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Review Article

Ideal Pollution Free Urban Space with Environmental Parameters, Circular Economy, and Sustainability.

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Abstract

Urban sector is posing serious challenges presently and is likely to become an issue of great global concern in future. Around 55 percent of the total global carbon footprint is contributed from the urban sector. The resulting contributing factors are mainly on account of continuous increasing urban population, non-optimization of concreting to non-concreting urban surface and vertical to horizontal spread of urban area coupled with other environmental parameters of relevance. These environmental issues are in the form of insufficient urban air ventilation, increasing urban heat island, inadequate carrying capacity of road network leading to traffic congestion resulting into enhanced air pollution, inadequate disposal and treatment of municipal solid waste and sewage and so on so forth. To address issues referred to above, an attempt has been made by the authors to design pollution free ideal city with reference to environmental issues coupled with circular economy and sustainability in the present paper. Such an ideal city is presently for a population of 1 lakh but will be designed and planned for a predicted population in the year 2051 and accordingly forecasting done by different methods. On the designed population of 2051, the area of the city estimated using WHO norms of 50 square meters per person as open space. The water consumption, sewage generation, solid waste generation also estimated in the present paper along with revenue generated by transforming waste into usable products. Moreover, around 40 percent urban area is kept as green area where organic farming is developed, and revenue earned. In addition to above, an ideal city is designed to have adequate air ventilation, balancing concreting to non-concreting urban space to reduce urban heat island and thereby reduction in urban energy demand. All the rainwater will be collected and stored and is used to cater population demand. The revenue earned from transformation of waste to usable products, organic farming, reduction in energy demand, recreational and commercial activities, etc will provide adequate input to circular economy and sustainability. essment process for sustainable environmental climate change and control towards sustainable development.

Keywords: Urban Design, Air Ventilation, Transformation of Waste to Usable Products, Carrying Capacity of Roads, Urban Heat Island, Circular Economy, Sustainability.

1. Introduction

The widespread urbanization and sudden changes in the land uses led to the over utilisation of resources, in particular freshwater resources resulting in a lot of environmental problems such as reduction in the infiltrating capacity of rainwaters through the ground which in turn decreases the recharge of aquifers resulting into environmental problems such as floods and torrential rains. As it is seen that there is a gradual increase of 1% every year in the water consumption from 1980 which resulted into water scarcity to that extent that as per data almost 2 billion of the world's population resides on countries with immense water scarcity and four billion world's population suffers from excessive water scarcity for at least one month of every year. Lastly, the report

states that out of 10 people 3 person do not have access to safe drinking water and 6 out of 10 of the world's population lack accessibility to proper sanitation services. Thus, looking at the present situation worldwide certain countries have taken suitable steps for it [1].

Natura 2000 mainly comprises of 27 thousand protected areas within the states which are under the European Union, which includes 18% of land and 6% of water bodies. This entire infrastructure is responsible for the conservation of 1400 wildlife species and 233 variety of plants under various categories. Similarly, the covering grid of Natural 2000 at Italy involves 19% land covers and 4% of water bodies especially marine bodies [2]. The total coverage within boundaries of Italy is 2613 number of site areas, encompassing the biological areas of Alpine, Continental, Mediterranean and Marine – Mediterranean. The entire system within Italy is responsible for the conservation of over 3000 bird species, nearly 235 species of animals (which includes a variety of insects, reptiles, amphibians, mammals, fish and molluscs), 115 types of plants and 132 kinds of habitats. Globally, almost 75% of the natural resources are being consumed which leads to Greenhouse gas emissions of around 60 to 80 percent worldwide [3]. Simultaneously, almost 70 percent of the urban spaces globally are suffering from circumstances such as climate change which are easily seen through calamities like flood, drought and heat waves and there would be a rapid increase of these disasters on days to come. To find a solution to avoid such situations in days to come certain proposals of green infrastructure for the urban areas and certain environment friendly methods are being proposed all over the world [1].

The developing countries like India are suffering from critical issues such as climate threats and environmental degradation [4]. Thus, in order to find a solution to the such major problems, special attention is given to green and blue infrastructure which includes green spaces, trees, green parks forests, oceans, seas, rivers, lakes and other water utilities. As per an Intergovernmental panel based on climatic changes, it is very necessary that amount of carbon dioxide emission reduces below 45 percent from the year 2010 to the year 2030 and should reach to a net zero by the year 2050, so that the temperature increase remains within 1.5 degree Celsius by the end of this century [5]. In India, within the years of 1901 to 2018 the average increase of temperature per year was recorded to be 0.7 degree Celsius.

