

HARNESSING THE POWER OF MICROSOFT ACCESS FOR THE MANAGEMENT OF NPDES PERMIT COMPLIANCE DATA IN A MULTI-PERMITTEE SCENARIO

Prasad V. Chittaluru, Ph.D., P.E., and Donna Huey
PBS&J, Inc.

1560 Orange Avenue, Suite #400
Winter Park, Florida 32789

ABSTRACT

Full implementation of the United States Environmental Protection Agency's (EPA) NPDES MS4 permit program imposes extensive compliance and reporting requirements on municipalities. Typical requirements include development, revision, and implementation of a comprehensive Storm Water Management Program (SWMP). An overall Annual Report needs to be submitted to EPA, which qualitatively and quantitatively describes the specific task accomplishments and compliance status of each permittee.

EPA is sued a MS4 Permit to Pinellas County and 22 co-permittees, effective November 1, 1997. Pinellas County contracted PBS&J to develop a user-friendly and comprehensive data management system to collect, compile and summarize permit compliance data from all the 23 co-permittees and generate the annual summary report for submission to EPA.

In order to facilitate the collection, analysis and compilation of a vast amount of data from these permittees, Pinellas County contracted PBS&J to develop a user-friendly and comprehensive data management system to perform this challenging task. Though this task appears to be simple in concept, implementation was complicated due to these factors: the portions of permit applicable for each co-permittee vary significantly; the type of data to be collected and reported varied for each co-permittee; no common data collection, storage or analysis methodology existed among the permittees at the time of this project; and the GIS/Database system of the County is not used by several of the co-permittees.

PBS&J successfully accomplished this task through a team of MS4 Permit Experts, GIS Analysts, and Database Designers in conjunction with the staff from all the co-permittees. The Pinellas County NPDES Permit Tracking System was developed as a flexible stand-alone application in Microsoft Access, with a simple and intuitive graphical user interface that even an inexperienced computer user could use with minimal training. Each co-permittee department has the ability to specify their own performance measures without affecting the performance of other departments or co-permittees. Generation of annual summary reports is as simple as a click of a button. The database was designed for use in both a multi-user network environment and a single-user desktop setting, and can be expanded to incorporate spatial intelligence using GIS. This project is a demonstration of the power of applying the new information technology tools in conjunction with specialized functional knowledge of MS4 permits to simplify an otherwise daunting task of tracking NPDES permit compliance activities.

INTRODUCTION

In response to the need for comprehensive National Pollutant Discharge Elimination System (NPDES) requirements for discharge of storm water, Congress amended the Clean Water Act in 1987 to require the U.S. EPA to establish phased NPDES requirements for storm water discharges. To implement these requirements, EPA published the initial permit application requirements in November 1990 for certain categories of storm water discharges associated with industrial activity and discharges from municipal separate storm sewer systems serving populations of 100,000 or more. Municipal categories were classified as medium or large if they serve populations greater than 100,000 or more and 250,000 or more respectively. Applications for these permits were submitted by large and medium municipalities by November 1992 and May 1993 respectively. Many permits have been issued to date throughout the country.

Full implementation of the NPDES MS4 permit program has imposed extensive compliance and reporting requirements on municipalities throughout the country. Requirements for a typical MS4 permit include the development, revision, and implementation of a comprehensive Storm Water Management Program (SWMP) including pollution prevention measures, treatment or removal techniques, storm water monitoring, use of legal authority and other appropriate means to control the quality of storm water discharge from the MS4.

Pinellas County and 22 co-permittees were issued an MS4 permit, which became effective November 1, 1997. Part V of the MS4 Permit requires submission of an overall Annual Report at the end of each permit year, which describes in both narrative and quantitative terms, the task accomplishments and compliance status of each permittee with reference to permit requirements. Summarizing the permit activities and preparing an annual summary report is a challenging task even in a single permittee scenario. With the need to summarize and report the activities of 23 different permittees, the complexity of this task increased many folds. Some of the factors that made this data compilation task more challenging were:

The applicable permit parts were different for each co-permittee

The type of data to be collected for each co-permittee varied in terms of what is reported and how the data was tracked

There was no common approach for data collection, storage and analysis among the co-permittees

The County's preferred database system was not used by other co-permittees

The resources available for the MS4 permit compliance activities were significantly different among the co-permittees, and

A suitable application was to be developed on a short notice due to the time constraints for submission of annual report

The NPDES project managers for Pinellas county and the co-permittees were knowledgeable of the complexity of this task and contracted PBS&J to develop a simple, straight forward method to collect, analyze, and summarize the data related to the MS4 permit compliance, and to automatically generate the Annual Report from the collected data. The County staff also had a vision to expand the NPDES data management system in the future to automate data transfer and data exchange

operations between this system and the County's Maxim0 Work Management System, Oracle system and the GIS system.

