Identification of Suitable Electronic Waste Disposal Site in Dhaka

Md Rakibul Hasan Arif and Mohammad Rafayet Hossain

***Abstract*—Dhaka, the capital of Bangladesh, has been experiencing rapid growth, and demand for new technology and electronic products is increasing day by day. This study aims to identify a suitable location for the disposal of e-waste in Dhaka City. Two objectives under this study were selecting relevant criteria and ranking all the criteria for determining a suitable e-waste disposal site. Seven criteria have selected under this study: residence, agriculture, waterbody, commercial land use, road network, soil characteristics, and slope of the study area. After the finalization of factors and identifying suitable parameters, Pairwise Comparison has been used to determine the weightage of all the factors. In this regard, buffer maps of different land use and slope maps have prepared. After converting vector maps into raster, reclassification of all the maps has been done, providing priority scale value from one to five indicating least suitable to most suitable. Weighted overlay analysis has done after reclassifying all the maps, and four potential e-waste disposal sites have found within the study area's territory. But three sites were within cantonment and other restricted areas. A suitable land has located in Tejgaon Industrial Area, which fulfils all the criteria. The surrounding land use of the area is manufacturing and processing activity which is compatible with the proposed disposal activities.**

***Index Terms*—Buffer, e-waste, incineration, multiplier, suitability.**

I. Introduction

From the 20th century, rapid changes in human civilization can be seen with the time being in association with technological advancements [1]. Due to increasing demand, the use of electronic products and number of electronic wastes are increasing day by day. There are four ways of disposal of e-waste: landfilling, incineration, recycling, and exportation. In Dhaka, only a small amount of e-waste is recycled mainly in Nimtali, Dholaikhal, and Elephant Road which are the major informal disposal sites ([2]-[4]). The concentration of informal disposals of e-waste is also high in Islampur, Kamrangirchar, Gingira, Mirpur 11, Mirpur 12, and Mohammadpur, etc. ([2], [4]). The disposal task has been done in small shops which are known as “Vangari shops” located in the densely populated area with no protection measure. According to the statistics, more than 12000 urban poor are engaged in e-waste disposal sectors without knowing its adverse impact on them [4]. Co-ordinated efforts are required for proper disposal of e-waste as it is involved with the protection of livelihood, health, and the environment [1].

Manuscript received March 29, 2022; revised June 25, 2022.

Md Rakibul Hasan Arif is with Royal Melbourne Institute of Technology, Melbourne, Victoria, Australia (e-mail: rakibulhasanarif@rocketmail.com).

Mohammad Rafayet Hossain is with College of Design, Iowa State University, Ames, IA 50011, USA (e-mail: m.h.rafayet@gmail.com).

II. Study Area

Being the capital, Dhaka is expected to generate a significant share of e-waste within the country. As a study area, Dhaka North City Corporation (DNCC) and Dhaka South City Corporation (DSCC) have been selected (Fig. 1). In this regard, Group C of the Detailed Area Plan has considered as the study area, which includes most of the parts of Dhaka North and South City Corporation. The study area has divided into 13 planning zones known as Detailed Planning Zones, DPZ [5].

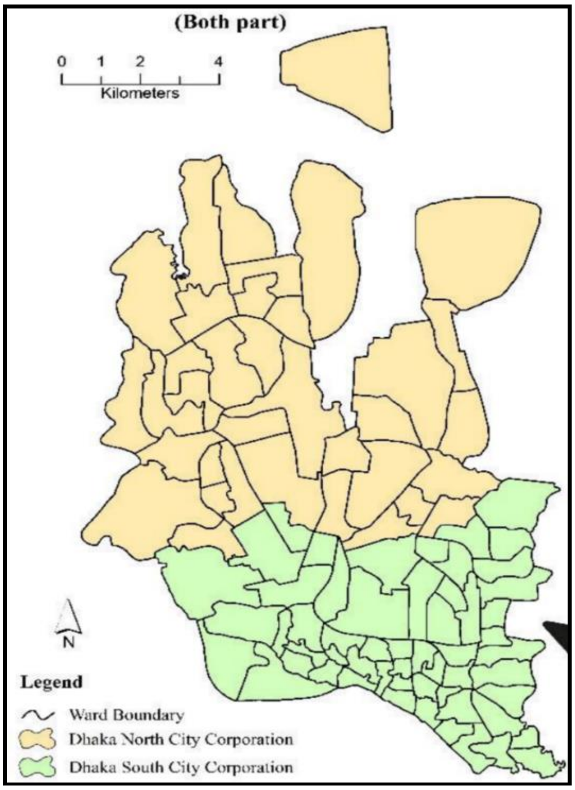

Fig. 1. Study Area.

III. Methodology

The study is conducted into two stages; identify the weightage of all the factors of consideration and GIS-based overlay analysis. After selecting all the factors, suitability analysis has been done based on the Pairwise comparison technique using Analytical Hierarchy Process (AHP). The consistency of the study has checked, and the judgment of the criteria is at an acceptable level. After the consistency check, all the constraints and potential factors have converted into thematic maps. The site suitability level is determined by calculating the Suitability Index (SI). Relative Importance Weights (RIWs) are aggregated to calculate SI at each level

doi: 10.18178/joebm.2022.10.5.717

of the criteria or factors. RIWs are the weights of the elements that are derived from the Pairwise Comparison (AHP technique). Within GIS applications, the map algebra function has used to determine SIs for raster cells. The higher number for a given cell indicates a more suitable potential site for disposal.