And as per the present scenario where there is excessive amount of greenhouse gas emissions it is projected that the average temperature increase per annum would increase up to 2.7 degree Celsius by 2099 and if the situation worsens it might also rise to 4.4 degree Celsius by the end of this century [6]. Various Indian cities have suffered a deterioration in the green and blue infrastructures due to fast increase in urbanisation throughout and a rapid change in the land use on the course of time. For example, it is being observed that there is a 925 percent increase in the number of built-up spaces in the city of Bengaluru in between 1973 to 2013 whereas the number of green infrastructures has decreased from 68 percent to 14 percent and blue infrastructures from 3 percent to less than 1 percent [7]. At the same time, there is a decrease of almost 60 percent of green spaces and 65 percent of water bodies in the city of Mumbai from 1977 to 2017 [8]. Similarly, Ahmedabad has also suffered the loss of green spaces by 50 percent from 2010 until the present day [9, 10].

Jaipur has experienced heavy urbanisation in the course of time, the densification has increased from 2.53% in 1975 to 6.5% in 1991. Rapid industrialization is one of the main reasons of the increase in the urban spaces, which has increased from 9.07% to 11.49% from 1975 to 1991. As a result, of the above phenomenon there is a decrease in the green spaces and forest areas from 2.15% to 0.68% since 1986 to 1991. Apart from decrease in the green spaces, improper discharge of wastewaters in the nearest nallah or street drain is also an issue to be addressed. Henceforth, the surface water resources are in very difficult condition as the nallahs and the Mansagar lake are in a process of degradation.

Also, as per a report by PHED from 1997 – 99 there is a rapid depletion in the water table at a rate of 1 meter per year and as per prediction by 2008 the water will be inefficient for extraction. Also, the existing water surfaces like lakes are also in very poor condition. As, due to lack of proper sewage management system the natural existing drainage channel within the city popularly known as Amanisha Nallah and Ganda nallah nowadays carry mostly untreated sewage and the wastes are also dumped in the nallah as well by the slum residents of the area [11].

1.1. Literature Review

During the nineteenth century era, the urban planners developed big green parks as a part of the landscaping within the core city area popularly known as "lungs of the city". These parks popularly known as green parks not only improved the city life but also enhanced the environments of the urban spaces [12]. Within the recent years, from 2016 to 2019 at Copenhagen urban spaces were developed which created linkages between adaptability depending on nature and climate and public or semi-public spaces used within the residential units for recreational gathering purposes. The end results were Bryggervangen and Sankt Kjeld's Square of Copenhagen which were community spaces having sustainable blue and green infrastructures which are sustainable, biodiverse, and climatically adaptable in nature [13]. London's administrative authority proposed a policy towards making a greener and more sustainable urban space include four tactical procedures, including "low carbon circular economy, smart digital city, green infrastructure, and natural capital accounting and lastly, healthy street approach [14].

As per research in Philadelphia, if the number of green covers (specially trees) is increased by 30%, it could avoid death occurrences of up to 400 per year, which takes place generally because of poor air quality as the heavy trees have a tendency of apprehending gaseous pollutants like Nitrogen Dioxide, Sulphur Dioxide, ozone, and other particulate matter of the air. Henceforth, it has been observed that green covers have a very positive relation with the increase in the immu-

nity system, cardiovascular conditions, and mental health as well [15].

1.2. Design of ideal urban space

An attempt has been made in the present paper to consider a population of 5 lakh proposed urban area near Jaipur based on 2011 census report and its ideal design done for the projected year of 2051. The population is projected for different decades by using Arithmetic, Geometric and incremental increase methods, and average projected population of the three methods is done as reflected in table-1 below. Ideal design is done on the predicted population for the year 2051 which is estimated at 10,75,925. An ideal area calculation done based on most ideal open space area of 50 M2/person as per WHO guidelines and by assuming 50:50 as open and built-up area ratio of ideally designed urban space as reflected in table-2 below.

1.3. Demographic and Area Calculations

Table 1: Shows the decadal population projections from 2021 – 2051 by Arithmetic Progression, Geometric Progression, Incremental method and finally the average of it, depending on the existing population of 2011.

Year	Projected Population by AP	Projected Population by aGP	Projected Population by Incremental Method	Average projected Population
2011	-	-	-	5,00,000(existing)
2021	5,75,000	6,29,692	6,12,000	6,05,564
2031	6,50,000	7,93,024	7,61,000	7,34,675
2041	7,25,000	9,98,722	9,47,000	8,90,241
2051	8,00,000	12,57,775	11,70,000	10,75,925

Table 2: Shows the proposed Open Area and proposed Built – up Area for an Ideal Urban Space for an existing population as per WHO guidelines

Year	PROPOSED OPEN AREA (IN Sq. Mts.)	PROPOSED BUILT - UP AREA (IN Sq. Mts.)	PROPOSED URBAN SPACE (IN Sq. Km.)
2011	-	-	-
2021	3,02,78,200 = 30.28 sq.km.	3,02,78,200 = 30.28 sq.km.	60.56 sq.km.
2031	3,67,33,750 = 36.73 sq.km.	3,67,33,750 = 36.73 sq.km.	73.46 sq.km.
2041	4,45,12,050 = 44.51 sq.km.	4,45,12,050 = 44.51 sq.km.	89.02 sq.km.
2051	5,37,96,250 = 53.8 sq.km.	5,37,96,250 = 53.8 sq.km.	107.6 sq.km.

