

Resources for Green Infrastructure Development and Maintenance: A Study with Particular Reference to Gated Communities in the Bangalore Metropolitan Area

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ABSTRACT

The objective of this study is to identify resources for the development and maintenance of green infrastructure in the privately developed gated communities. The study is primarily with a view to obtaining an environmental planning strategy and guidelines for creation and conservation of green infrastructure in the gated communities. This paper explores the resources for green infrastructure development and maintenance in selected gated communities in the Bangalore Metropolitan Area.

Key Words: *Green Infrastructure, Gated Community, Civic Amenities, Bangalore Metropole.*

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INTRODUCTION

The bane of 21st century is unprecedented urbanization and the vagaries of climate change. Several studies have estimated that by 2030 more than half of the world's population will be living in urban areas. This means that sustainable development of cities and metropolises will be the major challenge confronting administrators, planners, architects and designers globally. Green infrastructure, its design, development and maintenance is a part of any urban facility and administration. Providing resources for the development of green infrastructure is a major issue.

The “green infrastructure” of a city is made up of natural as well as deliberately designed and raised flora systems and elements of the city that significantly contribute to natural processes in maintaining the quality of air, water, microclimate and energy resources. The most essential part of this infrastructure is places that are constituted by water-pervious surfaces and/or soil to support plant material. The most visible elements of this infrastructure are the trees, shrubs and bowers. The principal parts of this infrastructure include natural areas as well as open to sky spaces. Parks, green medians of major roads, avenue trees are some of the obvious elements of green infrastructure in the city.

A gated community providing housing facilities is one of the planned prominent spatial manifestations of rapid process of urbanization. In its contemporary version, a gated community is a form of residential complex or housing estate with many self-contained and possibly exclusive amenities. Gated communities have their own enclosure made of walls, fences and hedges; exclusive entrances and paths for pedestrians, cyclists and motorists. Since they are located in the suburbs they have to develop their own parks and recreation spaces. The objective of this study is to identify resources for the development and maintenance of green infrastructure in the privately developed gated communities. The study is

primarily with a view to obtaining an environmental planning strategy and guidelines for creation and conservation of green infrastructure in the gated communities. This paper explores the resources for green infrastructure development and maintenance in selected gated communities in the Bangalore Metropolitan Area.

THE STUDY AREA

Bangalore, the capital of Karnataka, is the 5th largest metropolis of India. Geographically, it covers an area of 1307 sq. kms enclosing the *Bruhat Bangalore Mahanagara Palike* (greater Bangalore) and surrounding villages. The Bangalore Metropolitan Area has witnessed a fast increase of population (9.5 million, an estimate based on the 2011 census) very much as a result of the growth of the Information Technology (IT) industry. This has spawned pockets of haphazard urbanization especially along the outer ring planning districts. A spatial concomitance of this growth is the emergence of privately developed gated communities to cater to the housing needs substantially of the IT industry incumbents with relatively high disposable incomes. The emergence of these largely exclusive gated communities has led to its own environmental and social specificities. They manifest in the form of paucity of expert personnel for design and maintenance of green infrastructure and other service inputs needed.

Gated communities are generally well-planned with various collateral facilities. They are located in the suburbs and access to them is generally exclusive to private groups and community members. Therefore, the onus of developing green infrastructure here is entirely on the private developers and maintenance is generally the responsibility of the Residents' Welfare Associations. A larger proportion of open space is available for rest and recreation and is a common feature of these gated communities.

The design guidelines, exclusivities and open spaces, recreation facilities, self-contained service centres etc. of gated communities and

NGO's role therein also are to be recorded and especially those oriented towards the resources required for the green infrastructure. The structure and functioning of residents' welfare associations need to be studied with specific reference to green infrastructure related issues. The Bangalore Development Authority had sanctioned 96 residential group housing development plans till 2011. These are located in the 3rd Ring Planning Districts which are suburban areas and are developed as gated communities by private developers to attract buyers from the higher income segments with their own security specificities. The selling price of these properties increases in direct proportion to the amenities provided. As per the Land Use Zoning Regulations of RMP 2015, 10% of the total area has to be developed as parks and recreation areas.

CASE STUDIES

Six gated communities have been selected for study based on variables like location, site area, site geometry and housing type. The following is a brief account of the case-studies.

Six Gated Communities were studied along with their residential development plans sanctioned by the Bangalore Development Authority.

A brief description of each of the above case-studies including the green infrastructure of each is given below.

