N/A	N/A	N/A	N/A
PFO Conversion [2]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mixed [3]	N/A	N/A	N/A	166.89	0.76	92.4	13.72	0.06	7.6
TOTAL	***138.81***	***0.64***	***43.46***	***166.89***	***0.76***	***52.25***	***13.72***	***0.06***	***4.3***

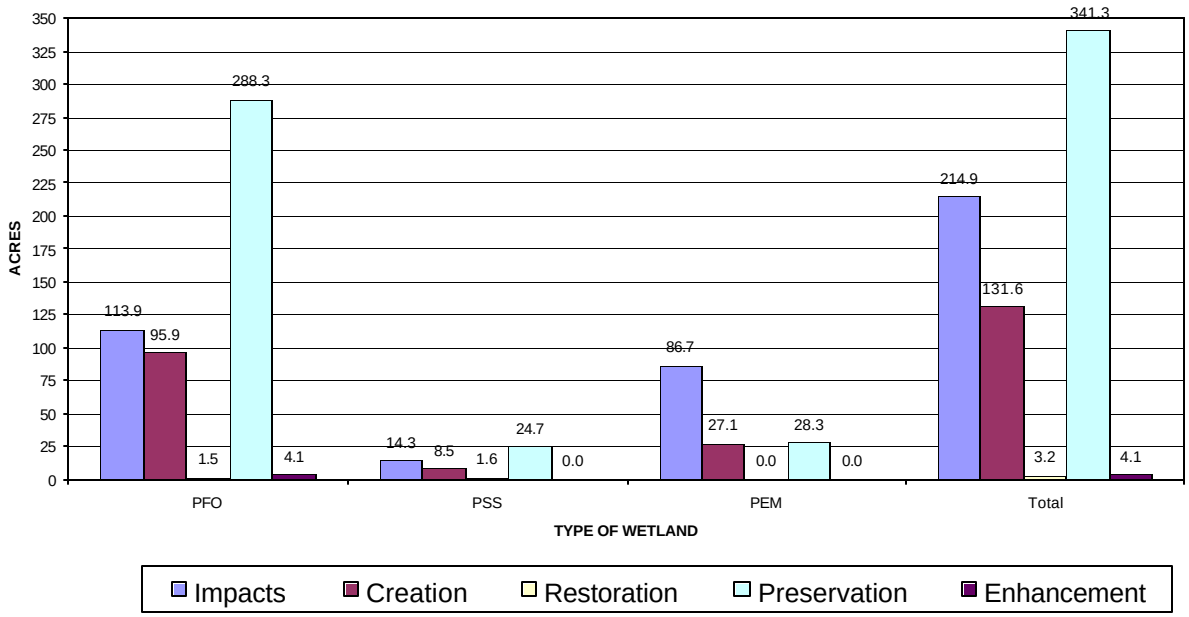


FIGURE 7. COMPARISON OF WETLAND MITIGATION VERSUS TYPE OF WETLAND IN NVRO, 2000-2004

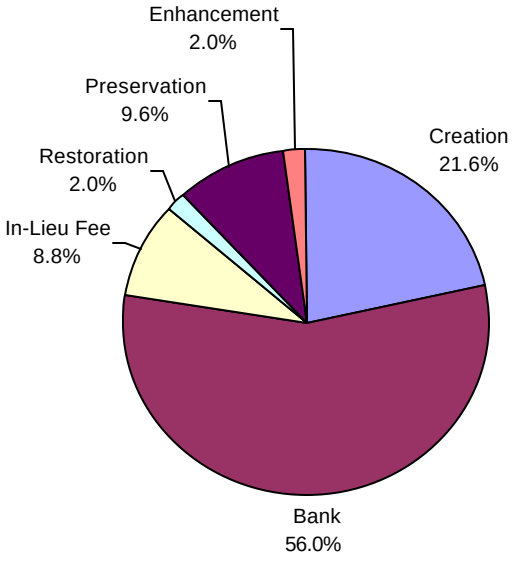


FIGURE 8. FREQUENCY OF MITIGATION TYPES APPROVED BY NVRO TO COMPENSATE FOR WETLAND IMPACTS, 2000-2004

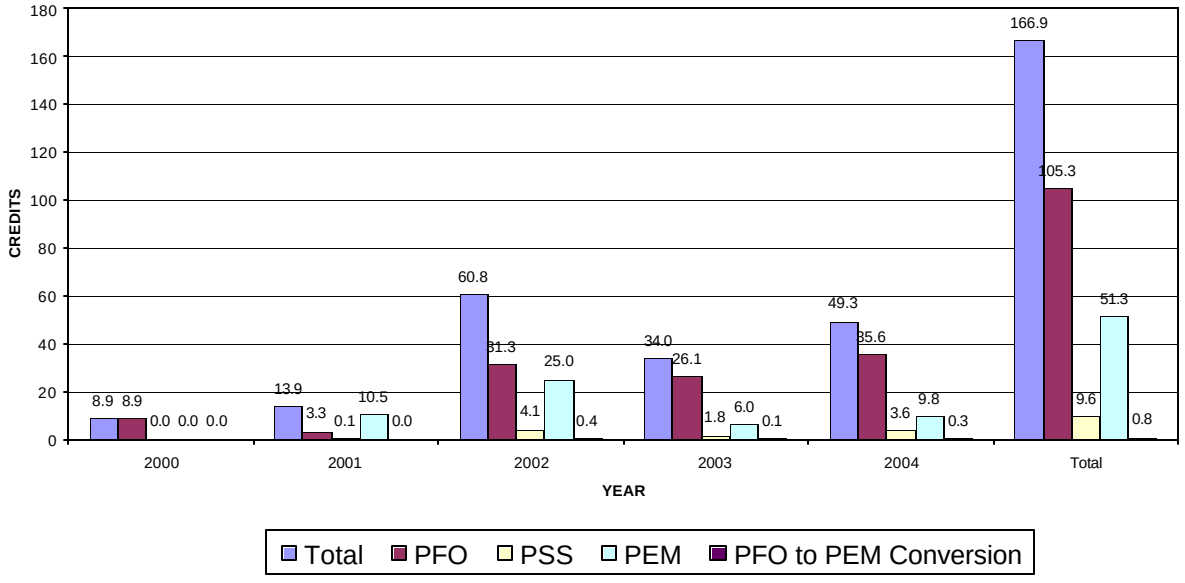


FIGURE 9. WETLAND MITIGATION BANK CREDITS ACCEPTED BY NVRO EACH YEAR, 2000-2004

impacts. Overall, 13.7 mitigation acres were compensated through in-lieu fee[9] (Figure 10). In-lieu fee provided 2.8% of all mitigation received versus 25.3% received from the banks.

When total mitigation accepted is divided into general permits and individual permits, the latter received more mitigation acres to compensate for larger impacts. The majority of the mitigation for individual permits was in the form of preservation (60.0%). For general permits, mitigation was mostly received in the form of bank credits (56.2%) (Table 9).