*Note- (Proposed Open Area as per WHO guidelines = 50 sq.m. per person,
Let us assume, Proposed Built up space = 50 sq.m. per person)

1.4. Solid Waste Management Calculations

An attempt has also been made to estimate the solid waste quantityduring different decades by assuming 0.8kg/capita as solid waste generation in the year 2011 and incremental increase of 0.1kg/capita for every decade. Such an estimation is shown in table 3 below which reveals the fact that by the year 2051, the total waste generation is expected to be of the order of 12,91,110 kg/day. It is also assumed that ratio of degradable and non-degradable is 85:15 percent and accordingly quantities of non-degredable and degradable wastes estimated and shown in table 4 and 5 below. Energy is proposed to be generated from non-degradable waste as indicated in table 4 and biofuel from degradable waste as per table 5.Similarly, the amount of compost generated is shown in table 6 and the amount of revenue earned during different decades from power, biofuel and compost reflected in table 7 below.

Table 3: Gives the total solid waste generated by the projected population from the year 2021 – 51 and of existing 2011 as well

Year	Waste Generated	Unit
2011	5,00,000x 0.8 = 4,00,000	Kg/Day
2021	6,05,564 x 0.9 = 5,45,008	Kg//Day
2031	7,34,675 x 1 = 7,34,675	Kg//Day
2041	8,90,241 x 1.1 = 9,79,265	Kg//Day
2051	10,75,925 x 1.2 = 12,91,110	Kg//Day

Table 4: Gives the amount of Non degradable waste that is generated out of the total solid wastes of 2021 – 51 and of existing 2011 as well and the power generated out of the non degradable wastes.

Year	Non degradable Waste	Unit	Power Generated	Unit
2011	60	Ton//Day	0.6	Megawatt
2021	82	Ton//Day	0.82	Megawatt
2031	110	Ton//Day	1.10	Megawatt
2041	147	Ton /Day	1.47	Megawatt
2051	194	Ton /Day	1.94	Megawatt

*Note- (Non degradable waste generated = 15% of the total waste generated,
Power generated = Non degradable waste generated / 100).

Table 5: Gives the amount of Degradable waste that is generated out of the total solid wastes of 2021 – 51 and of existing 2011 as well and the Biofuel generated out of the Degradable wastes.

Year	Degradable Waste	Unit	Biofuel Generated	Unit
2011	340	Ton/Day	7,286	Litres
2021	463	Ton/Day	9,928	Litres
2031	624	Ton/Day	13,382	Litres
2041	832	Ton/Day	17,838	Litres
2051	1097	Ton/Day	23,518	Litres

*Note- (Degradable waste generated = 85% of the total waste generated,
Biofuel generated = Degradable waste generated*21.43)

Table 6: Gives the amount of Degradable waste that is generated out of the total solid wastes of 2021 – 51 and of existing 2011 as well and the Compost generated out of the Degradable wastes.

Year	Degradable Waste	Unit	Compost Generated	Unit
2011	340	Ton/Day	28,220	Kg
2021	463	Ton/Day	38,450	Kg
2031	624	Ton/Day	51,831	Kg
2041	832	Ton/Day	69,087	Kg
2051	1097	Ton/Day	91,088	Kg

*Note- (Compost generated = Degradable waste generated*83)

Table 7: Gives the revenue which can be generated when non degradable waste is converted into energy in the form of power per year as well as degradable waste is converted into energy in the form of Biofuel and compost(-expressed in Rupees).

Year	Cost From Power (Per Year) (In Rupees)	Cost From Biofuel (Per Year) (In Rupees)	Cost From Compost (Per Year) (In Rupees)
2011	8,76,000	7,97,83,890	5,15,01,500
2021	11,93,567	16,30,60,599	14,03,43,545
2031	16,08,938	29,30,76,147	28,37,76,484
2041	21,44,591	48,83,09,869	50,43,36,216
2051	28,27,531	77,25,73,337	83,11,76,271

Note- (Cost generated from Power per year = (Non degradable waste generated*4000)*365)
*Note- (Cost generated from Compost per year = (Degradable waste generated*N)*365), where, N = n, (n+5), (n+10), (n+15), (n+20) respectively. Let n be considered to be 5 for the base year (2011).

*Note- (Cost generated from Biofuel per year = (Degradable waste generated*N)*365), where, N = n, (n+15), (n+30), (n+45) respectively. Let n be considered to be 45 for the first projected decadal population (2021) and N= (n-15) for the base year (2011).