Technical Approach

The overall objective of this project was study the MS4 permit requirements and develop a comprehensive and user-friendly data management system to collect, compile and summarize the permit compliance activities from all the permittees and their departments. The product of this data management system is the Annual Summary Report to be submitted to the EPA. In order to best meet the requirements of the County and the Co-Permittees, PBS&J developed a two-phased approach for this project.

Phase I - Application Development in MS Access: In this phase a custom relational database application was developed in Microsoft Access with standard data input screens for all users and a standard report module for all users to automatically generate Annual Summary Reports from the input data.

Phase II - Automated Input Routines for the County: This is a proposed phase in which a Bi-Directional Interface would be developed between the County's database systems (Maximo, Oracle, GIS) and the NPDES Application developed in Phase I, to facilitate seamless data exchange and eliminate duplicate data entry operations.

This paper discusses the design and development of the NPDES Permit Management System implemented to meet the Phase-I requirements discussed above.

Relational Database Design Fundamentals

We are constantly dealing with different types of *data* in our daily life. Data is everywhere, but data is not *information*. Information is data that is organized in a meaningful form with a well-defined structure. Good data management provides the structure necessary for transforming a maze of data into information. A relational database is composed of a number of data tables related to each other through common fields. This facilitates in searching for information across several tables efficiently, economically, and accurately. This makes the data more accessible, easy to maintain, update and use. A relational database management system (RDBMS) is a collection of programs that enables users to create and maintain a relational database (Simpson and Olson, 1997).

Prior to the information revolution, such database management needed a high level of computer knowledge and programming skills. Engineers seldom had such level of skills and therefore had to resort to traditional data management methods. The advent of Windows-based database software with simple Graphical User Interfaces (GUI) virtually eliminated the need of programming knowledge to harness the power of database systems. Database systems also facilitate the implementation of a security protocol for data access.

We all have our own data management systems in place (predominantly spreadsheets). Though they may seem to work fine at the individual level or within small groups, they are likely to be

corrupt the data when multiple users start managing the same data. We end up in situations where we have multiple copies of the same information and have difficulty in identifying the latest and most accurate data. In contrast to spreadsheets, relational database systems are easy-to-use tools for setting up a good data management practice. Using a RDBMS, we can quickly create queries to perform tasks that would have been very complicated to do with spreadsheets and generate a high quality report to summarize your analysis. The number of records (rows) one can have in a file is also a major limitation of spreadsheets. Lotus 1-2-3 (Release 5) allows 8 192 rows and Excel 97 allows 65,536 rows. So if we have large data sets like historical rainfall data or lake levels data or canal stage data, we now have the capability of using databases. We at PBS&J successfully used Access for data sets up to 10 million records.

Microsoft Access is the most popular desktop database in the market today. It is a part of the MS Office Professional Edition. It is easy to use yet powerful enough to dramatically improve our traditional data management systems. Due to its popularity, simplicity of use and its capabilities, MS Access was chosen as the RDBMS environment for developing the NPDES Permit Tracking System.

Setting up the Database Design

Any RDBMS is only as good as the design of the underlying tables and their relationships. In order to develop a good database design, it is essential to have a development team that has sound, functional knowledge of the problem as well as good database software designers. It is also imperative to discuss the needs of the clients in detail and get their approval prior to embarking on the design process (Elmasri and Navathe, 1994).

PBS&J assembled a team of MS4 Permit Experts, Storm Water Engineers, GIS Analysts, and Database Designers in order to develop the database design for the NPDES Permit Management System. Meetings were held with the responsible staff from all the 23 co-permittees. The MS4 permit experts studied the permit in great detail to understand the key items and requirements. A typical MS4 permit consists of nine (9) major program elements:

- Structural Controls and Stormwater Collection System Operation
- Areas of New Development and Significant Redevelopment
- Roadways
- Flood Control Projects
- Municipal Waste Treatment, Storage or disposal facilities not Covered by an NPDES Storm Water Permit
- Pesticide, Herbicide, and Fertilizer Application
- Illicit Discharges and Improper Disposal
- Industrial and High Risk Runoff
- Construction Site Runoff

Each of the program elements requires a set of tasks to be performed in order to achieve compliance. Each such task was assigned a task number and the activities required to be performed under each task to achieve compliance were outlined by the MS4 experts. These activities were designated as performance measures and the activities performed by each co-permittee under each performance measure were to be summarized accordingly. The performance measures were grouped

under four major categories namely date, inventory, project and compliance status. Each of these groups is briefly discussed below.