Wetland mitigation banks provided compensation for both individual and general permits relatively equally, with 89.9 credits and 77.0 credits purchased, respectively. However, 75.5% of general permits authorized with mitigation requirements (i.e. permanent impacts greater than 0.10 acre) used this option versus individual permits, which only used this option 46.8% of the time for mitigation (Table 10).

On-site mitigation (creation, restoration, preservation and enhancement) received the most mitigation (50.1%) in terms of area of mitigation accepted (Figure 11). Individual permits offered the most on-site mitigation with a total of 295.0 acres. On-site preservation for individual permits accounted for 77.5% (228.6 acres) of on-site mitigation. General permits received only 35.9 acres of on-site mitigation, consisting of 9.7 acres created and 26.2 acres preserved.

Off-site mitigation (creation, restoration, preservation and enhancement) provided 22.6% of total mitigation accepted. General permits received 15.2 acres for off-site mitigation, consisting of creation, restoration and enhancement. In contrast, individual permits received 134.1 acres through off-site mitigation.

The amount of mitigation each mitigation alternative received appears to be reflected by the presence of a relationship between mitigation measures and mitigation activity and the strength of the association between these two variables, as determined by the chi-square and phi coefficient, respectively. The chi square statistic showed an association between several of the mitigation alternatives and total mitigation. For example, creation, preservation, enhancement, bank and trust fund, were all associated with total mitigation. Preservation ($phi = 0.56$, $p < 0.05$) and creation ($phi = 0.67$, $p < 0.05$) had a moderate association with the mitigation measures. The relationship demonstrated by the

[9] In order to provide an assessment of in-lieu fee comparable to the other forms of mitigation, the amount of acres required for compensation were used.

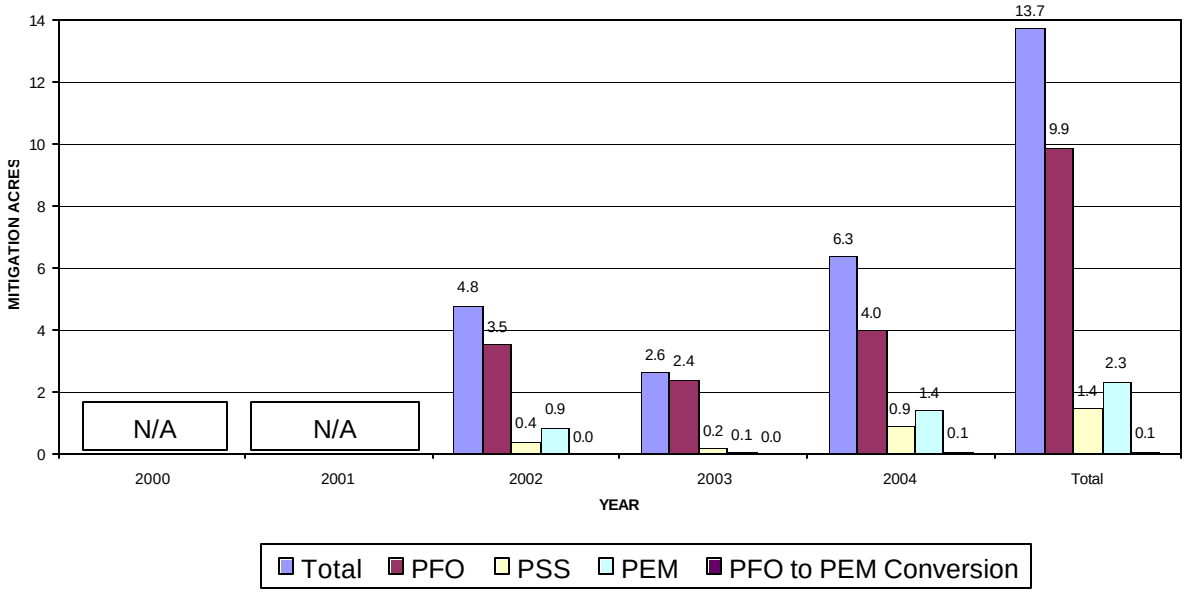


FIGURE 10. IN-LIEU FEE MITIGATION ACRES ACCEPTED FOR WETLAND IMPACTS BY NVRO EACH YEAR, 2000-2004

TABLE 9. WETLAND MITIGATION ACCEPTED BY NVRO FOR INDIVIDUAL AND GENERAL PERMITS, 2000-2004

PERMIT TYPE	CREATION (ACRES)	RESTORATION (ACRES)	PRESERVATION (ACRES)	ENHANCEMENT (ACRES)	BANK (CREDITS)	IN-LIEU FEE (MITIGATION ACRES)	*TOTAL MITIGATION*
General Permit [1]	23.9	0.9	26.2	0.2	77	8.8	***136.9***
Individual Permit	107.7	2.3	315.2	3.9	89.9	5	***523.9***
Total	***131.6***	***3.2***	***341.3***	***4.1***	***166.9***	***13.7***	***660.8***

Notes:

(1) Mitigation is not required for projects that qualify for reporting only general permits (total impacts less than 0.10 acre), which comprised 38% of general permits.

TABLE 10. COMPARISON OF MITIGATION ACCEPTED UNDER GENERAL AND INDIVIDUAL PERMITS BY NVRO, 2000-2004

MITIGATION TYPE	GENERAL PERMIT [1]				INDIVIDUAL PERMIT			
	FREQUENCY OF USAGE [2] (#)	ON-SITE (ACRES)	OFF-SITE (ACRES)	*TOTAL (ACRES)*	FREQUENCY OF USAGE (#)	ON-SITE (ACRES)	OFF-SITE (ACRES)	*TOTAL (ACRES)*
Creation	24	9.7	14.1	***23.9***	30	62.3	45.5	***107.7***
Bank	111	N/A	N/A	***77***	29	N/A	N/A	***89.9***
In-Lieu Fee	16	N/A	N/A	***8.8***	6	N/A	N/A	***5***
Restoration	1	0	0.9	***0.9***	4	2.3	0	***2.3***
Preservation	4	26.2	0	***26.2***	20	228.6	86.6	***315.2***
Enhancement	1	0	0.2	***0.2***	4	1.8	2	***3.9***
TOTAL	***157***	***35.9***	***15.2***	***136.9***	***93***	***295***	***134.1***	***523.9***

Notes:

(1) Mitigation information collected solely from general permits with mitigation requirements (i.e. greather than 1/10 acre).

(2) Frequency of usage does not directly translate into number of permits issued because applicants sometimes combine a variety of mitigation options to satisfy compensation requirements.