Adarsh Palm Meadows Gated Community: This community is a residential development by M/s Adarsh developers at *Bhogannahalli Village* and *Doddakannahalli Village, Varthur Hobli, Bangalore East Taluk, Bangalore* is located off the Outer Ring Road. The total site area is 114094.96 sq.mt. and the site has an irregular periphery. The roads constitute an area of 472.26 sq.mt. and the net site area for development is 113622.70 sq.mt. Two parks have been provided and the total area for parks and open spaces is 11409.496 sq.mt. while 6928.53 sq.mt is dedicated for civic amenities.

Table 1: Few Gated Communities in the Bangalore Metropolitan Area

Sl. No.	Gated Community	Location	Developer
1	Adarsh Palm Meadows	Gated Community on Survey nos. 89/1P, 89/2, 112/1P, 112/2 of Bhogannahalli and Survey nos 94/4P, 94/6P, 96/2P, 97/P, 98/2P, 98/1AP, 98/1BP, 99/P and 100/P of Doddakannahalli village, Varthur Hobli, Bangalore East Taluk, Bangalore	Adarsha Developers
2	Adarsh Serenity	Gated community on Survey nos. 180/1, 180/2, 181/1, 181/2, 182, 183/1, 177/1P, 179/1, 179/2, 179/3A, 179/3B, 179/4, 179/5, 185 (P) of Kanna-Mangala village, Bidarahalli Hobli, Bangalore East Taluk	Adarsh Developers
3	Sobha Althea	Gated Community on Survey nos. 62/2, 62/3 Chokkanahalli village, Yelanka Hobli, Bangalore North Taluk and Survey nos. 7/1, 9/1, and 9/2, Nagareshwara, Naganahalli village, K.R Puram hobli, Bangalore East Taluk.	Sobha Developers Ltd.
4	Chaitanya Smaran	Gated community on Survey nos. 143/1, 143/2P, 144/1, 144/2, 144/3, 144/4, 144/5, 144/6, 144/7, 145/1, 145/2P1, 146/1, 146/2, 146/3, 147/1, 147/2, 150/1, 150/2, 150/3 of Kannamangala village and 24/12, 24/13 of Seegehalli village, Bidarahalli Hobli, Bangalore East Taluk.	Chaitanya Smaran
5	Shriram Chirping Woods	Gated Community at. Ltd.on Survey nos. 70/1, 2, 75/1, 2, 3, 4, 6, 7, 76, 77/1 of Harohalli village, Yelahanka Hobli, Bangalore North Taluk	M/s Shriprop Housing Pvt
6	Sobha Amethyst	Gated community by on Survey nos. 3/1B, 3/2, 7, 162 of Haralur village, Varthur Hobli, Bangalore East Taluk.	Sobha Developers

The total built up area is 68390.29 sq.mt while ground coverage of 34.45 percent has been achieved. The development is a low-rise development with the maximum height being 7.71m.

There are 216 villas in 17 blocks. The smallest block has 3 villas while the largest blocks have 16 villas each. The blocks are organized in a linear parallel format. The villas are accessed from driveways with an average width of 18 m. Car parking at the rate of 2 cars per villa has been

provided and it includes both covered and non-covered surface parking. Visitor car parking at the rate of 10% has been provided. The total car parking provided is 475 nos. The layout along with the green infrastructure has been shown in Fig. 1.

Fig.1 Green Infrastructure of Adarsh Palm Meadows Gated Community



The prominent green infrastructure assets of this development are the two parks. They have been located in such a way as to provide easy public access. The internal streets facilitate avenue plantation. Rain water harvesting pits are located in the park area. The sewage treatment plant has been located close to the road with the prospect of possible connection to widen the city sewerage system.

Adarsh Serenity Gated Community: Adarsh Serenity gated community is a residential development by M/s Adarsh developers at Bhoganahalli Village and Doddakannahalli Village, Varthur Hobli, Bangalore East Taluk, and is located off the Outer Ring Road.

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The total site area is 98238.30 sq mt and the site has an irregular boundary. The net site area for development is 97732.45 sq mt. Six parks have been provided and the total area for parks and open spaces is 9773.24 sq mt. while 4957.00 sq mt is dedicated for civic amenities. The total built up area is 57125.69 sq mt while ground coverage of 31.51% has been achieved. The development is a low-rise development with the achieved height being 7.93 m.