A. Analytical Hierarchy Process (AHP)

The analytic hierarchy process (AHP) method is one of the most used methods in decision-making processes. It aims to quantify the relative priority of the given set according to the appropriate value scale. The decision is usually based on the perception of the individual who is supposed to make the final decision and assess priorities, emphasizing the importance of consistency and correlation of the alternatives compared in the whole decision-making process. AHP method is very flexible because it produces a simple way to find the relationship between criteria and alternatives. This method thereby assesses the relevance of the criteria in the real world. It determines the interaction between the criteria in case of complex problems with many criteria and a relatively large number of alternatives. By this method, complex problems could be decomposed into specific hierarchies [6].

B. Weighted Overlay

The Weighted Overlay tool applies one of the most used approaches for overlay analysis to solve multicriteria problems such as site selection and suitability models. In a weighted overlay analysis, each of the general overlay analysis steps are followed. ArcGIS completes the task into six stages, these are each raster layer is assigned a weight in the suitability analysis; values in the raster are reclassified to a common suitability scale; raster layers are overlayed, weight and totaling the values to derive a suitability value; values are written to new cells in an output layer, and the symbology in the output layer is given based on these values.

IV. Data Collection

For the study, relevant data have collected from both primary and secondary sources. At first, the World Health Organization (WHO) guidelines were studied for preliminary selection of criteria and sub-criteria. Two primary criteria were preliminarily selected: the first criterion is the distance from surrounding land use, and the second criterion is characteristics of geological features. Eight sub-criteria have chosen under the first criterion, and two sub-criteria have selected under the second criterion (Table I). After the preliminary selection of criteria and sub-criteria, an expert survey was done using the Delphi method.

In round 01, 10 sub-criteria within two major criteria have been selected based on several international hazardous waste disposal site standards. The experts were asked to choose and rank the criteria in the context of Bangladesh. Based on expert opinion, the criteria and sub-criteria were finalized. In round 02, the panels of experts were asked to conduct a pairwise comparison between sub-criteria to rank and identify the criteria of greater importance. In round 03, the experts were asked to rank the sub-criteria from unsuitable to highly suitable. Based on their opinion Analytical Hierarchy Process (AHP) has been done to identify the weightage of each criterion, and sub-criteria and Consistency Ratio was identified to check whether the study is reliable or not.

TABLE I: Selection of Criteria and Sub criteria by experts in Round 1, 2, and 3

Selection Criteria	Sub criteria	Criteria 01, 02, 03	Sub criteria 01	Sub criteria 02	Criteria round 03
Distance from land use	Residence	Yes	Yes	Yes	Yes
	Agriculture		Yes	Yes	Yes
	Industry		Yes	Yes	No
	Commercial		Yes	Yes	Yes
	Historical		Yes	Yes	No
	Road		Yes	Yes	Yes
	Water body		Yes	Yes	Yes
	Welfare Center		Yes	Yes	No
Geological features	Water table	Yes	Yes	No	No
	Slope		Yes	Yes	Yes
	Soil type		Yes	Yes	Yes

V. Data Collection

A. Selection of Factors and Identification of Suitable Distance

Sub-criteria or factors under two criteria were finalized by the end of Round 02 of the Delphi Method. To select a suitable e-waste disposal site, distance from residential, commercial, and service activities is required to be considered as disposal practices may impact the living condition, natural, and human environment.

TABLE II: Finalization of Suitable Distance from Different Land Uses Based on Expert Opinion in Delphi Method (Round Three)

Criteria	Sub criteria	Ranges	Suitability
Distance from Land use	Residential	0-300	Not Suitable
		300-600	Neutral
		>600	Highly Suitable
	Agricultural	0-1000	Not Suitable
		1000-2000	Neutral
		>2000	Highly Suitable
	Water body	0-300	Not Suitable
		300-600	Neutral
		>600	Highly Suitable
	Commercial and service activities	0-250	Not Suitable
		250-500	Neutral
		>500	Highly Suitable
	Road	0-100	Highly Suitable
		100-200	Neutral
		>200	Not Suitable
Geological features	Soil type	Sand	Not Suitable
		Alluvial	Neutral
		Clay	Highly Suitable
	Slope	0-5 degree	Highly Suitable
		5-10 degree	Neutral
		>10 degree	Not Suitable

Commercial and service activities include commercial land use, service activity, and Government services. Distance from the water body and agricultural land use is a significant factor because there is the probability of pollution by surface runoff. The road is also a very important factor because the disposal site requires accessibility of transportation. Geological features such as slope and soil type are considered to reduce the possibility of waterlogging. (Table II). After finalizing all the factors and suitability ranges, the experts have done Pairwise Comparison of the factors. Each expert was asked to compare seven selected factors according to their preference (Table III).