1.5. Sewage Treatmnent Calculations

The estimation of sewage generation has also been done during different decades by assuming water consumption figure of 125 litre/capita/dayfor the year 2011 and an increase of 10litre/capita/day for succeeding deades. Water consumption figures during different decades are shown in table 8 below. Assuming 70 percent of the water used as sewage generation is reflected in table 9. Concentration of sewage is shown in table 10 and designed sewage quantity for the sewage treatment plant(STP) shown in table 11. The quantity of expected sludge so formed in the STP is reflected in table 12. Such a quantity of sludge is proposed to be transformed into biogas and its expected quantity alongwith cost of revenue earned is reflected in table 13.

Table 8: Shows the total projected water consumption in each decade per day as per the projected population.

Year	Water Consumed (per person)	Unit	Water Consumed (as per population)	Unit
2011	125	Litres/Person/Day	6,25,00,000	Litres/Day
2021	135	Litres/Person/Day	8,17,51,140	Litres/Day
2031	145	Litres/Person/Day	10,65,27,875	Litres/Day
2041	155	Litres/Person/Day	13,79,87,355	Litres/Day
2051	165	Litres/Person/Day	17,75,27,625	Litres/Day

Table 9: Shows the total projected sewage generation in each decade per day as per the projected water consumption.

Year	Sewage Generated	Unit	Sewage Generated	Unit
2011	4,37,50,000	Litres/Day	43,750	Cubic meters/Day
2021	5,72,25,798	Litres/Day	57,226	Cubic meters/Day
2031	7,45,69,513	Litres/Day	74,570	Cubic meters/Day
2041	9,65,91,149	Litres/Day	96,591	Cubic meters/Day
2051	12,42,69,338	Litres/Day	1,24,269	Cubic meters/Day

*Note- (Sewage generated = Water consumed (as per population) *0.7)

Table 10: Shows the characteristics of water of the sewage wastewater.

S. No	Parameters	Concentration		
		Minimum	Maximum	Average
1	BOD in mg/l	176	390	283
2	COD in mg/l	308	760	534
3	TSS in mg/l	84	1182	633

Assuming the design rate flow is 1.5 times of the average regular flow.

Table 11: Gives the Total volume of Sewage to be handled by the Sewage Treatment plants.

Year	Total Volume of Sewage to be Handled by the Sewage Treatment plants	Unit
2011	43,750 x 1.5 = 65,625	Cubic meters/Day
2021	57,226 x 1.5 = 85,839	Cubic meters/Day
2031	74,570 x 1.5 =1,11,854	Cubic meters/Day
2041	96,591 x 1.5 =1,44,887	Cubic meters/Day
2051	1,24,269 x 1.5 =1,86,404	Cubic meters/Day

- Average suspended solids = 633 mg/l(as per Table 9)
- Assuming 80 percent removal of suspended solids from the Sludge extracted
- Thus, Total Suspended solids removed = 633 x 0.8 = 506 mg/l
- Also, Quantity of settled solids = St = 506 x Vx x 1000/ 106
- Assuming, that Primary sludge contains 4% solids by dry weight.
- Hence, the volume of settled sludge=S = St x 100/4 (As shown in Table 11)

Table 12: Gives the Total Quantity of Settled Sludge and total volumme of Settled sludge to be generated from sewage treatment plants to the sludge disposal units.

Year	Quantity of Settled Solids	Unit	Volume of Settled Sludge	Unit
2011	31,327	Kg/Day	7,83,166	Cubic meters/Day
2021	40,976	Kilogram/Day	10,24,396	Cubic meters/Day
2031	53,395	Kilogram/Day	13,34,865	Cubic meters/Day
2041	69,163	Kilogram/Day	17,29,073	Cubic meters/Day
2051	88,982	Kilogram/Day	22,24,538	Cubic meters/Day

1.6. Land Use Map of the Proposed Ideal Urban Space

Taking into consideration the above extracted data, an ideal township of area 112 sq.km. have been proposed for the projected population of the year 2051 with an existing population of 5,00,000. (as per the land use map at 3.4) The proposed urban space would utilise the electricity, biofuel and compost from the solid wastes that would be generated by the population of the space. Also, the wastewater and the sludge that is been generated from the sewage treatment plant would be reused within the proposed space for irrigation purpose and for industrial purposes as an alternative to the surface and ground water sources. As, the recycled products from the solid wastes that are being generated, in the process of waste management would be proposed to be used in the form of electricity for the street lights and biogas would be used as an alternative ignition fuel to CNG and LPG. The recycle and the reuse procedure of the solid and the liquid waste that has been generated would provide an economic gain which would increase its sustainability and would encourage in the optimum amount of pollution within the proposed township as the space is planned in a ratio of 50 : 50, where the amount of built – ups and the amount of green space is almost of equal percentage. (as per the area calculations at Table 13)