There are 171 units in 27 blocks. The smallest blocks have 1 unit while the largest blocks have 14 units each. The blocks are organized in a linear parallel format. The villas are accessed from driveways with an average width of 9.76 m. Car parking at the rate of 2 cars per villa has been provided and it includes both covered and uncovered surface parking. Visitor car parking at the rate of 10% has been provided. The total car parking provided is 444 nos.

The prominent green infrastructure assets of this development are the six parks. They have been located in such a way as to provide easy public access. The internal streets facilitate avenue plantation. Rain water harvesting pits are located in the park areas. The sewage treatment plant has been located far from the public road and connection to the general city sewerage system has yet to be worked out. The waste water treatment plant has been located in one of the park areas.

Sobha Althea Gated Community : This community is a residential development by M/s Sobha Developers Ltd at *Chokkanahalli* village, *Yelahanka Hobli*, Bangalore North Taluk and *Nagareshwara, Naganahalli* village, K.R Puram *Hobli*, Bangalore East Taluk is located off the Peripheral Ring Road. The total site area is 148214.77sq.mt. and the site has an irregular boundary. The road area is 187.60 sq.mt and the net site area for development is 145641.17sq.mt. Nine parks/open spaces

have been provided and the total area for parks and open spaces is 14825.78 sq.mt. while 7415.86 sq.mt is dedicated for civic amenities. The total built up area is 360075.31 sq.mt while ground coverage of 35.19% has been achieved. The development is a high-rise development with the maximum height being 72.45m.

There are 1559 residential units (row houses and apartments) in 16 blocks. The smallest block has 6 residential units while the largest block has 500 residential units. The blocks are organized in a linear parallel format. The residential units are accessed from driveways with an average width of 12 m. Car parking at the rate of 2 cars per residential unit has been provided for row houses/flats more than 225sq.mt but less than 325sq.mt and at the rate of 1 car per residential unit less than 150 sq.mt area. Visitor car parking at the rate of 10% has been provided. The total car parking provided is for 1639 cars. The layout along with the green infrastructure is shown in Fig. 2.

Fig. 2: Green Infrastructure of Sobha Althea gated community



The major green infrastructure asset of the community is the park and open space area provided as per regulations. The park/open space area has however been fragmented into nine smaller spaces distributed all over the entire area. This to a certain extent limits public access. Avenue plantations of the internal streets contribute significantly to the community's

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green infrastructure assets. Rain water pits are located in the park areas. The sewage treatment plant has been located close to the road in view of possible connection to the larger city sewerage system.

Chaitanya Smaran Gated Community: *Chaitanya Smaran* gated community is a residential development by M/s *Chaitanya Smaran* at *Kannamangala* village, and *Seegehalli* village, *Bidarahalli Hobli*, Bangalore East *Taluk* is located off the White field *Hoskote* Main Road. The total site area is 1,22,330 .08 sq.mt. and the site has an irregular spread. The roads constitute an area of 996.84sq.mt and the net site area for development is 1,22,330 .08 sq.mt. Eleven parks/open spaces have been provided and the total area for parks and open spaces is 12,628.03 sq.mt. while 6,207.37 sq.mt is dedicated for civic amenities. The total built up area is 54,559.70 sq.mt while ground coverage has been of 23.98 percent. The development is a low-rise development with the maximum height being 9m.

There are 123 residential units (villas and mansions) in 123 individual blocks. There are six types of residential units. The blocks are organized as groups of parallel row houses. The residential units are accessed from driveways with an average width of 6 m. Car parking has been provided for 361 cars. The layout and green infrastructure are shown in Fig. 3.

Park and open space area is the major green infrastructure asset of the community provided as per the regulations. However, the park and open space area has been fragmented into eleven smaller areas and distributed throughout the site which may restrict easy public access. The internal streets have avenue plantations and since the nature of development is in the form of villas there is a considerable variety in the gardens maintained by individual owners which enhances visual delight. Rain water harvesting pits have been located in the park areas. The sewage treatment plant has

Fig. 3: Green Infrastructure of Chaitanya Smaran Gated Community



been located close to the road with the prospect of possible connection to the general city sewerage system.

Shriram Chirping Woods Gated Community: Shriram Chirping Woods gated community is a residential development by M/s *Shriprop Housing Pvt Ltd* at *Harohalli Village, Yelahanka Hobli, Bangalore North Taluk*, is located off the *Doddaballapur Main Road*.