TABLE III: PREFERENCE SCALE OF PAIRWISE COMPARISON IN AHP

Preference level	Preference value
Equally preferred	1
Moderately preferred	3
Strongly preferred	5
Very strongly preferred	7
Extremely preferred	9
Intermediate values	2, 4, 6, 8

B. Calculation of Weightage of the factors

After the Pairwise Comparison of the factors, their weightage is determined by following the AHP method for each expert (Table IV, Table V, Table VI).

TABLE IV: PAIRWISE COMPARISON MATRIX FOR EXPERT 01 (ROUND 03)

Sub criteria	Residential (C_1)	Agriculture (C_2)	Water body (C_3)	Commercial (C_4)	Road (C_5)	Clay Soil type (C_6)	Slope (C_7)
Resid. (R_1)	1	2	3	5	3	5	9
Agri. (R_2)	$\frac{1}{2}$	1	$\frac{1}{2}$	3	3	5	7
Water (R_3)	$\frac{1}{3}$	2	1	3	5	5	7
Commer. (R_4)	$\frac{1}{5}$	$\frac{1}{3}$	$\frac{1}{3}$	1	$\frac{1}{3}$	3	3
Road (R_5)	$\frac{1}{3}$	$\frac{1}{5}$	$\frac{1}{3}$	3	1	3	5
Clay Soil (R_6)	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{7}$	$\frac{1}{3}$	1	3
Slope (R7)	$\frac{1}{9}$	$\frac{1}{5}$	$\frac{1}{7}$	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$	1
Sum	**2.677**	**5.933**	**5.509**	**15.476**	**12.999**	**22.333**	**35**

[1-Equally preferred, 3-Moderately preferred, 5-Strongly preferred, 7-Very strongly preferred, 9- Extremely preferred; 2, 4, 6, 8- Intermediate value between adjacent judgments the two]

For Residential land use,

$$\sum C_1 = 1+\frac{1}{2}+\frac{1}{3}+\frac{1}{5}+\frac{1}{3}+\frac{1}{5}=2.677$$

Similarly, C2, C3, C4, C5, C6, C7 have calculated.

TABLE V: CALCULATION OF AVERAGE WEIGHTAGE OF THE FACTORS

Sub criteria	Residential (C_1)	Agriculture (C_2)	Water body (C_3)	Commercial (C_4)	Road (C_5)	Clay Soil type (C_6)	Slope (C_7)	Average Weightage (C_8)
Residential (R_1)	$\frac{1}{2.677}$	$\frac{2}{5.933}$	$\frac{3}{5.509}$	$\frac{5}{15.476}$	$\frac{3}{12.999}$	$\frac{5}{22.333}$	$\frac{9}{35}$	0.327
Agriculture (R_2)	$\frac{.5}{2.677}$	$\frac{1}{5.933}$	$\frac{.5}{5.509}$	$\frac{3}{15.476}$	$\frac{3}{12.999}$	$\frac{5}{22.333}$	$\frac{7}{35}$	0.185
Water body (R_3)	$\frac{.333}{2.677}$	$\frac{2}{5.933}$	$\frac{1}{5.509}$	$\frac{3}{15.476}$	$\frac{5}{12.999}$	$\frac{5}{22.333}$	$\frac{7}{35}$	0.235
Commercial (R_4)	$\frac{.2}{2.677}$	$\frac{.333}{5.933}$	$\frac{.333}{5.509}$	$\frac{1}{15.476}$	$\frac{.333}{12.999}$	$\frac{3}{22.333}$	$\frac{3}{35}$	0.072
Road (R_5)	$\frac{.333}{2.677}$	$\frac{.2}{5.933}$	$\frac{.333}{5.509}$	$\frac{3}{15.476}$	$\frac{1}{12.999}$	$\frac{3}{22.333}$	$\frac{5}{35}$	0.110
Clay Soil type (R_6)	$\frac{.2}{2.677}$	$\frac{.2}{5.933}$	$\frac{.2}{5.509}$	$\frac{.143}{15.476}$	$\frac{.333}{12.999}$	$\frac{1}{22.333}$	$\frac{3}{35}$	0.044
Slope (R7)	$\frac{.111}{2.677}$	$\frac{.2}{5.933}$	$\frac{.143}{5.509}$	$\frac{.333}{15.476}$	$\frac{.333}{12.999}$	$\frac{.333}{22.333}$	$\frac{1}{35}$	0.027
Sum	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**

For Residential land use,

$$\text{Average weightage}=\frac{0.374+0.337+0.545+0.323+0.231+0.224+0.257}{7}=0.327$$

Similarly, R_2, R_3, R_4, R_5, R_6 and R_7 have calculated. Calculation of Eigen value for R_1

For R_1,

Eigen vector = (.374*.327) + (.337*.185) + (.545*.235) + (.323*.072) + (.231*.110) + (.224*.044) + (.257*.027) = 2.557

Similarly, the value of R_2, R_3, R_4, R_5, R_6 and R_7 are being calculated, respectively.