Date Dependent Activities: Date dependent activities are those actions that need to be completed by a specific date provided within the NPDES permit. These are actions such as completing a report by the end of the first permit year or implementing a specific program within 24 months of the effective date of the permit.

Inventory Driven Activities: Inventory driven activities are those activities for which a count will be provided in the annual report to EPA. These are activities such as screening a percentage of your total outfalls for potential pollutants or recording the number of public education activities provided. The system continues to keep track of all data entries so that at any point in time the user can see the total number reported to date prior to entering new records.

Project Related Activities: Project related activities are those activities where the compliance action is tied directly to individual projects and is managed on a project by project basis. These are such activities as keeping track of new development activities or making sure new projects comply with applicable best management practices as outlined in the NPDES permit document. All individual data entries are maintained within the system and the annual report is designed to generate a summary table showing how many projects were reviewed and found to be in compliance and how many were reviewed and found not to be in compliance.

Compliance Status Activities: Compliance status check activities are those activities for which a simply yes or no answer is sufficient to satisfy the action required by the NPDES permit. These are such activities as maintaining internal records or form a committee. The status of compliance may change throughout the permit year. As the compliance status changes and that information is recorded within the system, all individual entries will be maintained, however, the last change will be the status that is recorded within the annual report.

MS4 permit requirements were broken down into simple tasks. Each task was provided with a list of suggested performance measures, which would help in ensuring permit compliance. This formed the basis for the development of a database system in Microsoft Access environment to track all the compliance actions. The database was designed for use in both a multi-user network environment and a single-user desktop setting. The relationship between each of these database elements is depicted in Figure 1.

Development of Graphical User Interface

In order for the RDBMS to be utilized effectively by Pinellas County and the co-permittees it had to be created with an intuitive and user friendly graphical interface. It was the goal of this program to ensure ease of use due to the varied computer experience of many of the co-permittees. To accomplish ease of use, one of the most important considerations is the logical flow of information review and input. Additionally, no one form can contain more information than a typical user can digest quickly.

Additional considerations included the ability to incorporate security measures. Initial login screens were developed to allow the user to choose their appropriate group and input a password before having access to any data entry screens. These forms were developed with consistent look and feel as the data entry forms to give the user a consistent interface from which to work.

Finally, the creation of the annual report documents needed to be accessed through these forms. The users needed to be provided flexibility to modify the reporting period. Custom coding was implemented in order to provide this flexibility while still preventing the user to modify the report format and design. Sample log-in, data entry and report creation screens are presented in Figure 2 to illustrate the easy-to-use visual interface developed for the NPDES Permit Management System.

Database Usage

Database usage follows a logical progression. The user logs into the database by choosing their appropriate group and entering the approved password. Based upon who logs in, the system automatically sub-sets the permit requirements based upon guidelines established at each participating municipality. The user can immediately upon entering the system review these overall requirements for which they have responsibility, generate summary report documents, or begin to add or edit data. If the user chooses to add or edit data they are provided the option to choose the particular required action for which they would like to enter data. Once the compliance data has been entered into the system, many different report formats are available for permit managers to review the data at various levels of summary. Certain users have additional access to modify the performance measures for required actions in order to better accommodate their business practices. The user navigation flow chart is documented in Figure 3.

Main Program Entry Screen

Pinellas County NPDES Permit Tracking System
Permit Number FL5000005

Welcome to the Pinellas County NPDES Permit Tracking System!

Please Sign In with your User Name and Password...

Department:

Password:

Please make your choice by clicking on the appropriate button...

Pinellas County NPDES Permit Tracking System
Permit Number FL5000005

Welcome to the Pinellas County NPDES Permit Tracking System!

Using this system you can track your Storm Water Management Program Implementation and the NPDES Permit Compliance. You can review Permit Requirements, Assign Custom Performance Measures for Activities, Enter Monitoring Data, and Generate Reports.

Permit Part #

Please make your choice by clicking on the appropriate button...

End Date:

Permit Task Selection Screen

Pinellas County NPDES Permit Tracking System

Browse through and select the desired activity using navigation buttons below ...

Permittee: Department:
 Permit Part #: Permit Page #:
 Description:
 Activity:
 Deadline:

Please make your choice by clicking on the appropriate button...