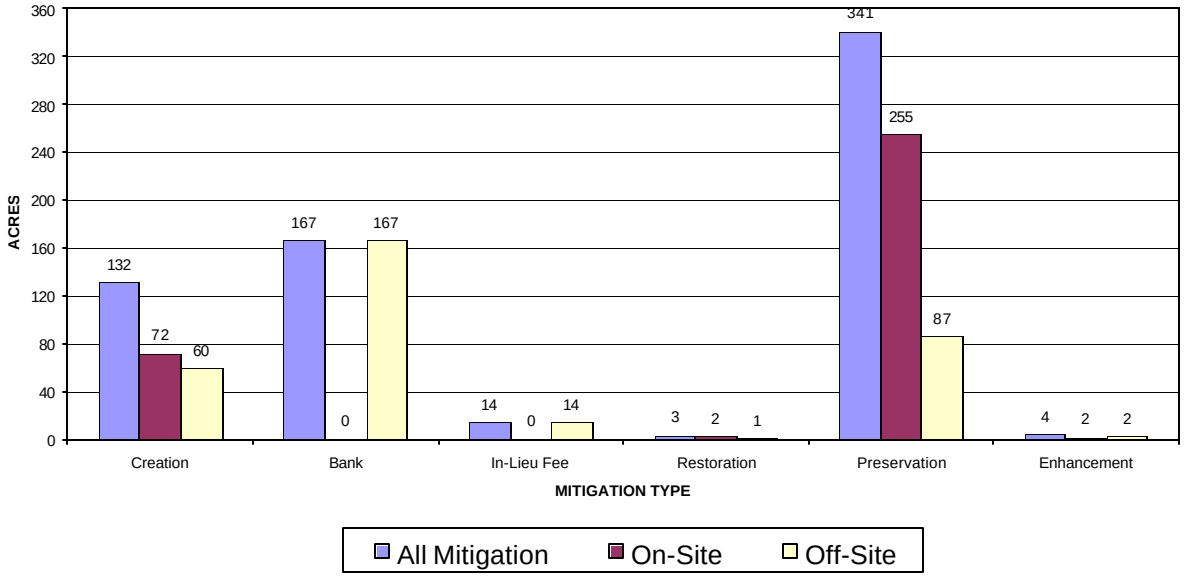


FIGURE 11. ACREAGE OF ON-SITE AND OFF-SITE WETLAND MITIGATION APPROVED BY NVRO, 2000-2004

chi-square and the strong positive association reflected by the phi coefficient (phi = 0.92, $p < 0.05$) for mitigation banks lends support to the finding that banks are the most frequently used form of mitigation, although these results should be interpreted with caution due to the low expected cell count (22.2%).

7.0 DISCUSSION

7.1 Challenge in Conducting the Analysis

7.1.1 Chi-Statistic and Phi Coefficient Analysis

One challenge encountered during the data analysis was in obtaining valid results from the chi-statistic and phi coefficient. Because no two values were the same, the analysis did not provide meaningful results. By collapsing the data into three categories (low medium and high), the validity of the data of interest was improved. Despite these improvements to the dataset analyzed, low expected cell counts were still obtained in the results. Whereas the desired expected cell count as a rule of thumb is 80%, the highest cell count achieved was 63.3% (Plyler 2005). Therefore, the results offered by the chi-statistic and phi coefficient results should be interpreted with caution.

7.1.2 Mitigation Data Analysis

The other challenge encountered was in the analysis of the mitigation data. Total mitigation could not be assessed for each Cowardin classification due to how mitigation banks are established and how in-lieu fee contributions are distributed. Additionally, in-lieu fee and mitigation bank credits could not be directly analyzed with the other forms of mitigation in terms of Cowardin classification.

Each mitigation bank contains a different amount of acres of land and a varying amount of acres per Cowardin classification due to physical and biological determinants. Credits were established to create a standard for mitigation banks to trade the accrual or attainment of wetland functions at the bank (Lawson 2004). The total expected credit at the bank's maturity are determined in the process of the wetland mitigation bank's approval by the Mitigation Bank Review Team. However, credit available does not directly translate into acres or type of wetland (Lawson 2004). Therefore, when 1 acre of impacted

PEM wetland is mitigated through the purchase of 1 credit (1:1 mitigation to loss ratio for PEM wetland), 1 credit purchased does not translate into 1 acre of PEM wetland created, restored, preserved or enhanced within the bank. What it does mean is a mixture of wetlands was created, restored, preserved or enhanced, but not necessarily 1 acre worth. In order to provide an accurate picture of the amount of wetland acres created, restored, preserved and enhanced by wetland mitigation banks for each Cowardin classification, each bank owner must be consulted to obtain the necessary information.

A similar situation is faced in assessing mitigation for the in-lieu fee. The Corps determines the in-lieu fee estimate for a particular project based upon the area in which the impacts will occur. This allows TNC to buy bank credits if the funds cannot be directed towards a project within the 3 years allotted (Corps 2003b). The in-lieu fee estimate is given in cost per acre, of which the applicant is required to pay the amount of mitigation required (i.e. if 0.5 acre is required for mitigation at a 1:1 ratio, then the applicant contributes an in-lieu fee equivalent to 0.5 acre). The cumulative monies are used by TNC to fund projects for both wetlands and streams; therefore it is difficult to determine where the monies for these specific in-lieu fee contributions for wetland impacts were (or are intended to be) directed.

When mitigation banks and in-lieu fee are assessed individually, the analysis was relatively straightforward. Mitigation banks are assessed in terms of credits purchased. This was broken down into Cowardin classification to determine how much credit was purchased for each type of wetland. However, knowledge is not gained on the actual acres or amount of each wetland type received in compensation from wetland mitigation banks. For in-lieu fee, mitigation acres were used to provide a measurement of comparison because the amount of money contributed would not provide similar information. It is important to note that mitigation acres do not translate into actual acres, but was a way to assess total mitigation and in-lieu fee mitigation per type of wetland. The mitigation acres were determined from the amount of impacts multiplied by the required ratio (i.e. if 1 acre of PFO wetland was impacted, the required mitigation was for 2 mitigation acres of PFO wetland).

A few assumptions were necessary to allow an analysis of in-lieu fee and mitigation bank credits with the other types of mitigation. For in-lieu fee, it was assumed that the monies collected for wetland impacts translated into wetland mitigation and the acreage of mitigation required. Bank credits were assumed to equal 1 acre of mitigation. For comparison with other mitigation types, Cowardin

classifications were not assumed for the mitigation acres collected from in-lieu fee and wetland mitigation bank credits. For both mitigation bank and in-lieu fee, the credits or acres received in compensation for all types of wetlands were totaled and placed in a new column titled "mixed wetlands." These assumptions were necessary to provide an analysis of overall mitigation and how mitigation banks and in-lieu fee fit into the larger picture of wetland mitigation in terms of acreage, ratios and percents.

7.2 Comparison with Data From Other Sources

Data was collected from two sources for an understanding of the wetland permit program throughout Virginia and for a comparison with the research data. VIMS compiled the first data set used for comparison. The VIMS data reported total nontidal wetland impacts from 1993 to 2002 and 2000 to 2002 totaling 2516.8 acres and 757.9 acres, respectively. Mitigation accepted by the Corps for all permits issued during this timeframe totaled 7103.8 acres during 1993 to 2002 and 2918.9 acres during 2000 to 2002 (VIMS 2002). In contrast, the NVRO VWPP Program (research data) permitted 103.2 acres of impact and received 303.9 acres towards mitigation (Table 11). VIMS data did not report the number of permits from which the data was obtained.