The rationality of the expert opinion has been checked by using Consistency Ratio. Consistency ratio is a comparison between Consistency Index and Random Index.

$$\text{Consistency Index}=\frac{\lambda\max - n}{n-1}$$

λmax= Principal (Summation) Eigen value

n = Number of Factors

Random Indices for Consistency Check

N	1	2	3	4	5	6	7	8	9	10
Random Index	0	0	.58	.9	1.12	1.24	1.32	1.41	1.45	1.51

If the judgment is consistent the consistency ratio will be less than or equal to 10% and if the value is greater than 10%, the judgment will be considered inconsistent.

TABLE VI: AVERAGE WEIGHTAGE AND CALCULATION OF EIGEN VALUE

Sub Criteria	Avg. (C_7)	Eigen Value
Residential (R_1)	0.327	2.557
Agriculture (R_2)	0.185	1.423
Water body (R_3)	0.235	1.890
Commercial (R_4)	0.072	0.528
Road (R_5)	0.110	0.819
Clay Soil (R_6)	0.044	0.323
Slope (R7)	0.027	0.209
Sum	**1.000**	**7.748**

Based on the opinion of Expert 01

Consistency Index (CI) =0.125, for *n*=7, Random Index (RI) =1.32

Consistency Ratio=CI/RI=.125/1.32=.094<.1 or 10%, The judgment is consistent.

Similar procedure has been followed for the other four experts. Detailed calculation has been included in E-Component.

TABLE VII: CALCULATION OF CONSISTENCY RATIO

Calculation	Expert 01	Expert 02	Expert 03	Expert 04	Expert 05	Expert 06
Consistency Index (CI)	.125	.120	.170	.094	.121	.117
Random Index (RI) For N=7	1.32	1.32	1.32	1.32	1.32	1.32
Consistency Ratio (CI/RI)	.094	.091	.13	.071	.092	.088
Consistency	Yes	Yes	No	Yes	Yes	Yes

For an expert, the Consistency Ratio is 0.13>1 or 10%, the opinion is not consistent (Table VII). So, it will be excluded from the study for the inconsistent judgment. After determining weightages for all experts, the average value for each factor is calculated (Table VIII). AHP calculations for all the experts have been included in E-Component: Table 01-Table VIII.

TABLE VIII: AVERAGE WEIGHTAGE OF FACTORS FOR EACH EXPERT

Sub criteria	Expert 01	Expert 02	Expert 04	Expert 05	Expert 06	Average
Residence	0.327	0.353	0.316	0.329	0.357	0.34
Agriculture	0.185	0.242	0.246	0.231	0.216	0.22
Water body	0.235	0.156	0.171	0.126	0.122	0.16
Commercial	0.072	0.102	0.128	0.15	0.169	0.12
Road	0.11	0.079	0.065	0.076	0.075	0.08
Soil type	0.044	0.043	0.046	0.056	0.037	0.05
Slope	0.027	0.025	0.028	0.033	0.024	0.03
Sum	**1**	**1**	**1**	**1**	**1**	**1**

C. Suitability Analysis

After determining weightage by using the AHP method, ArcGIS software is used to conduct suitability analysis. Suitability analysis requires the weightage of criteria factors analysis for the identification of a suitable location. After selecting criteria and sub-criteria, Pairwise Comparison was made, and the weightage was determined. From Table VIII, it is clear that residential land use has given the highest priority as Dhaka is a densely populated city and the major land use is residence. So, it is considered as the most important factor by the experts. The second highest priority has been given to agricultural land use because a few amounts of agricultural land are required to be preserved for food production.

Pollution of agricultural land will directly affect the productivity of the study area. Pollution of water bodies will reduce the accessibility to uncontaminated water for drinking purposes and other activities. In this regard, the factor water body has also given greater preference. Accessibility to road networks has also been considered an essential factor because of the hauling distance covered by the waste carrying vehicles. Slope and soil type have given less priority because there is an opportunity of infilling and provision of the concrete ground of the disposal site, which will reduce the possibility of soil pollution.

D. Multiple Ring Buffer Analysis

The location of the disposal site should not impact the natural and human environment, so multiple buffers have created in ArcGIS. Among the seven factors, five of them are a distance from different land uses. The length of buffer has been suggested by the experts considering the distance from land uses in previous relevant studies. Most of the study area is situated within a 300m buffer for residential land use, considered the least suitable distance. Only a few sites are found to be located at a reasonable distance from residential land use. Only a few lands available for cultivation. The minimum distance from land use for residence 300m, agriculture 1000m, water body 300m, commercial 250m, road 100m have proposed for suitable e-waste disposal site. For the selected land uses, five buffer maps have prepared. So most preferred distance can be maintained for agricultural land use (Fig. 2-Fig. 3). Several water bodies surround the study area. So, it is difficult to find land located at a suitable distance from the water body. Appropriate distance is also challenging to maintain because of the high density of land use for commercial purposes. From Fig. 2, it can be said that in the study area, a large portion of land use is used for circulation. So, accessibility can easily provide for the potential disposal site.

From the Digital Elevation Map, the Slope Map of the study area has formulated using the slope tool in ArcGIS. It can be seen from the map, the slope of most of the area lies within 0-5 degrees, the surface is plain, which is suitable for the e-waste disposal site. A slope greater than 15 degrees is considered to be not ideal for the disposal site. There are six categories of soil in the study area; these are alluvial silt, alluvial clay and silt soil, Canadian alluvium, and Madhupur clay residuum (Fig. 3).