As per planning is conerned, it is being inspired from the planning of the city of Jaipur designed by Vidyadhar Bhattacharjee, that is the concept of Prastara (as per the Ancient Indian Town Planning also known as Vastu Shastra [16]. Where, entire urban space has been divided into a grid of 3 x 3 where the grid lines acting as primary roadways within the urban space, resulting into formation of nine square of almost equal sized cubes which are used for prominent land use zones. The major land uses within the township are Green park (one zone), Water park (one zone), Cultural Hub (two zones), Miscellenous Activities (two zones), Commercial activities (two zones) and Stadium (one zone). (as per the land use map at 3.4) The idea behind the proposed zoning are making an urban space more sustainable in nature and upliftment of Indian Culture specially of Rajasthan. Inorder, to support the major activity zones various other zones are being proposed including Residential areas with high rise towers placed at a distance of atleast 50 meters between them, Commercial areas, Medical Facilities and Institutional zone. The required infrastructural services within the proposed area includes Organic Farming zones, Parking zones, Green area zones which are used as buffer zones, Sewage Treatment Plants (at the two diagnolly placed corners of the proposed plan (at North West and South East)) , Solid Waste Treatment Plants (at the two diagnolly placed corners of the proposed plan (at North East and South West). (as per the land use map at 3.4)

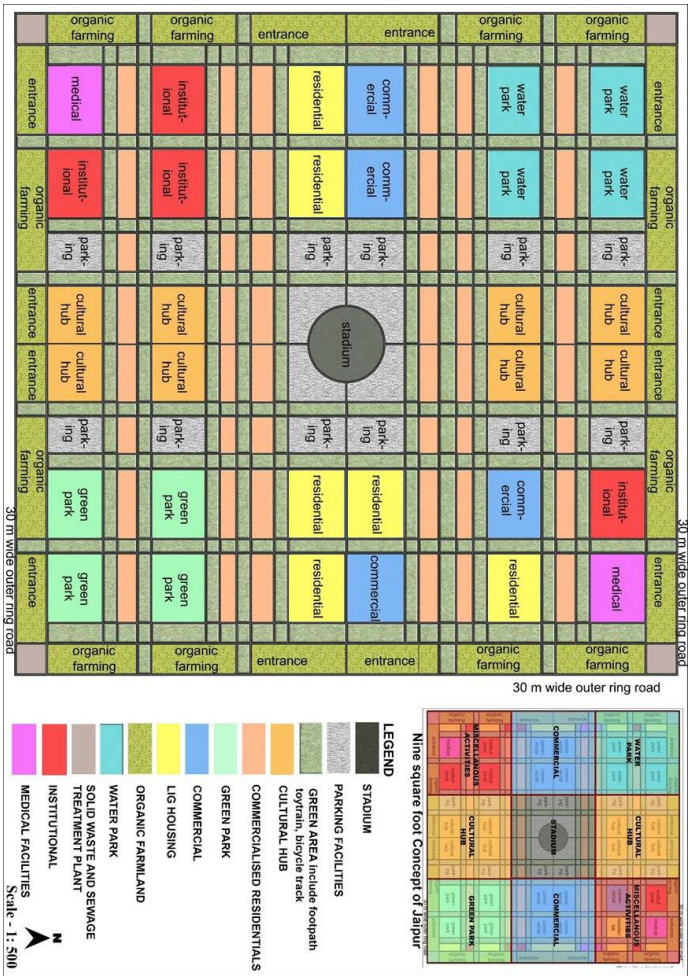

Figure 1: The proposed Land use plan for the proposed Ideal Township (source – author)

1.7. Area Calculations of the Proposed Ideal Township (Urban Space)

Table 13: Gives the Area Calculations of the proposed Urban space along with textures used for the assigned surfaces. (source – author).

AREA CALCULATIONS		
Total Area		112 sq. km.
AREA NAME	**COLOUR**	**AREA**
Cultural Hub		6 sq. km.
Commercial		4.8 sq. km.
Commercialized Residentials		10 sq. km.
Residential		6 sq. km.
Institutional		4 sq. km.
Medical		1.8 sq. km.
Parking		6.2 sq. km.
Stadium		1.1 sq. km.
Waste Treatment Plant		0.4 sq. km.
Circulation		11.2 sq. km.
Entrance		5 sq. km.
Total Area of Concrete Surfaces		56.5 sq. km.
Water Park		4.1 sq.km.
Green Park		4.1 sq.km.
Organic Farming		14.2 sq.km.
Green Area		33.1 sq. km.
Total Area of Non Concrete Surfaces		55.5 sq. km.

1.8. Transportation

An attempt has also been made by the present authors to design the road network with adequate carrying capacity. Such an attempt would not only reduce the traffic congestion but will provide adequate free flow traffic to reduce air pollution and would address an alarming issue of carbon footprint.