The reason for the large difference between the research data and VIMS data is that all Corps permits were utilized, including permits upon which DEQ generally does not assert jurisdiction (i.e., Nationwide Permits). However, it is interesting to note the contrast in the amount of acres impacted and mitigated under the Corps wetland permit program and under the VWPP Program. In terms of mitigation, the mitigation to loss ratio for the VIMS data was 2.8:1 for 1993 to 2002 and 3.9:1 for 2000 to 2002 (VIMS 2002). Based upon the information provided from the VIMS data, it appears the Corps also utilizes mitigation to loss ratios to provide "no net loss." Additionally, because the research data compiled specifically for this analysis had a mitigation to loss ratio of 2.9:1, it appears that the Corps and DEQ are providing comparable mitigation for acreage of wetland impacts permitted by each agency.

The SPGP-01, Activity 1 data provided a closer comparison to the research data than the VIMS data. Numbers for impacts permitted and mitigation accepted were typically lower for the research data. While SPGP-01, Activity 1 data covered the whole state; the numbers were not much higher than those of the research data. Based upon the comparison, it appears that NVRO permits the majority of Virginia's

TABLE 11. COMPARISON BETWEEN RESEARCH DATA AND U.S. ARMY CORPS OF ENGINEERS' NONTIDAL WETLAND DATA COMPILED BY THE VIRGINIA INSTITUTE OF MARINE SCIENCE (VIMS) [1,2]

YEAR ISSUED	LOCALITIES OF ISSUANCE [3]	IMPACTS TOTAL (ACRES)	MITIGATION [4] TOTAL (ACRES)
VIMS - Corps			
1993-2002	All in dataset	2,516.80	7,103.80
1993-2002	NVRO	610.6	1,418.80
2000-2002	All in dataset	757.9	2,918.90
2000-2002	NVRO	323.4	722.5
Research Data - VWPP			
2000-2002	NVRO	103.2	303.9

Notes:

(1) Data source: Virginia Institute of Marine Science Wetlands Program (2002). Virginia Nontidal Wetlands Impacts Data Home Page [Online]. Available: http://www.vims.edu/rmap/wetlands.

(2) The data reported by VIMS were collected from the U.S. Army Corps of Engineers (Corps) Norfolk District's wetland permitting program for nontidal wetland impacts and mitigation. All permits issued under this program were included.

(3) VIMS data provided nontidal wetland permit data on localities throughout Virginia. However, not all localities throughout the state or for NVRO, were listed.

(4) VIMS mitigation data included combined acres from on-site and off-site creation, enhancement, preservation, restoration, and wetland bank credits. Estimates for in-lieu fee were not included. Therefore, in-lieu fee estimates in the research data were not included in the comparison.

wetland impacts related to this type of project activity. Under SPGP-01, Activity 1, 327 permits were issued while NVRO VWPP Program (research data) for that same timeframe and corresponding activity issued 205 permits. For those permits issued, 65.2 acres and 50.1 acres were authorized under SPGP-01, Activity 1 and research data, respectively. The mitigation accepted under the SPGP-01, Activity 1, totaled 125.7 acres versus the 94.4 acres accepted under the VWPP Program (Table 12) (Corps 2004a, 2004b). Although the comparison is of permitted activities that include residential, commercial and institutional activities, these activities are probably the most permitted activities statewide. The overall conclusion is that an analysis of NVRO VWPP Program provides a representative assessment of the statewide VWPP Program in terms of wetland impacts and wetland mitigation.

7.3 Project Activities and Locations

One trend correctly hypothesized was the type of activity permitted most frequently. Residential projects were permitted 53.5% more frequently than other types of project activities, which is probably due to the current large residential growth in northern Virginia. It is doubtful that the current percent of permits issued or authorized for residential activity can be sustained as changes in demand and reduction in available land parcels reduce the amount of residential projects in northern Virginia. It would be interesting for this trend to be tracked over a longer period of time in order to determine if there is a succession to development types in northern Virginia. Once the residential areas are built, the next most permitted activity, commercial, may exceed residential as needs turn from houses to convenient commercial centers.

Based upon the research, it appears that Prince William and Loudoun Counties have the most development activities impacting wetlands. However, violations (impacts taken without a permit) were not assessed. It is possible that this is because county government officials and/or developers working in these counties are more knowledgeable about the state requirement to obtain permits to impact wetlands. If this is true, then other counties may be experiencing more development activity but this is not captured in the data because the developers did not seek permits. More research would need to be conducted on locations of permitted impacts and reported violations to develop a conclusion.

TABLE 12. COMPARISON BETWEEN RESEARCH DATA AND U.S. ARMY CORPS OF ENGINEERS - NORFOLK DISTRICT STATE PROGRAM GENERAL PERMIT (SPGP-01) NONTIDAL WETLAND DATA [1]

PERMIT TYPE	NO. PERMITS ISSUED	IMPACTS				MITIGATION [2]			
		PFO (ACRES)	PSS (ACRES)	PEM (ACRES)	*TOTAL (ACRES)*	PFO (ACRES)	PSS (ACRES)	PEM (ACRES)	*TOTAL (ACRES)*
SPGP-01 Activity Type [3]									
1	327	42.7	4.3	18.3	***65.2***	98.7	6.4	20.6	***125.7***
2	881 [4]	1.6	0	1.9	***3.5***	2.5	0	1.6	***4.1***
Total	***1,208***	***44.3***	***4.3***	***20.2***	***68.7***	***101.2***	***6.4***	***22.2***	***129.8***
General Permit Category (Research Data) [5]									
WP1 & WP4 [6]	205	30.1	4.2	15.8	***50.1***	71.5	6.8	16.1	***94.4***
WP3 [7]	18	1	0	2.6	***3.6***	1.6	0	1.9	***3.4***
Total	***223***	***31.2***	***4.2***	***18.4***	***53.7***	***73***	***6.8***	***18***	***97.8***

Notes:

(1) Data source: U.S. Army Corps of Engineers, Amended First Annual Review of the Norfolk District's State Program General Permit (SPGP-01),February 2004; U.S. Army Corps of Engineers, Second Annual Review of the Norfolk District's State Program General Permit (SPGP-01), December 2004.

(2) SPGP-01 data included combined acres from on-site and off-site creation, restoration, and wetland bank credits. Estimates for in-lieu fee were not included. Therefore, in-lieu fee estimates in the research data were not included in the comparison.

(3) SPGP-01 data from DEQ reported permits issued under SPGP-01 (Activity 1 and 2 and all subcategories). The data range was provided fromNovember 1, 2002 to November 2004. Data for December 2003 and December 2004 were not provided within the SPGP-01 Annual 1st and 2nd Reports.