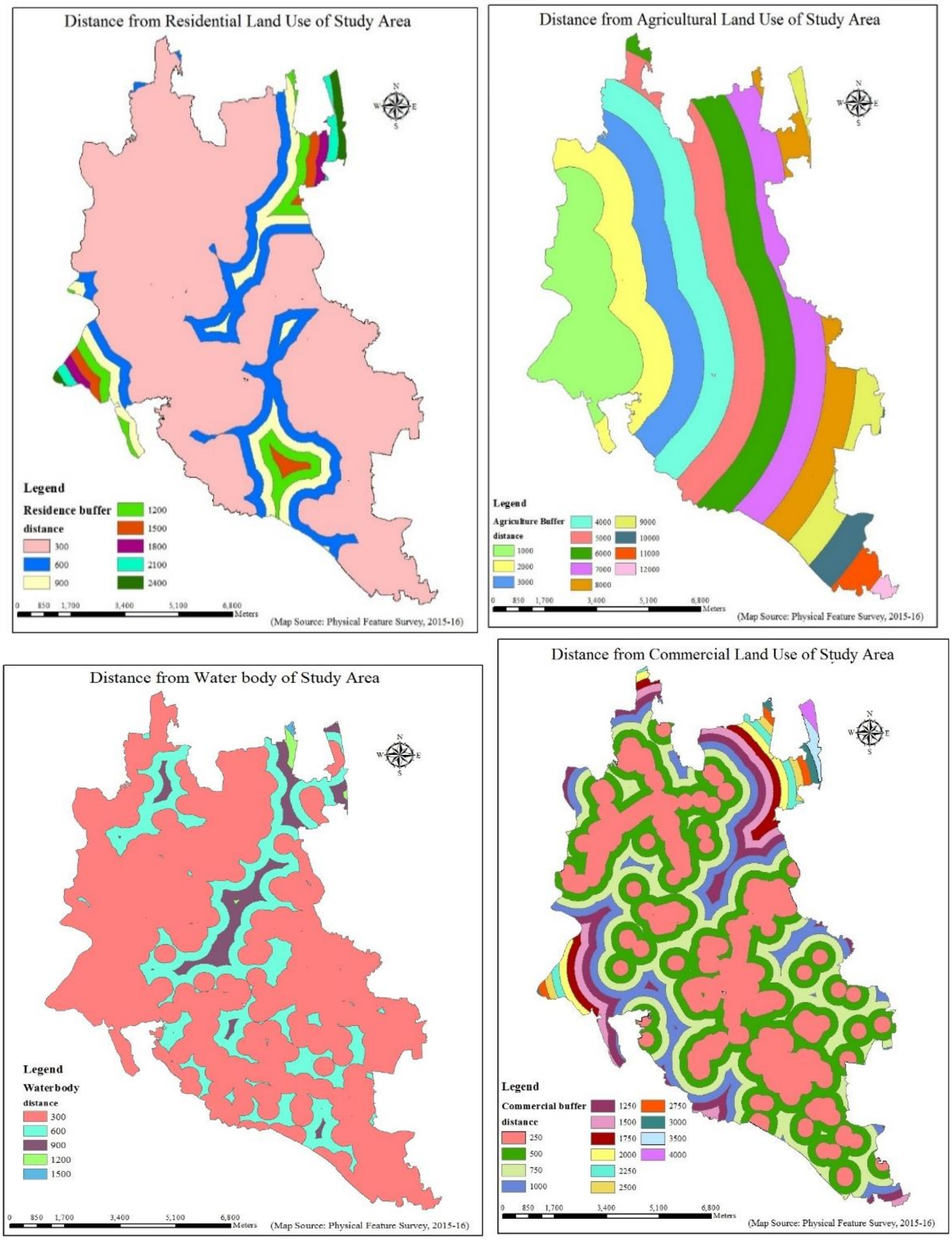

Fig. 2. Multiple Ring Buffer Creation (Residential, Agricultural, Water Body, and Commercial).

