UNIVERSITI PUTRA MALAYSIA

WATERSHED ANALYSIS OF THE SEMENYIH RIVER BASIN, SELANGOR,MALAYSIA

MUHAMMAD BARZANI GASIM

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WATERSHED ANALYSIS OF THE SEMENYIH RIVER BASIN, SELANGOR, MALAYSIA

By

MUHAMMAD BARZANI GASIM

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, In Fulfilment of the Requirement for the Degree of Doctor of Philosophy

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DEDICATION

This doctoral thesis is dedicated to the following most patient person in my life, especially to:

My mother, SALEHAH

My Wife, SUSAN

My Kids:

Haniff

Nabilah

Fadhil

And

Abd. Razak

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirements for the degree of Doctor of Philosophy

WATERSHED ANALYSIS OF THE SEMENYIH RIVER BASIN, SELANGOR, MALAYSIA

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September 2003

Chairman: Associate Professor Wan Nor Azmin Sulaiman, Ph.D.

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The Semenyih River Basin has undergone various degrees of land use changes since the last decade, particularly associated with urbanization and industrialization. The total area of the basin is 266.60 km^2 and contains 36 sub-catchments with sizes ranging from 1.37 to 35.57 km^2. An integrated study was carried out to determine the various factors of land use changes that may affect the stability of the watershed and its subsequent impacts on water quality. Rock and soil samples were analyzed in a petrographic and XRF methods and sieve analysis for soil. Rainfall-runoff relationships were created to elucidate the hydrologic responses and to develop the graphical analysis. Stream flow pattern of particular years were grouped to show their flow variations. 18 water quality parameters were performed from the 11 sampling locations at the Semenyih River that were also used for the hydrological measurements. The water quality analysis is involved 4 in-*situ* parameters and 14 laboratory parameters. The relationships of hydrology and water quality variables were determined by regression and correlation analysis. The above three criteria was used together with land use and population density factors to develop the basin classification system.

The geology of the study area consists of five rock formations with the dominant feature being granitic rocks. The soil in the study area comprises seven soil series and five types of soil texture. Seven categories of land use were identified and forests constitute the largest land use. Rainfall-runoff relationships based on hydrologic response analysis showed that urbanization in Semenyih town contribute to significant surface runoff compared to the other land uses. Graphical analysis indicated that the Semenyih dam regulates the flow of the Semenyih River. The principal categories of pollution sources were from domestic activities, industries, manufacturing activities and land clearing activities. The results indicated that water quality deterioration due to urban wastes was significant (WQI 56 to 48). The mean values for eight water quality parameters (turbidity, TDS, NO_3, NH_3-N, SO_4, BOD, *E.coli* and COD) increased by 30% to 50% (WQI 53 to 36) during wet periods. The mean concentration of the water quality parameters analyzed between dry and wet periods was significantly different ($p<0.05$). The results of the Semenyih River Basin classification was established for the 36 sub-catchments and indicated that 12 forested sub-catchments can be classified as "good"; six agriculture and forested sub-catchments as "fair"; ten agriculture and settlements sub-catchments as "slightly disturbed" and eight urban sub-catchments classified as "disturbed". Finally, based on this study it can be concluded that the condition of the Semenyih Basin is slightly disturbed. In the near future, more land will be developed, due to increase in infrastructure development, population and industrial activities that will increase of the pollution level in the Semenyih River.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

ANALISIS LEMBANGAN SUNGAI SEMENYIH, SELANGOR, MALAYSIA

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Pengerusi: Profesor Madya Wan Nor Azmin Sulaiman, Ph.D.

Fakulti: Sains dan Pengajian Alam Sekitar

Lembangan Sungai Semenyih telah mengalami pelbagai tingkatan perubahan guna tanah sejak dekad lalu, terutamanya yang berkaitan dengan perbandaran dan perindustrian. Keluasan lembangan ialah 266.60 km persegi, mengandungi 36 sub-lembangan dengan julat keluasan di antara 1.37 sehingga 35.57 km persegi. Suatu kajian integrasi telah dijalankan untuk menentukan kepelbagaian faktor penyebab perubahan guna tanah yang mempengaruhi kestabilan lembangan dan seterusnya memberikan kesan kepada kualiti air. Contoh batuan dan tanih telah dianalisis menggunakan kaedah petrografi dan XRF dan analisis sieve untuk tanih. Hubungan hujan-air larian diwujud untuk memperjelaskan keadaan kesan hidrologi serta untuk membentuk analisis grafik. Corak larian air bagi selang masa beberapa tahun telah dikelompokkan untuk menunjukkan variasi aliran. 18 parameter kualiti air dan pengukuran hidrologi telah dilakukan berdasarkan kepada 11 lokasi pensampelan di Sungai Semenyih. Analisis kualiti air adalah melibatkan 4 parameter insitu dan 14 parameter makmal. Perhubungan diantara variable-variabel hidrologi dan kualiti air ditentukan menggunakan analisis regresi dan korelasi. Ketiga kriteria di atas digabungkan dengan faktor guna tanah dan ketumpatan penduduk untuk membangunkan sistem pengkelasan lembangan .

Geologi kawasan kajian terdiri dari lima formasi batuan dengan didominasikan oleh batuan granit. Tanah di kawasan kajian terdiri daripada tujuh siri tanah dan lima jenis tekstur tanah. Tujuh kategori guna tanah telah dikenal pasti dengan hutan merupakan kategori guna tanah yang terluas. Hubungan di antara hujan dan air larian berdasarkan kajian kesan hidrologi menunjukkan bahawa kegiatan perbandaran di Pekan Semenyih adalah penyumbang kepada berlakunya air larian permukaan yang signifikan jika dibandingkan dengan jenis guna tanah yang lain. Analisis secara grafik menunjukkan bahawa aliran Sungai Semenyih berada dibawah kawalan Empangan Semenyih. Kategori utama sumber pencemaran telah dikenal pasti, iaitu hasil buangan dari kegiatan domestik, kegiatan pembuatan dan kegiatan pembukaan tanah. Hasil kajian mendapati bahawa pencemaran keatas kualiti air yang disebabkan oleh buangan bandar secara amnya adalah signifikan (WQI 56 hingga 48). Kepekatan tujuh parameter kualiti air (turbiditi, TDS, NO_3, NH_3-N, SO_4, BOD, *E.coli* dan COD) meningkat sehingga 30% ke 50% semasa pensampelan musim hujan. Purata ketumpatan beberapa parameter kualiti air yang dianalisis diantara musim kering dan musim hujan adalah berbeza secara signifikan ($p<0.05$). Hasil daripada pengkelasan terhadap 36 sub-lembangan Sungai Semenyih menunjukkan bahawa 12 sub-lembangan termasuk dalam kategori guna tanah hutan dikelaskan sebagai "baik"; enam sub-lembangan pertanian dan hutan sebagai "sederhana"; sepuluh sub-lembangan pertanian dan penempatan sebagai "sedikit terganggu" dan lapan sub-lembangan dikelaskan sebagai "terganggu". Akhirnya, dapatlah disimpulkan dalam kajian ini bahawa Lembangan Semenyih berada dalam keadaan sedikit terganggu. Pada masa hadapan Lebih banyak lagi kawasan akan berkembang seiring dengan meningkatnya pembangunan infrastruktur, peningkatan jumlah penduduk dan kegiatan perindustrian yang seterusnya akan membawa kepada meningkatnya paras pencemaran Sungai Semenyih.

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