(4) The permit number for projects permitted under SPGP-01 Activity 2 were not reported separately for wetland and stream impacts. Because, wetland impacts in this category were small and the reported stream impacts were 32,431 linear feet of streambed, permits with wetland impacts are probably significantly lower. Only seven individual projects proposed impacts over 300 linear feet of streambed.

(5) Research data range provided from 2002 to 2004 and only those permits with impacts under 1 acre, the maximum threshold to qualify for SPGP-01.

(6) VWPP Categories probably issued under SPGP-01, Activity 1.

(7) VWPP Category probably issued under SPGP-01, Activity 2.

7.4 Mitigation Types

7.4.1 Selection of Mitigation Types

It is difficult to determine why an applicant chooses one mitigation type over another without surveying the applicants who received permits from 2000 to 2004. However, two factors are assumed to play a role in the mitigation type chosen. First, the size of the project in terms of acres and timeframes played a role. If the project is small (temporally and spatially), there is little opportunity for on-site mitigation and off-site mitigation may be too costly and time consuming. Therefore, the best option for the applicant is the wetland mitigation bank or in-lieu fee.

The second factor is whether a consulting company provided assistance in the application process and if so, which one. If a consultant was not used, the appeal of a lengthy mitigation project could be overwhelming because it is unlikely that the applicant has the necessary expertise or knowledge in-house. If an applicant retains the services of a consultant who offers mitigation services in-house, on-site or off-site mitigation might appear more feasible. Also, the firm is available to provide answers to the applicant's questions regarding wetland mitigation options. Essentially, mitigation that involves creation, enhancement or restoration may be more attractive to applicants retaining the services of a consultant, especially if the consulting company has mitigation expertise in-house.

The reason why mitigation banks were chosen more frequently than the other forms of mitigation is likely due to the ease of this option. This mitigation condition of the permit is satisfied once the applicant pays the bank. Additionally, the mitigation banks possibly cost less in the long run than on-site or off-site mitigation (Gardner 2000). When a mitigation plan includes creation, restoration or enhancement, there is a cost to start the mitigation project and to monitor its success over a defined period of years. This can incur large costs, especially if the mitigation project is not successful, requiring additional monitoring and possibly a new design. As to the type of applicant using wetland mitigation banks, a survey of the types of applicants was not conducted. However, based upon experience gained from compiling the data and that residential projects accounted for 56.1% of general permits, mitigation banks were used by all types of applicants, but more frequently by applicants with small projects and applicants building residential projects.

7.4.2 Comparison of Mitigation Selection Frequency with DEQ's Mitigation Preferences

The actual frequency of mitigation types does not correlate well with the DEQ's preference in types of mitigation. DEQ values on-site mitigation over off-site mitigation (9 VAC 25-210-115). In terms of on-site versus off-site mitigation, on-site mitigation did receive the most acreage for both general and individual permits, with individual permits providing the most. The reason for this trend of more on-site mitigation than off-site mitigation, is probably because the land the project is being conducted upon is already owned, and therefore easier to implement on-site mitigation than acquiring land off-site or paying for off-site creation, restoration, enhancement or preservation on land owned by another person(s).

A possibility why individual permits propose on-site and also off-site mitigation more frequently than general permits is there is already a long and lengthy commitment associated with individual permits. Individual permits are generally sought for large-scale projects, in terms of project size in addition to the amount of impacts. Larger projects generally have more opportunities and flexibility for on-site mitigation due to more land within the project's boundaries. Additionally, there is a higher likelihood that projects with large sites could preserve more wetlands than smaller land parcels. Lastly, because individual permits have higher impacts than general permits and the project must be announced for public comment, it is possible these types of mitigation are proposed in efforts to make the proposed impacts more palatable to the permitting agencies and the public.

In addition to the preference of on-site to off-site mitigation, DEQ also ranks preferred mitigation types: restoration, creation, mitigation banking and in-lieu fee fund (9 VAC 25-210-115). In terms of mitigation types chosen most frequently, the actual scenario ranks wetland mitigation banks (56.0%) as the highest, followed by creation (21.6%), in-lieu fee (8.8%) and restoration (2.0%). The amount of mitigation each mitigation alternative received appears to be reflected by the presence of a relationship between mitigation measures and mitigation activity and the strength of the association between these two variables, as determined by the chi-square and phi coefficient, respectively. When total acres received for each mitigation type is reviewed, preservation (341.3 acres) is ranked highest, followed by

mitigation banks (166.9 credits), creation (131.6 acres) and enhancement (4.1 acres). Restoration received only 3.2 acres during the 5 years reviewed.

The reason why the actual ranking of mitigation type by either frequency or quantity does not correlate closely with the DEQ's preferences is most likely due to several reasons. First, the popularity of mitigation banks due to the ease offered by this form of mitigation. Second, higher ratios for preservation are used for compensation, which leads to a larger number of acres received in mitigation. The final reason is that creation is desirable over restoration to create more wetlands to achieve the goal of "no net loss."

7.5 Achieving "No Net Loss"

Total mitigation far exceeds total permitted impacts, producing a mitigation to loss ratio of 3.03:1. Based upon this ratio, it appears that the goal of "no net loss" is achieved. However, it is important to look at the effect of not requiring compensation from reporting only general permits and the large amount of compensation received in the form of preservation.

In considering the impacts permitted under the reporting only general permits, it is important to understand the cumulative effect these permits may have on overall mitigation. Even though the impacts were few, it is conceivable that the cumulative impacts authorized by reporting only general permits causes a decrease in the total received mitigation below the goal of "no net loss," despite the mitigation ratios findings. It was hypothesized that the net mitigation compensates for the impacts permitted by these permits and therefore the goal of "no net loss" is not affected by the impacts incurred under the reporting only general permits. It is important to restate that the mitigation ratios are in place to protect functions (9 VAC 25-210-115.C).

Therefore, if the "expected ratio"[10] (the ratio one would expect to receive if mitigation received was unknown and therefore, calculated the required mitigation based upon impacts with mitigation requirements) is below the calculated total mitigation to loss ratio with reporting only impacts and

[10] The expected ratio was determined by multiplying only the Cowardin classification impacts that received mitigation by the applicable mitigation to loss ratio for that wetland type. This mitigation total was then divided by the sum of all wetland impacts, including those permitted under reporting only general permits. Therefore, this ratio is the minimum expected ratio for the research data.

corresponding mitigation included ("hypothetical ratio"),[11] then one should question if the difference is great enough to cause a net loss of functions.

In an attempt to provide an answer to this question, several variables were considered: total acres permitted, possible mitigation if compensation was required for reporting only general permits and several scenarios of mitigation to loss ratios. If mitigation had been required, then the total mitigation required for reporting only general permits would have been 7.83 acres, creating a hypothetical ratio of 1.55:1. The expected ratio for permitted impacts was 1.51:1. Therefore, the lack of mitigation for reporting only general permits is decreasing the expected ratio, however the difference does not appear to be that great.