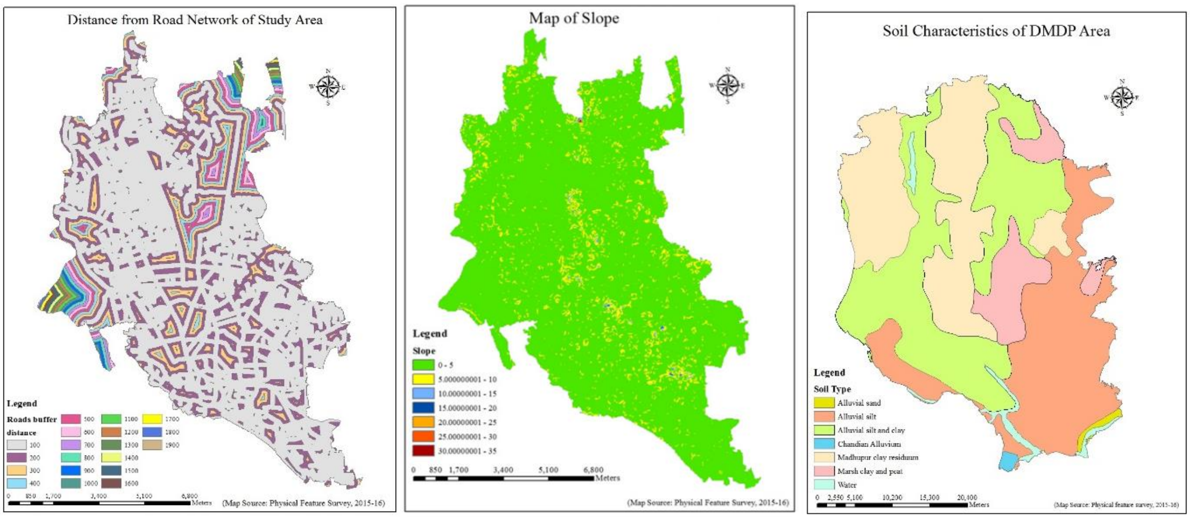

Fig. 3. Multiple Ring Buffer Creation (Road, Slope, and Soil).

The soil characteristics of the area can be seen in Fig. 3, which is located within Dhaka Metropolitan Development Plan (DMDP) area. The primary soil characteristic of the study area is Madhupur Clay Residuum which is suitable.

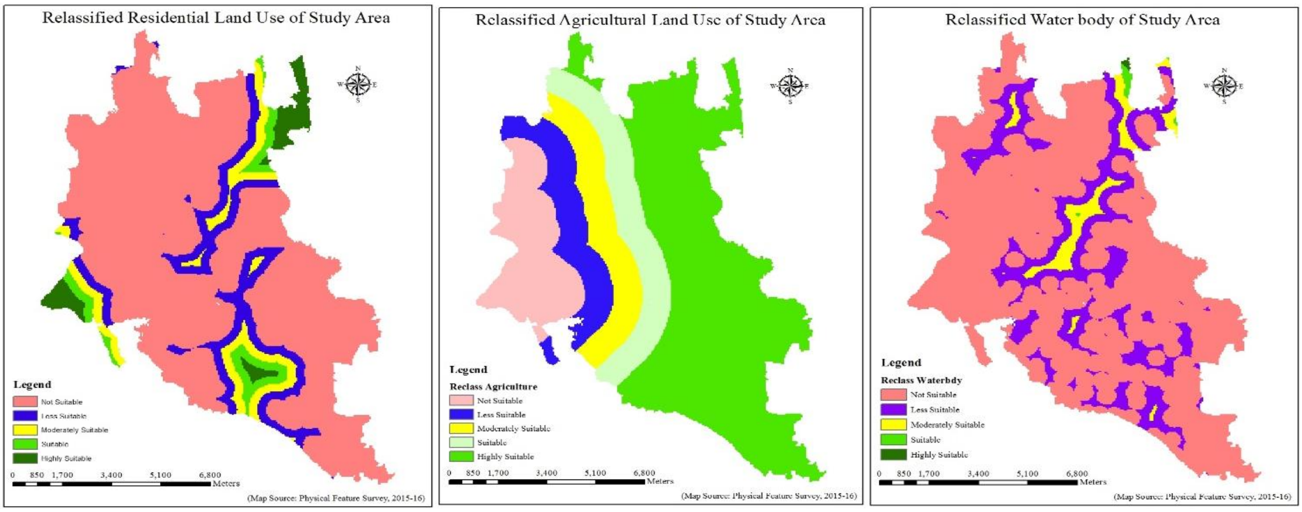

Fig. 4. Reclassification of Raster Map (Residential, Agricultural, and Water Body).

After buffer analysis, the criteria maps are converted from vector to raster maps using the Features to Raster tool. A soil map is also transferred to a raster map for analysis. A raster map is used in the suitability analysis to evaluate both continuous and discrete data.

