LANDFILL SITE SUITABILITY USING GEOGRAPHIC INFORMATION SYSTEM AND ANALYTICAL HIERARCHY PROCESS

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This entire research is dedicated with deepest love to my dearest parents, sisters, brothers, fiancé and family.

Thank you for their never ending love, trust, understanding, support, and motivation.

May Allah give us the best rewards.

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ABSTRACT

In solid waste management, landfilling is the lowest ranking of waste management, but it is still widely practiced because it is convenient and consumer friendly. Unfortunately, many landfill sites have closed and this is a main issue in solid waste management. The purpose of this study is to suggest suitable and potential sites for landfill in Johor Bahru area through mapping technique and database system by using parameters that had been identified. Landfill site selection is a complex task because it needs to consider many criteria including economic, social, geological and environmental criteria. Analytical Hierarchy Process (AHP) is a method for analysis and supports decision where multiple and competing objectives are involved and multi alternatives are available. AHP is grouped in Multi Criteria Decision Analysis used to analyze landfill site suitability method. An extensive literature study on previous landfill site selection was conducted. Fifteen parameters were identified to use in AHP process. In this method, the process is divided into hierarchy before pair wise comparison was done and the result is prioritizing according to their weightage. The process is continued with weightage evaluation and its consistency. Landfill site selection process involved many spatial data and strenuous in handling it. Thus, Geographic Information System (GIS) can give significant help because it can potentially handle large volume of data that need to be evaluated and processed. The method used in GIS is digitizing, buffering and overlays. As a result in AHP, the most important criterion is river weighted 0.149 or 14.9% of all criteria and the least important criteria are distance to main road weighted 0.028 or 2.8% of other criteria. In GIS method, there are six parameters selected which are main road, plantation, residential area, swamp, grassland and river coverages. The findings identified two potential sites for landfill area because it satisfied all given requirements. As a conclusion, integration of GIS and AHP is suitable to be used in landfill site selection process.

ABSTRAK

Didalam pengurusan sisa pepejal, tapak pelupusan berada di kedudukan terendah bagi pengurusan sisa. Walau bagaimanapun, ianya tetap diamalkan secara meluas kerana mudah dan mesra pengguna. Namun, banyak tapak pelupusan telah ditutup dan ianya menjadi isu utama di dalam pengurusan sisa pepejal. Tujuan kajian ini adalah untuk mencadangkan tapak pelupusan yang baru bagi kawasan Johor Bahru menggunakan teknik pemetaan dan pangkalan data dengan menggunakan parameter-parameter yang telah dikenal pasti. Pemilihan tapak pelupusan sampah merupakan satu tugas yang rumit kerana ia perlu mengambil kira banyak kriteria termasuk kriteria ekonomi, sosial, geologi dan alam sekitar. *Analytical Hierarchy Process* (AHP) adalah satu kaedah analisis dan menyokong keputusan yang melibatkan pelbagai objektif yang bersaing dan pelbagai alternatif sebagai hasil akhir. AHP adalah salah satu kaedah di dalam Analisis Keputusan Pelbagai Kriteria yang digunakan untuk menganalisis kaedah kesesuaian tapak pelupusan. Kajian literatur secara mendalam telah dijalankan terhadap pemilihan tapak pelupusan sampah yang terdahulu. Lima belas parameter telah dikenal pasti untuk digunakan di dalam proses AHP. Dalam kaedah ini, proses dibahagikan kepada tatatingkat sebelum perbandingan berpasangan dilakukan dan keputusannya disusun mengikut keutamaan pemberat mereka. Proses diteruskan dengan penilaian pemberat dan keseragamannya. Pemilihan tapak pelupusan membabitkan banyak data spatial dan kompleks untuk diuruskan. Oleh itu, Sistem Maklumat Geografi (GIS) digunakan kerana ia berpotensi untuk mengendalikan jumlah data yang besar yang perlu dinilai dan diproses. Kaedah yang digunakan dalam GIS ialah pendigitalan, penampaman, dan penindihan. Keputusan daripada AHP ialah, kriteria yang paling penting adalah sungai dengan pemberat 0.149 atau 14.9% daripada semua kriteria dan kriteria yang paling kurang penting adalah jalan utama dengan pemberat 0.028 atau 2.8% daripada kriteria lain. Dalam kaedah GIS, terdapat enam parameter dipilih iaitu jalan raya utama, ladang, kawasan perumahan, paya, rerumput dan sungai. Keputusannya menunjukkan dua tapak yang berpotensi untuk kawasan tapak pelupusan baru dikenal pasti kerana memenuhi syarat-syarat yang telah ditetapkan. Kesimpulannya, penggabungan diantara GIS dan AHP adalah sesuai digunakan dalam proses pemilihan tapak pelupusan sampah.