When the actual ratio for the dataset is considered, there is no decrease in the ratio. The actual overall mitigation received by NVRO from 2000 to 2004 was 660.8 acres for the 218.3 acres permitted or a ratio of 3.03:1. Based upon the actual overall mitigation to loss ratios, reporting only general permits are not decreasing the actual overall ratio and appear to be adequately compensated. However, the difference is larger when the hypothetical ratio is compared to the overall mitigation to loss ratio of 1.46:1 that does not include preservation. "No net loss" in terms of acreage is still met, but the decrease in the ratio could mean the lack of attaining "no net loss" of functions. The amount of preservation accepted as mitigation does show potential to affect achieving the goal of "no net loss" in term of functions.

The preservation of wetlands is important, but it is questionable whether or not a high percent should be accepted as a form of mitigation, especially if the overall goal of "no net loss" appears to be affected. Although preservation is generally accepted at a higher mitigation to loss ratio than required, the preservation of wetlands does not create new acreage or new functions. Additionally, preservation acreage may actually be higher depending on how the wetland mitigation bank credits and in-lieu fee are utilized, and therefore could contribute to an increase in the overall preservation of wetlands. The overall mitigation to loss ratio decreases (1.46:1) when preservation is not included because a large percent of mitigation in the form of preservation was accepted by NVRO.

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[11] The hypothetical ratio was determined by multiplying all Cowardin classification impacts (including those impacts permitted under reporting only general permits) by the applicable mitigation to loss ratio for that wetland type. This mitigation total was then divided by the sum of all wetland impacts. Therefore, this would be the overall ratio if mitigation were required for reporting only general permits.

A 1:1 ratio achieves “no net loss” in terms of acreage, but it is difficult to determine what ratio achieves the functions objective. The ratios were established as a way to address “no net loss” of functions, but how conservative are the mitigation to loss ratios? It is possible that the mitigation to loss ratios equally provide functions of lost wetlands and it is also possible that the ratios are overly conservative. Additionally, it is unknown how high or low the functions were for wetlands impacted. It is possible a wetland with low functions was compensated by a high valued wetland, which means the ratios involved were not necessary to replace the lost functions of the impacted wetland.

This is an important aspect in understanding how well functions are being protected. If one assumes that the ratios are overly conservative, it is possible that the calculated overall mitigation to loss ratio of 1.55:1 safeguards “no net loss” of functions. If this is the case, then the actual overall mitigation to loss ratio (excluding preservation) of 1.46:1 may be sufficient.

The question of how mitigation to loss ratios address “no net loss” of functions needs to be answered in order to fully understand how preservation of wetlands affect this goal and how the goal is supported by the mitigation to loss ratios. However, it is difficult to assess and determine how “no net loss” is being achieved in terms of functions because there is no agreed standard for quantifying the functions of wetlands impacted and created wetlands (Mitsch and Gosselink 2000). Until a standard is accepted for quantifying the quality of wetlands, it will be difficult to assess and therefore determine if “no net loss” of functions is being attained in Virginia.

7.6 Future Research Possibilities

This information and analysis can support future studies on topics that investigate all aspects of the VWPP Program, especially the success of wetland creation and the reason a type of mitigation is chosen over the other forms. The information provided in this paper allows for a basic understanding of what is accepted as mitigation in NVRO. It would of interest to know and understand if there is a trend to the type of mitigation chosen. If so, it may be useful information for both consulting firms and government agencies. However, more research is needed on the success of wetland creation in order to determine the overall success of mitigation.

The research data provides information to quantify each mitigation type chosen from 2000 to 2004. From an analysis of the data, it cannot be determined if the mitigation accepted was successfully built or if at all. Without a follow-up study, it is unknown if the applicant (or appointed responsible party) has fulfilled the mitigation requirements once the permit is received. Even if NVRO receives mitigation proposals that achieve the goal of "not net loss," without an analysis of the success of the mitigation, a false impression is made of the actual situation. To prevent a false impression, it is important to compile data that assesses mitigation banks and a random sample of wetland creation projects. This research will provide government agencies with important information that may help to focus resources or encourage certain types of mitigation.

In addition to understanding the success of mitigation projects, it is important to learn more about the cumulative effect of multiple wetland alterations on the landscape. The majority of projects propose small quantities of impacts, but when viewed in light of the overall landscape, these small impacts may have a larger effect than currently realized or understood. It is important not only for DEQ to understand the effect of these small cumulative impacts on the landscape, but the public must also be educated in this regard. A public educated about the cumulative effect of wetland impacts and the mitigation used to compensate for those impacts, will aid in making the VWPP Program more successful over time.

It is also important that DEQ supports and encourages additional research on the functional assessment of wetlands. DEQ should support research to select a method to measure functions of wetlands, both prior to and after development activities. This is critical in understanding how the functions of wetlands are affected by impacts and how functions are replaced by various types of mitigation. Without this research, the VWPP Program cannot adequately determine if the goal of "no net loss" of wetland functions is achieved. Only with a full understanding of wetland functions and wetland mitigation, from permit application to the completion of mitigation requirements, will the overall program be successful in ensuring that the goal of "no net loss" is attained for both acreage and functions.

8.0 CONCLUSIONS

The analysis of the VWPP Program revealed several trends. First, it showed that the majority of impacts were permitted for residential projects. Second, the total mitigation received exceeded total

permitted impacts. Third, compensation was provided most frequently through the purchase of credits from wetland mitigation banks. Finally, the data showed that the "no net loss" of acres was maintained despite unmitigated impacts from reporting only general permits. However, this type of data analysis was not able to illuminate how "no net loss" of functions are impacted by reporting only general permit impacts and by the large amount of preservation accepted as mitigation.

More research needs to be conducted to determine if mitigation to loss ratios provide enough mitigation to compensate for lost functions and on the success of wetland mitigation banks and individual wetland mitigation projects. Additionally, it is important that research on wetland functions and ecological services is supported by the DEQ to provide a full understanding of how successful NVRO is in attaining the goal of "no net loss" for both acreage, and more importantly, functions. Collaborating the information gathered from the necessary additional research with information provided in this paper will provide a better understanding of how well NVRO is achieving the goal of "no net loss."

9.0 SUMMARY

Review of the wetland permit program in northern Virginia provides insight into the process of achieving "no net loss" of existing acreage and functions by the VWPP Program as administered by the DEQ. The research conducted and presented in this paper, shows that an evaluation of wetland impacts and wetland mitigation as administered by NVRO provides a representative look at how these development impacts and mitigation are handled in Virginia.

Based upon the analysis of NVRO permitted wetland impacts and accepted compensation from 2000 to 2004, it appears NVRO is achieving the goal of "no net loss" in terms of acreage. In terms of functions, the analysis indicates that "no net loss" is potentially not being met. This may be due to the high amount of wetland preservation accepted as compensation. DEQ needs to support research on how to evaluate and quantify "no net loss" in terms of functions both prior to and after development activities and on how certain types of mitigation options might adequately mitigate for lost functions. Until a standard is accepted for quantifying the quality of wetlands, it will be difficult to assess and therefore determine if "no net loss" of functions is being attained in Virginia.