The Vehicular movement of the entire area as is more inspired from the planning concept of Prastara. Henceforth, the entire urban space is surrounded by two major ring roads, one being the Outer Ring road and the other being the Inner Ring road, both being 30 meters wide (containing 2.5 meters of pedestrian pathway and 1.5 meters bicycle track on both the sides of the vehicular ring roads with 10 meters wide vehicular road on both the directions). The other vehicular roads within the urban space are 25 meters wide forming a grid network inteconnected to each other (containing 2.5 meters of pedestrian pathway and 1.5 meters bicycle track on both the sides of the vehicular Roads with 8 meters wide vehicular road on both the directions). All the Land use zones are differentiated by an individual parking area and a green zone. The entire urban area is pedestrian friendly, encouraging bicycles, e – rickshaw's and walking as one of the important source of transportation. (as per the blow up plan at Figure 3)

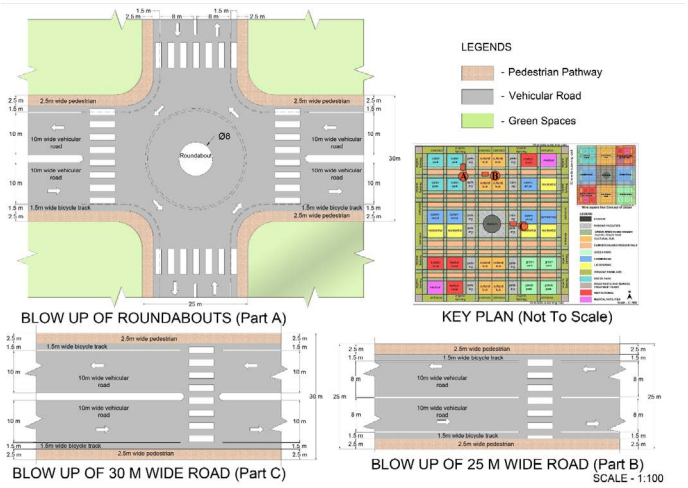

Figure 2: The blow up plans of one of the Roundabouts, 30 meters wide road and 25 meters wide road (source – author)

1.9. Detailed Plan of the Various Zones

The proposed zone for Water Park is divided four Water parks utilizing the water extracted from the rain water harvesting and the recycled water extracted from the sewage treatment plant. The water parks would contain various water sports which are well known all over the world.

Plan of the 1st water park includes water sports like Water Canoing, Inflatable Water Ride and Water Skiing. This water park has separate entry and exit zones, also have a water fountain which is also a hangout area for the visitors. The demarkated zones for service include changing rooms, sitouts, food stalls, toilets, drinking water areas and other essential services like ESS units and so on. The entire water park is pedestrianized with a walking pathway width of 10 meters, it is also paved on both sides which is 3 meters wide and 1 meter wide, for the purpose of siting, resting and hanging out. (as per the plan of 1st water park as shown in Figure 3)

Plan of the 1st Water Park:

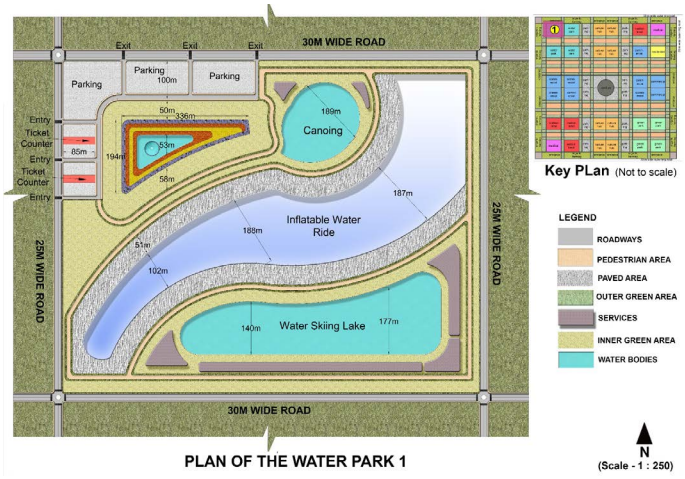

Figure 3: The proposed plan of the Water park 1 for the proposed Ideal Township.

Plan of the 2nd Water Park: As a part of the four water parks, the 2nd water park have certain similar water sports including Water Boarding and Water Tunnel Roller Coaster. (as per the plan of 2nd water park as shown in Figure 3).