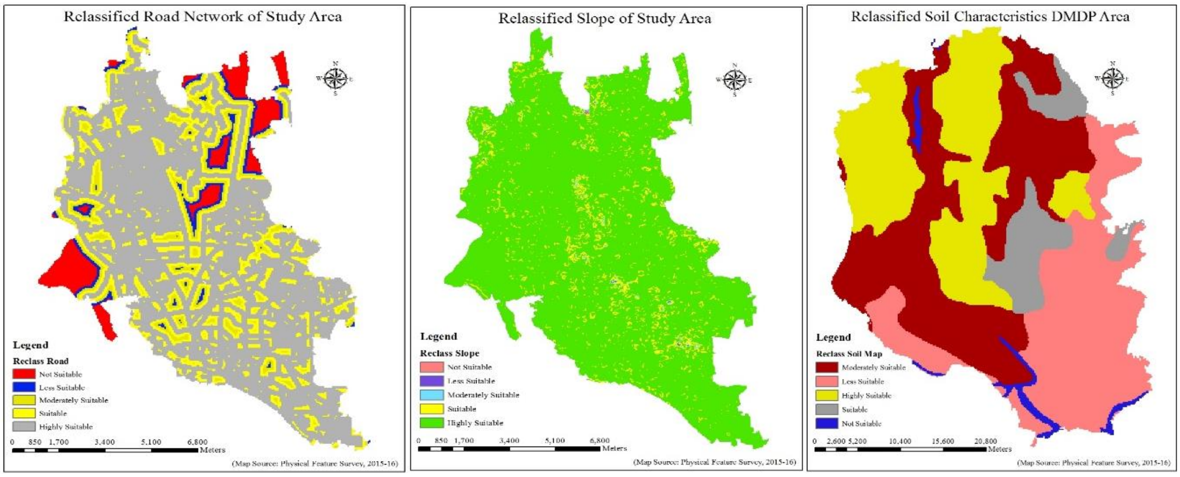

Fig. 5. Reclassification of Raster Map (Road, Slope, and Soil).

All data sets converted into raster maps; reclassification has done depending on the priority of the parameters of the factors (Fig. 4, Fig. 5). For buffer map, the parameter is the distance from land uses, and the scale is “1” to “5”, indicating least suitable to highly suitable. The scale must be reversed for the road as the suitability decreases with the distance from the road. For slope, the scale value is also needed to be reversed as the lower slope indicates a more suitable site for disposal.

The soil map is then reclassified based on the soil characteristics from “1” to “5”, which indicates least suitable to highly suitable. The most preferred soil characteristic is clay soil which prevents the pollutants from inflowing into the ground sub-surface aquifer. In the study area, the most prominent land use is residence. So suitable land for any kind of disposal practices is difficult to find considering residential land use. A similar scenario can be seen for a water body and commercial land use. For agricultural land use, a suitable distance can be maintained for disposal activities. Most of the area is highly suitable while considering road networks, soil characteristics, and slopes.

E. Weighted Overlay Analysis

It is the last stage of suitability analysis in which all layer of factors is combined in a table (Table VIII). Each raster is assigned a percentage influence according to its importance. The weight is a relative percentage, and the sum of the % influence weights must add up to 100. Each cell value is multiplied by their percentage influence then added to create the output raster.

Each factor is given specific weightage for each factor determined in AHP calculation, such as for residential land use, the weight is 34%, for agriculture, the weight is 22%, etc. The summation of the weight of all the factors must be equal to 100 per cent. The input data is assigned a scale of “1 to 5”, which also indicates least suitable to highly suitable. According to experts, the land uses of restricted areas, historical conservation sites, education, and research and recreational areas cannot be changed.

VI. Results

The final suitability map can be seen in Fig. 6. Seven raster layers are overlaid with each other to extract the final suitable map. The given values of cells for each raster map are multiplied with the weightage provided from the AHP calculation. The addition of cell values will produce the final output raster map. From the map, suitable locations have been identified for potential e-waste disposal sites. From the final map, there is a parcel of land ideal for the disposal of e-waste. Most of the area falls in the category of less (48%) to moderately (45.4%) suitable zone. Only 0.5% land parcel is suitable for the e-waste disposal site.

Dhaka is one of the densely populated cities with a large variety of land uses. The most dominant land use of the study area is residential and mixed-use. And the land uses are changed with the time. The amount of vacant land in the study area has been declined within the last 10 (2016-2015) years due to development activities. So, an extreme scarcity of vacant land has been created. As a result, the identification of suitable e-waste disposal sites in the study area has become challenging.

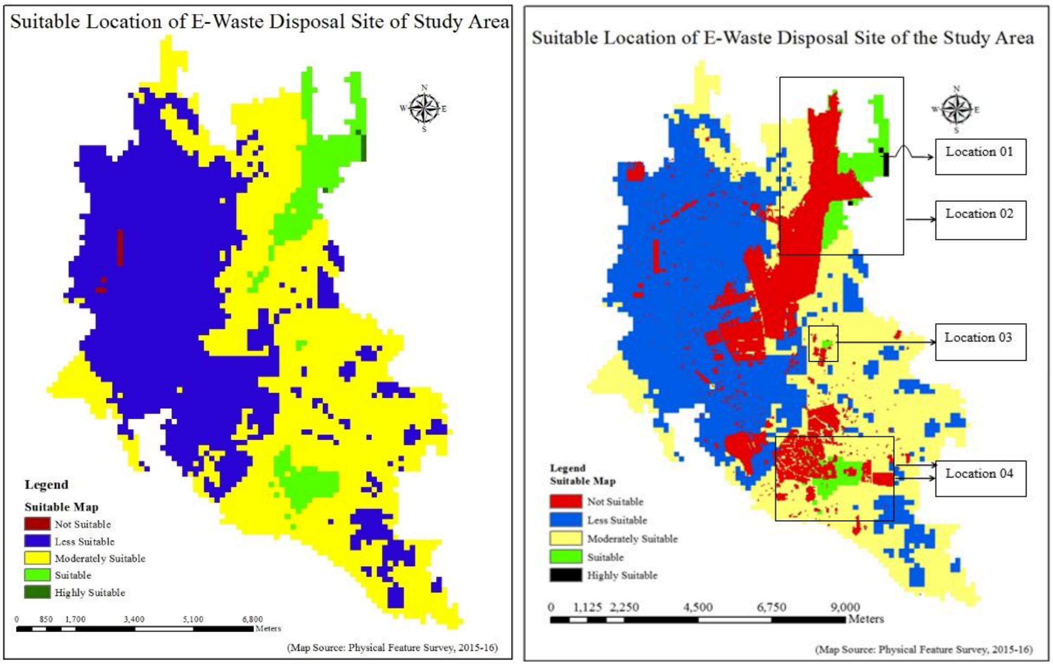

Fig. 6. Selection of Suitable Site.