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APPENDIX A - TABLES

TABLE A-1. ANALYSIS OF ACCEPTED ON-SITE MITIGATION BY NVRO, 2000-2004

COWARDIN CLASSIFICATION	TOTAL IMPACTS (ACRE)	TOTAL MITIGATION		ON-SITE MITIGATION												*TOTAL ON-SITE MITIGATION*		
				CREATION			RESTORATION			PRESERVATION			ENHANCEMENT					
		(ACRE)	(RATIO)	(ACRE)	(RATIO)	(%) [1]	(ACRE)	(RATIO)	(%) [1]	(ACRE)	(RATIO)	(%) [1]	(ACRE)	(RATIO)	(%) [1]	*(ACRE)*	*(RATIO)*	*(%) [1]*
PFO	113.9	389.81	3.42	43.75	0.38	11.22	0.65	0.01	0.17	224.55	1.97	57.6	1.83	0.02	0.47	*270.78*	*2.38*	*69.46*
PSS	14.29	34.83	2.44	3.98	0.28	11.43	1.61	0.11	4.62	16.18	1.13	46.45	0	0	0	*21.77*	*1.52*	*62.5*
PEM	86.69	55.5	0.64	24.26	0.28	43.71	0.03	0	0.05	14.03	0.16	25.28	0	0	0	*38.32*	*0.44*	*69.05*
PFO Conversion [2]	3.39	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	*N/A*	*N/A*	*N/A*
Mixed [3]	N/A	180.61	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	*N/A*	*N/A*	*N/A*
TOTAL	***218.27***	***660.75***	***3.03***	***71.99***	***0.33***	***10.9***	***2.29***	***0.01***	***0.35***	***254.76***	***1.17***	***38.56***	***1.83***	***0.01***	***0.28***	***330.87***	***1.52***	***50.07***

Notes:

(1) Percent of total mitigation.

(2) Mitigation for PFO wetland to PEM wetland conversion impacts was provided by mitigation wetland bank and in-lieu fee.

(3) This category was used in order to capture acres mitigated through use of mitigation wetland banks and in-lieu fee.

TABLE A-2. ANALYSIS OF ACCEPTED OFF-SITE MITIGATION BY NVRO, 2000-2004

COWARDIN CLASSIFICATION	TOTAL IMPACTS	TOTAL MITIGATION		OFF-SITE MITIGATION												*TOTAL OFF-SITE MITIGATION*		
				CREATION			RESTORATION			PRESERVATION			ENHANCEMENT					
	(ACRE)	(ACRE)	(RATIO)	(ACRE)	(RATIO)	(%) [1]	(ACRE)	(RATIO)	(%) [1]	(ACRE)	(RATIO)	(%) [1]	(ACRE)	(RATIO)	(%) [1]	*(ACRE)*	*(RATIO)*	*(%) [1]*
PFO	113.9	389.81	3.42	52.18	0.46	13.39	0.88	0.01	0.23	63.75	0.56	16.35	2.22	0.02	0.57	*119.03*	*1.05*	*30.54*
PSS	14.29	34.83	2.44	4.53	0.32	13.01	0	0	0	8.53	0.6	24.49	0	0	0	*13.06*	*0.91*	*37.5*
PEM	86.69	55.5	0.64	2.89	0.03	5.21	0	0	0	14.29	0.16	25.75	0	0	0	*17.18*	*0.2*	*30.95*
PFO Conversion [2]	3.39	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	*N/A*	*N/A*	*N/A*
Mixed [3]	N/A	180.61	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	*N/A*	*N/A*	*N/A*
TOTAL	***218.27***	***660.75***	***3.03***	***59.6***	***0.27***	***9.02***	***0.88***	***0***	***0.13***	***86.57***	***0.4***	***13.1***	***2.22***	***0.01***	***0.34***	***149.27***	***0.68***	***22.59***

Notes:

(1) Percent of total mitigation.

(2) Mitigation for PFO wetland to PEM wetland conversion impacts was provided by mitigation wetland bank and in-lieu fee.

(3) This category was used in order to capture acres mitigated through use of mitigation wetland banks and in-lieu fee.

TABLE A-3. ANALYSIS OF ACCEPTED BANK AND IN-LIEU FEE MITIGATION BY NVRO, 2000-2004

COWARDIN CLASSIFICATION	TOTAL IMPACTS (ACRE)	TOTAL MITIGATION		BANK			IN-LIEU FEE		
		(ACRE)	(RATIO)	(ACRE)	(RATIO)	(%) [1]	(ACRE)	(RATIO)	(%) [1]
PFO	113.90	389.81	3.42	N/A	N/A	N/A	N/A	N/A	N/A
PSS	14.29	34.83	2.44	N/A	N/A	N/A	N/A	N/A	N/A
PEM	86.69	55.50	0.64	N/A	N/A	N/A	N/A	N/A	N/A
PFO Conversion [2]	3.39	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mixed [3]	N/A	180.61	N/A	166.89	0.76	92.40	13.72	0.06	7.60
TOTAL	***218.27***	***660.75***	***3.03***	***166.89***	***0.76***	***25.26***	***13.72***	***0.06***	***2.08***

Notes:

(1) Percent of total mitigation.

(2) Mitigation for PFO wetland to PEM wetland conversion impacts was provided by mitigation wetland bank and in-lieu fee.

(3) This category was used in order to capture acres mitigated through use of mitigation wetland banks and in-lieu fee.

TABLE A-4. WETLAND MITIGATION ACCEPTED BY NVRO ANNUALLY, 2000-2004

YEAR	CREATION (acres)	RESTORATION (acres)	PRESERVATION (acres)	ENHANCEMENT (acres)	BANK (credits)	IN-LIEU FEE (mitigation acres)	*TOTAL MITIGATION*
2000	9.7	0	0	0	8.9	0	***18.7***
2001	22.7	0	23.3	0	13.9	0	***59.9***
2002	30.3	0.4	28.3	0.5	60.8	4.8	***125***
2003	41.8	2.3	250.4	2.3	34	2.6	***333.4***
2004	27.1	0.5	39.3	1.2	49.3	6.3	***123.8***
Total	***131.6***	***3.2***	***341.3***	***4.1***	***166.9***	***13.7***	***660.7***

TABLE A-5. WETLAND MITIGATION ACCEPTED BY NVRO FOR INDIVIDUAL PERMITS ANNUALLY, 2000-2004

YEAR	CREATION (acres)	RESTORATION (acres)	PRESERVATION (acres)	ENHANCEMENT (acres)	BANK (credits)	IN-LIEU FEE (mitigation acres)	*TOTAL MITIGATION*
2000	9.7	0	0	0	8.9	0	***18.7***
2001	22.7	0	23.3	0	13.1	0	***59.2***
2002	24.4	0.4	28.3	0.5	46.9	2.8	***103.2***
2003	35.2	1.6	248.8	2.3	14	0.2	***302.2***
2004	15.8	0.3	13.8	1	7	1.9	***39.7***
Total	***107.7***	***2.3***	***314.2***	***3.9***	***89.9***	***5***	***522.9***