Apart from this, there are three swimming pools which are being provided including one swimming pool for adults and two swimming pools for kids. The park also includes one Koi pool and has a Restaurant cum Bar over a water body. The other miscellanous facilities within the park include a commercial zone having three outlets for shopping purpose and also a refreshment corner which is a café cum hanging out zone. The service areas of the park includes changing rooms, Toilets , drinking water areas and other essential services like maintenance areas, ESS units etc. This park also has separate vehicular entry and exit zones with parking areas (two and four wheeler) adjacing to the entry and exit areas. Apart from the entry and exit, the entire park is pedestrainaized surrounding all the activities, having 10 meters wide pathway throughout and 3 meters wide and 1 meter high raised paved platforms on both the sides for hanging out. The others include landscaping having fountains and separate ticket counters. (as per the plan of 2nd water park as shown in Figure 3)

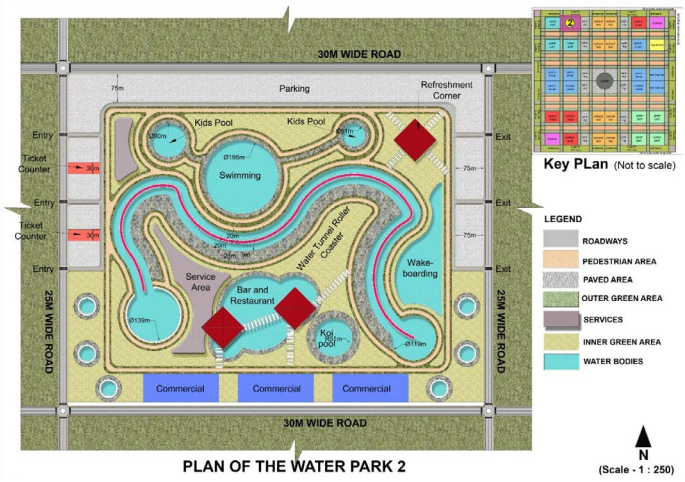

Figure 4: The proposed plan of the Water park 2 for the proposed Ideal Township (source – author).

Plan of the 3rd Water Park: The 3rd water park is prominently used for Paddle surfing as a primary sport in this park. Apart from that it includes water activities like Boating and a Swimmimg training centre. (as per the plan of 3rd water park as shown in Figure 4) In a very similar manner as the other water parks plan, the central part of the park is a proposed non motorised zone with a 10 meters wide pedestrianized pathway running throughout. The motorised zone has been separated as the park is surrounded by motorised parking on three sides, adjacent to the three vehicular roads surrounding it. The entry and exit zones has been separated, also, there are two ticket counters provided at the entry gates. Although the park is surrounded by vehicular roads of 30 meters and 25 meters on all the four sides but the park is accessible only by two sides. The rear side of the park have certain commercialshops which area primarily used for refreshment including snacks, drinks and stationaries. Lastly, the grey coloured zones (as per the plan of 3rd water park as shown in Figure 4) would be supposedly used for services

including changing rooms, Toilets and area used for other services related to supply and maintenance.

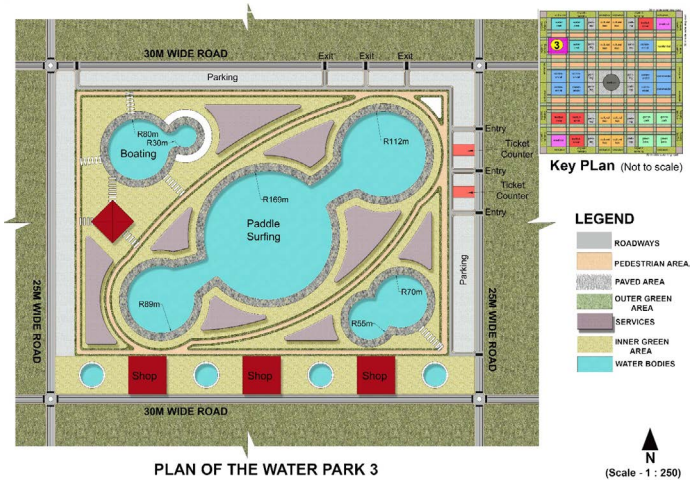

Figure 5: The proposed plan of the Water park 2 for the proposed Ideal Township (source – author).

Similar, to the proposed 1st, 2nd and 3rd Water park even the 4th Water park is proposed with some interesting water sports encouraging reusability and sustainability.

1.10. Plan of any One of the Green Parks

One of the functional and sustainable part of the entire urban space are the proposed green parks, where the green surfaces are maintained by using the recycled water from the sewage being generated from the entire urban space.

The purpose of the green park is not only making the environment a better place to live in but also for the recreational purpose. As the primary function of the green park is an amusement park. This park contains certain recreational activities like Roller Coaster, Trampoline, Merry Go – round, Flying Swinger, See – saw, Swings, Slides and Flying Swinger. (as per the plan of any one of the green parks as shown in Figure 5) This park also have certain other miscellanous activities which involve a refreshment zone used for café and sitting areas. Although the green parks contain vehicular roads on all the three sides, but the parks are proposed to have vehicular accessibililty on any two sides of the park having separate entry and exit zones. There is no accessibility with the other two sides, as one side of it is used for vehicular parking and the other side is proposed to have flower beds of various species. Similar, to the water parks, even the green parks have also been pedestrianized with a continuous paved pathway of 10 meters running