From the map, several suitable locations of e-waste disposal sites can be seen. Among them, location 01 is the most suitable land parcel for the development of the e-waste disposal site, and location 02 is found to be the suitable land for e-waste disposal (Fig. 6). Location 01 and 02 are situated in DPZ 11, Dhaka cantonment area where land-use change is restricted. As most of the land use of cantonment areas is not specified in Detailed Area Plan (DAP) and Google maps, it is considered vacant space in overlay analysis. So, a suitable disposal site is found to be located in this area as it fulfils the study's criteria. As both accessibility and development are restricted in these areas, the location cannot be considered a suitable location. Another land parcel is found to be suitable in DPZ 6 CBD northeast, located in Tejgaon Industrial Area in Location 03.

Most of the surrounding land use is manufacturing and processing activity which the experts suggest though education and research centre is located close to the suitable land. As the significant land use compatible with the proposed land use, Location 03 can be recommended as the new e-waste disposal site for the study area. But in DAP 2015-16 Group C, it is mentioned that hazardous industries are recommended to be replaced with suitable light industries, and the site will be restricted to light industries only [5]. E-waste is hazardous waste, and the disposal activities may not be compatible with the proposed land use in DAP. In Location 04, the land use is recreational facilities, places of historical importance, and educational where uses are recommended as unalterable by the experts and the surrounding land use are not compatible for such kind of site. In this regard, a suitability study is required to introduce an integrated e-waste disposal site for the DMDP area. The site will include disposal activities such as segregation, reuse, dismantle, recycle, and final disposal, which will be done in an integrated manner rather than locating in scattered areas and will reduce the threat of pollution of the environment in different areas.

VII. Conclusion

This study will help policymakers to develop e-waste management policies and guidelines with the consultation of relevant experts. A strategy for e-waste collection and transportation system can also be developed from the e-waste generation sources to the disposal sites. This study had some shortcomings. The existing land use map of the study area was not updated. The groundwater level has been excluded from the study because of data unavailability despite being an important criterion. The difficulty was also faced during the expert survey because of the busy schedule of experts. The study could have provided a better outcome if the study could incorporate more e-waste experts. But unfortunately, the author could access only a few of them. The owners and workers of formal and informal disposal sectors were not cooperative in providing any information regarding e-waste disposal practices. No baseline studies available, and no standards and regulations were introduced regarding e-waste disposal for Bangladesh.

Conflict of Interest

We certify that we are the only authors of the paper titled “Identification of Suitable Electronic Waste Disposal Site in Dhaka”. We do not need to take permission from any other organization. All the contents of the papers are results of our own contribution and we have the sole authority to publish this paper in any journal we want. we declare there is no conflict of interest to publishes the paper titled “Identification of Suitable Electronic Waste Disposal Site in Dhaka”.

Author Contributions

Both authors contributed equally in each stage of the preparation of this manuscript. First author made a significant contribution in data collection and analysis related activities. Second author contributed more on report preparation related activities.

Acknowledgment

First of all, we would express our humble gratitude to Almighty Allah whose blessings have made it possible for us to accomplish the study in proper way. We would also express profound gratitude to our supervisor Dr. Roxana Hafiz, Professor and Head, Department of Urban and Regional Planning, Bangladesh University of Engineering and Technology for her valuable suggestions, constructive criticisms, and comments in each stage of the study. Her constant guidance and supervision did not only guide the study in appropriate manner, but also encouraged us a lot in the whole period. Finally, we would like to express our gratitude to our classmates and seniors’ students for their supports and inspirations.

References

[1] M. N. Islam, “E-waste management in Bangladesh,” *International Journal of Innovative Human Ecology & Nature Studies*, vol. 4, no. 2, pp. 1-12, 2016.

[2] S. U. Ahmed, *Informal Sector E-waste Recycling Practises in Bangladesh*, Dhaka: Ananya Rahman, 2011.

[3] S. Hossain, “Study on e-waste: Bangladesh situation,” Environment and Social Development Organization, Dhaka, 2010.

[4] F. Hossain, “E-waste in Dhaka: Current situation and management,” Bangladesh Agricultural University, Environmental Science, Mymensingh, 2012.

[5] Bangladesh Institute of Planners. (2008). Detailed Area Plan (DAP) of Dhaka: Shattering the vision of DMDP. [Online]. Available: https://www.thedailystar.net/news-detail-67825

[6] M. Lapevski and R. Timovski, “Analytical hierarchical process (ahp) method application in the process of selection and evaluation,” in *Proc. International Scientific Conference UNITECH 2014*, 2014.