TABLE A-6. WETLAND MITIGATION ACCEPTED BY NVRO FOR GENERAL PERMITS ANNUALLY, 2000-2004

YEAR	CREATION (acres)	RESTORATION (acres)	PRESERVATION (acres)	ENHANCEMENT (acres)	BANK (credits)	IN-LIEU FEE (mitigation acres)	*TOTAL MITIGATION*
2000	0	0	0	0	0	0	***0***
2001	0	0	0	0	0.8	0	***0.8***
2002	5.9	0	0	0	13.9	1.9	***21.8***
2003	6.6	0.7	0.6	0	20	2.4	***30.2***
2004	11.3	0.2	25.6	0.2	42.4	4.5	***84.1***
Total	***23.9***	***0.9***	***26.2***	***0.2***	***77***	***8.8***	***136.9***

APPENDIX B – GLOSSARY

Avoidance – "…not taking or modifying a proposed action or impact so that there is no adverse impact to the aquatic environment" (Lawson 2004).

Compensatory Mitigation – "An action taken that provides some form of substitute aquatic resource for the impacted resource" (9 VAC 25-210-10).

Cowardin Classification – A comprehensive wetland and deep water classification system developed in 1979 for the U.S. Fish and Wildlife Service (Cowardin et al. 1979).

- Palustrine wetlands – "…nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 parts per million. These types of wetlands are traditionally known as marsh, swamp, bog, fen, and prairie" (Cowardin et al. 1979).
- Palustrine Emergent Wetlands (PEM) – "…class of wetlands characterized by erect, rooted, herbaceous plants growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content, excluding mosses and lichens. This vegetation is present for most of the growing season in most years and is usually dominated by perennial plants" (Cowardin et al. 1979).
- Palustrine Scrub-Shrub Wetlands (PSS) – "…class of wetlands dominated by woody vegetation less than six meters (20 feet) tall. The species include true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions" (9 VAC 25-690-10).
- Palustrine Forested Wetland (PFO) – "…class of wetlands characterized by woody vegetation that is six meters (20 feet) tall or taller. These areas typically possess an overstory of trees, an understory of trees or shrubs, and an herbaceous layer" (Cowardin et al. 1979).

Draining – "…human-induced activities such as ditching, excavation, installation of tile drains, hydrologic modification by surface water runoff diversion, pumping water from wells, or similar activities such that the activities have the effect of artificially dewatering the wetland or altering its hydroperiod" (9 VAC 25-210-10).

Dredging – "…a form of excavation in which material is removed or relocated from beneath surface waters" (9 VAC 25-210-10).

Excavate or excavation – "…ditching, dredging, or mechanized removal of earth, soil or rock" (9 VAC 25-210-10).

Fill – "…replacing portions of surface water with upland, or changing the bottom elevation of a surface water for any purpose, by placement of any pollutant or material including but not limited to rock, sand, earth, and man-made materials and debris" (9 VAC 25-210-10).

Function – "…all the processes that occur in a wetland. For example, many wetlands capture sediment from surface waters;…" (Lewis 2001).

In-Kind Compensation – "Replacement of a wetland area by establishing, restoring, enhancing, or protecting and maintaining a wetland area of the same physical and functional type" (Corps 2002).

Minimization – "…lessening impacts by reducing the degree or magnitude of the proposed action and its implementation" (Lawson 2004).

Mitigation Credits – Represents the accrual or attainment of aquatic functions at a bank (FR 1995).

Mitigation Debits - Represents the loss of aquatic function at an impact or project site (FR 1995).

Out-of-Kind Compensation – "Replacement of a wetland area by establishing, restoring, enhancing or protecting and maintaining an aquatic resource of different physical and functional type" (Corps 2003).

Perennial Stream – "…means a stream that has flowing water year round in a typical year" (9 VAC 25-690-10).

Section 404 of the Clean Water Act - Section 404 of the CWA requires permits for discharges of dredged or fill material into "waters of the United States" and wetlands and at specified disposal sites. The permit process requires public notice and an opportunity for a public hearing on the proposed permit. The Section 404 permit covers activities such as: development fills, water resource projects (i.e. dams and levees), infrastructure development (i.e. highways and airports) and conversion of wetlands to uplands for farming and forestry (USEPA 2003). Through the Corps approval or disapproval of Section 404 permit applications, the agency implements its jurisdiction over a broad range of varying waterbodies and wetlands.

Significant alteration or degradation of existing wetland acreage or function – "…human-induced activities that cause either a diminution of the a real extent of the existing wetland or cause a change in wetland community type resulting in the loss or more than minimal degradation of its existing ecological functions" (9 VAC 25-210-10).

Value – "Something worthy, desirable, or useful to humanity; although the term is often used in ecology to refer to processes (e.g., primary production) or ecological structures (e.g., trees) as they are "valuable" to the way an ecosystem functions, the term generally should be limited to an anthropocentric connotation. Humans decide what is of 'value' in an ecosystem" (Mitsch and Gosselink 2000).

Wetland Creation – "The manipulation of the physical, chemical, and/or biological characteristics of a site to develop a wetland on an upland or deepwater site, where a wetland did not previously exist. Successful wetland creation or establishment may result in a gain of wetland acreage" (Corps 2002).

Wetland Restoration – “The manipulation of the physical, chemical, and/or biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded wetland. Successful wetland creation or establishment may result in a gain of wetland acreage and/or improvement in wetland functions” (Corps 2002).

Wetland Enhancement – “The manipulation of the physical, chemical, and/or biological characteristics of an existing wetland (disturbed or degraded) site to heighten, intensify, rehabilitate, or improve one or more specific function(s), or to change the growth stage or composition of the vegetation present. Enhancement is undertaken for a specified purpose(s) such as water quality improvement, floodwater retention, or wildlife habitat and does not result in a gain in wetland acreage” (Corps 2002).

Wetland Preservation – “The removal of a threat to, or preventing the decline of wetland conditions in perpetuity by an action in or adjacent to a wetland. Preservation includes but may not be limited to purchase of land or easements, repairing water control structures or fences, recording restrictive covenants on lands, or structural protection…” (Corps 2002).

VITA

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Sarah has worked in the environmental field since she completed her undergraduate studies in 2001. She first worked in the regulatory and compliance department of an environmental consulting agency specializing in industrial wastewater. After a couple of years, Sarah decided to expand her education and knowledge of natural resources management and enrolled in Virginia Tech's Natural Resources Program. During this time, her interests shifted from regulation of wastewater to wetlands. She is now working as a permit writer for the Virginia Water Protection Program in the Virginia Department of Environmental Quality's Northern Virginia Regional Office.