Figure 6: The proposed plan of any one of the Green parks for the proposed Ideal Township (source author).

throughout all the activities. The grey textured zones are proposed to be used for the purpose of services including maintenance, sitting areas, toilets etc. There is a stretch of 5 meters of shrubs on both sides running throughout the paved pathway. Apart from the functional areas, service areas and the walkaways, the entire park is a green area. (as per the plan of any one of the green parks as shown in Figure 5)

1.11. Plan of any one of the Cultural Hub

The primary function of proposing a cultural hub is the upliftment of Indian culture and making it a tourists friendly area. Complimenting to the term that India country which is known for its variety of rich cultures, the culture of Rajasthan is considered to be one of the prominent one and is known for its richness. Thus, the cultural hub is known for its various art, crafts and other cultural activities including the various performance art forms of the state depicting its richness and colour. As per the plan, (as shown in Figure 6) the zones of the cultural hub which is surrounded by 30 meters wide road on two sides (north and south) and 25 merters on the other running two sides (east and west) is divided into four major parts through four vehicular roads of 20 meters connecting from all the four surrounding roads. The connecting vehicular roads within the area is mostly for the four wheeler carts which are run by electricity. As, the central part of the plan has a roundabout having e - vehicular parking and a flower garden in the centre. The e – vehicles is proposed to take the visitors to the different activity areas. The two major parts of the proposed plan have two respective Open Air Theatres which would be primarily used for the art form such as Puppetry and other performing arts such as various Rajasthani folk dance forms and Rajasthani folk music. Apart from the seating areas on both the sides of each of the O.A.T. s, there are galleries and green room which would be provided. Also, there would be certain exhibition area on both sides of the Open Air Theatres which would exhibit the props to be used for the various performance art forms that would be performed on stage including puppetry and various dance forms. There are two foodcourts that would be provided at corners of the Open Air Theatres for refershment purpose.

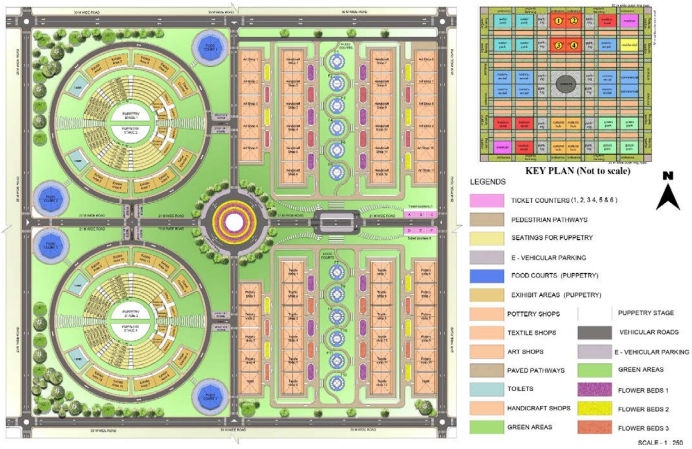

Figure 7: The proposed plan of any one of the Green parks for the proposed Ideal Township (source author).

The other two zones of the cultural hub would be used for handicrafts, textiles, arts, pottery and others. In these two zones there are proposed shops accompained by workshops where vivsitors would not only get the opportunity to buy the products but will also get an opportunity to know the entire proccess of making them. Thus, it would be an informative zone which would also involve economy generation. As per the plan there are 23 retail workshops in each zone of the hub. The area in between would be assigned for recreational and refreshment use. It has food courts and sitting areas.

The all the four zones of the hub is pedestrainized, except a ring road around each Open Air Theatres with separate entry and exit. In case of handicraft and textile shops the entry and exit zones are adjacent to each other with a drop off zone in between. The all the four parts have significant areas for utilities such as toilets, driniking water zones, ticket counters etc. and also for other services with separate service entries for each.

2. Conclusion

The ideal city designed is aimed at pollution free city with reference to environmental issues coupled with circular economy and sustainability in the present paper. Such an ideal city is presently for a population of 1 lakh is designed and planned for a predicted population in the year 2051 and accordingly forecasting done by different methods. On the designed population of 2051, the area of the city estimated using WHO norms of 50 square meters per person as open space. The water consumption, sewage generation, solid waste generation also estimated in the present paper along with revenue generated by transforming waste into usable products. Moreover, around 40 percent urban area is kept as green area where organic farming is developed, and revenue earned.

Moreover, this ideal city is designed to have adequate air ventilation, balancing concreting to non-concreting urban space to reduce urban heat island and thereby reduction in urban energy demand. All the rainwater will be collected and stored and is used to cater population demand. The revenue earned from transformation of waste to usable products, organic farming, reduction in energy demand, recreational and commercial activities, etc will provide adequate input to circular economy and sustainability. Such an ideal city would provide zero carbon footprint which is great effort to address an alarming issue of climate change.

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