The total site area is 37,129.60 sq.mt. and the site has an irregular boundary. The road area is 3,986.06 sq. mt. and the net site area for development is 35,273.12 sq. mt. The total area for parks and open spaces is 3,712.96 sq. mt while 1,856.48 sq. mt is dedicated for civic amenities. Two parks have been provided. The total built up area is 17, 859.36 sq. mt while ground coverage is 24.77 percent. It is a low-rise development with the maximum height being merely 11.7 m.

Fig. 4: Green Infrastructure of Shriram Chirping Woods Gated Community

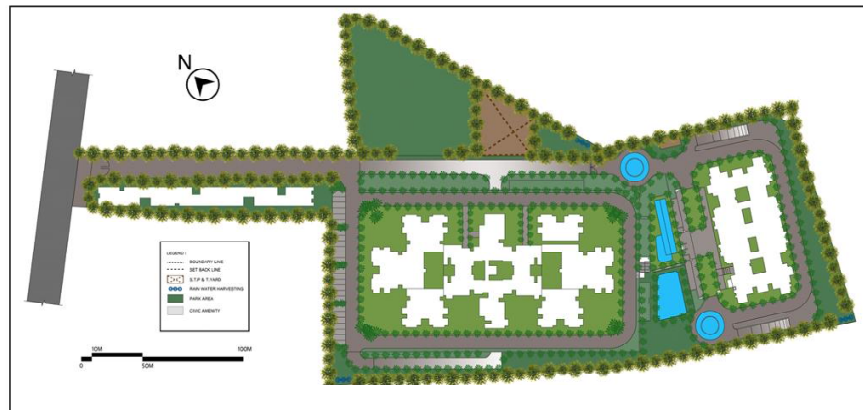


There are 118 residential units in 2 blocks. The smaller block has two floors of residential units while the larger block has three floors of residential units. Stilt floor car parking has been provided at the rate of one car per residential unit. Visitor car parking at the rate of 10% has been provided. The total car parking provided for 137 four wheelers. The prominent green infrastructure assets of this development are the two parks. One of the parks has been located in such a way as to provide easy public access while the other acts as a buffer between the railway line and the residential development. The internal streets facilitate avenue plantation. Rain water harvesting pits are located in the park areas. The sewage treatment plant has been located close to the road with foresight of possible connection to the city-scale sewerage system.

Sobha Amethyst Gated Community: Sobha Amethyst gated community is a residential development by M/s Sobha Developers Ltd at Haralur village, Varthur Hobli, Bangalore East Taluk is located off the Sarjapur Road beyond the Outer Ring Road.

The total site area is 28,110.42 sq mt and the site has an irregular geometry. The road area is 132.12 sq mt and the net site area for development is 26,572.78 sq mt. A large park has been provided and the total area for parks and open spaces is 2,814.04 sq.mt. while 1,405.52 sq.mt is dedicated for civic amenities. The total built up area is 75,447.32 sq.mt while ground coverage is 14.21 percent. It is a high-rise development with the height being 62.75m. There are 275 residential units in 2 blocks. There are four types of residential units. The residential units are accessed from driveways with an average width of 6 m. Car parking has been provided for 408 cars. The layout and green infrastructure of the community are shown in Fig. 5.

Fig.5: Green Infrastructure of Sobha Amethyst Gated Community



Park and open space area, which is the major green infrastructure asset of the community, has been provided as per the regulations. The park and open space has been provided at one side of the residential unit

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with easy public access. The internal streets have avenue plantations. Rain water harvesting pits have been located in the park and set back areas. Waste water treatment system has been provided. The sewage treatment plant has been located close to the road with the idea of possible connection to the city-scale sewerage system.

DISCUSSION

The following observations with particular reference to green infrastructure can be made from the above study of the six gated communities based on their sanctioned residential development plans. In compliance with the bye laws and the Land Use Zoning Regulations of RMP 2015 10% of the total site area has been developed as park for recreational purpose in the gated communities. It is also observed that in some gated communities this area is fragmented into small park spaces and distributed across the gated community whilst in others it is concentrated and developed as a single large open space. However, it is noted that there is ease of public access in both the cases. In some of the case studies outdoor sports facilities like tennis and basket ball courts are provided.

Water is critical for the development and maintenance of green infrastructure. It is interesting to note that rain water harvesting is being carried out by all the gated communities and the rain water harvesting pits and collection ponds are appropriately located in the park areas and are designed to be part of the park landscaping scheme.