Example Data Entry Screen

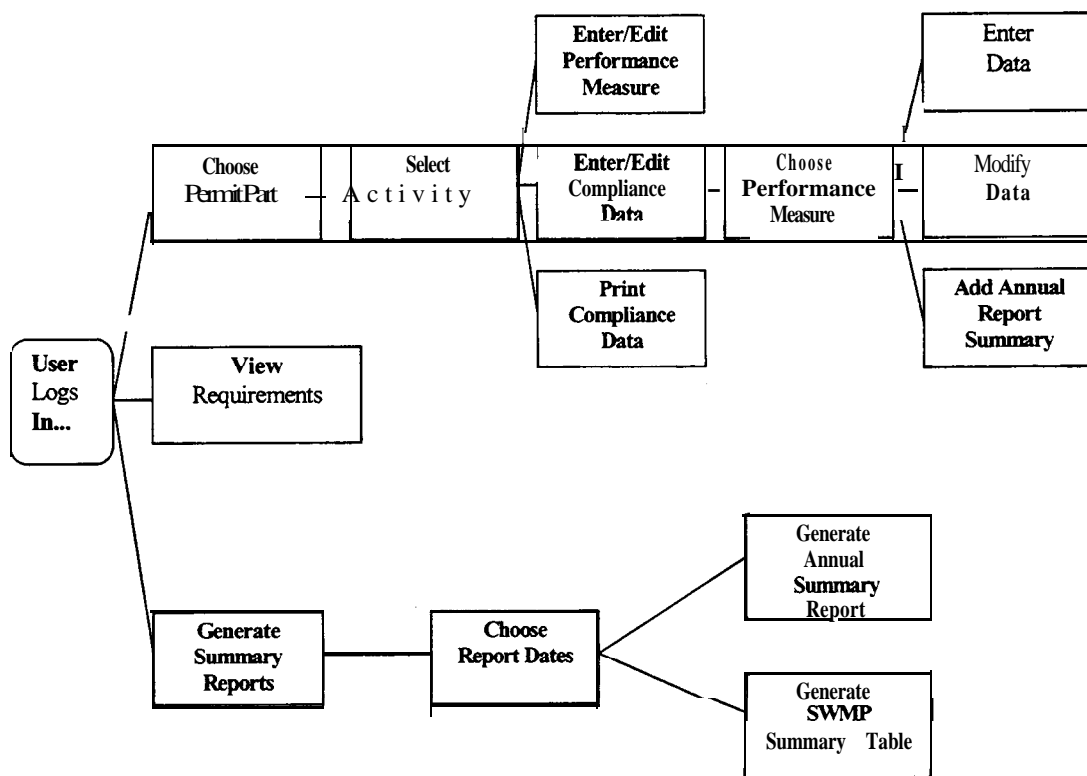
Pinellas County NPDES Permit Tracking System

Enter "Inventory" Compliance Data for the Selected Performance Measure...

Date:
 Permittee: Permit Measure No.:
 Department: Performance Class:
 Description:

Inventory Details ...

Reported To Date:
 Current # Reported:
 Compliance Status: No Yes



CONCLUSIONS

This database system is emerging as a valuable tool for the County's NPDES Program Coordinator who has the onerous task of preparing the Annual Permit Compliance Summary Report. The database can be expanded in the future to incorporate spatial intelligence using GIS or can be integrated with other County databases. This project is a demonstration of the power of applying state-of-the-art information technology tools in conjunction with specialized functional knowledge of MS4 permits to simplify an otherwise daunting task of tracking permit compliance activities of 23 different co-permittees and their departments. It is imperative for the civil engineers of the next millennium to be aware of the new developments in information technology and be able to harness the power of the new software tools. This will result in developing innovative and more efficient solutions to many of our project tasks.

REFERENCES

- Alves, J., White, B., Potts, E., *NPDES Permitting for Industrial and Domestic Wastewater Discharges*, Presented at Florida Chamber of Commerce 15th Annual Permitting Short Course, Orlando, Florida, February 1999.
- Elmasri, R. and Navathe, S. B., *Fundamentals of Database Systems* Addison-Wesley Publishing Company, New York, New York, 1994.
- Lienhart, S., et al., *NPDES Stormwater Permitting Phase 2*, Presented at Florida Chamber of Commerce 15th Annual Permitting Short Course, Orlando, Florida, February 1999.
- Simpson, A. and Olson, E., *Mastering Access 97*, Sybex, Inc., Alameda, California, 1997.