Waste water treatment plants are present in all the gated communities. An interesting observation has been the presence of grey water spouts and outlets, duly marked, in the open spaces and parking areas. This water it is observed has been used to maintain the green infrastructure as well as for functions like washing and cleaning the vehicles, dust bins etc.

All the six gated communities are located in the suburbs and are remote from the city sewerage network. The sewage generated by the community is treated *in-situ* and the sewage treatment plants are appropriately but discreetly located. In some cases it appears as if the sewage treatment plants are located in anticipation of a future connection to the larger city sewerage system.

Table 2: Density of Population in Gated Communities

Sl. No.	Gated Community	Site Area (sq.mt)	No. of units	Popula-tion	Density of Population (persons/sq.mt)
1	Adarsh Palm Meadows	114094.96	216	1080	0.01
2	Adarsh Serenity	98238.30	171	885	0.01
3	Sobha Althea	145641.17	1559	7795	0.05
4	Chaitanya Smaran	122330.08	123	615	0.01
5	Shriram Chirping Woods	37129.60	118	590	0.02
6	Sobha Amethyst	28110.42	275	1375	0.05

The population density in the gated communities is low. The residents have the benefit of enjoying the landscaped open spaces of the community.

Table 3: Built-up Area Open Space Ratio in the Gated Communities

Sl. No.	Gated Community	Site Area (sq.mt)	Total Built-up Area (sq.mt)	Open space Area (sq.mt)	Ratio of Built-up area to Open space
1	Adarsh Palm Meadows	114094.96	68390.29	11407.49	6:1
2	Adarsh Serenity	98238.30	57125.69	9776.62	6:1
3	Sobha Althea	145641.17	360075.35	14825.78	24:1
4	Chaitanya Smaran	122330.08	54559.70	12628.03	4:1
5	Shriram Chirping Woods	37129.60	17859.36	3712.96	5:1
6	Sobha Amethyst	28110.42	75447.32	2814.04	27:1

The internal streets of the communities provide opportunity for avenue plantation which will become the green infrastructure assets of the community. The mandatory set back areas in addition to providing space for visitors parking in some communities also function as open spaces for the development of the community's green infrastructure assets. In yet others, they facilitate the development of jogging and cycling tracks. The population density in the gated communities is low. The residents have the benefit of enjoying the landscaped open spaces of the community. There is a wide variation in the ratio of built-up area to open space in the case studies.

The Nature of Vegetation

The most essential resource for green infrastructure is all places and spaces that have water-pervious surfaces and/or soil to support plant material. The most visible elements of green infrastructure are the trees, shrubs and bowers and other areas with greenery. Gated communities are located mainly in the suburbs and are remote to the general city parks and other passive recreational spaces. The community members need breathing space where they can relax and enjoy the endowments of nature.

As per land use Zoning regulations 10% of the respective site areas have to be in the form of parks and open spaces. This bye law has been in force because the gated communities are considerably distant suburban developments and access to the city's general parks for passive recreation is not easy. The developers of the gated communities have to develop the parks and other open spaces like playfields for recreational needs—both passive and active—of the residents. The compliance of this regulation in the case-studies is given in the following table.

Table 4: Ratio of site area and parks and open space area in the selected gated communities

Sl. No.	Gated Community	Site Area (sq.mt)	No. of units	Population	Density of Population (persons/sq.mt)
1	Adarsh Palm Meadows	114094.96	216	1080	0.01
2	Adarsh Serenity	98238.30	171	885	0.01
3	Sobha Althea	145641.17	1559	7795	0.05
4	Chaitanya Smaran	122330.08	123	615	0.01
5	Shriram Chirping Woods	37129.60	118	590	0.02
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A visual survey has been made to identify the prominent green elements which are also the green infrastructure assets of the community in case-studies here considered. Trees are the most dominant green infrastructure assets. Peripheral trees planted in the set-backs serve as good visual characteristics of the site boundary. The internal private streets of the gated communities have avenue trees which provide shade as well as visually characterize or define the internal site circulation system. Trees also constitute visual barriers for activity spaces which require visual segregation or privacy like swimming pool areas.

The environmental quality and visual ambience of open spaces have been enhanced by bowers as areas shaded by trees and other plants or as places enclosed by overhanging boughs of trees. Topiaries and trellises covered with vines or arbors with flowering vines have also been used to add significance and wholesomeness to open spaces. Shrubs are used to divide and distinguish spaces.

Seasonal flowering plants have been judiciously planted in open spaces and parks in such a way that there are some flowers throughout the year i.e. all through the different seasons. Lawns have been raised in parks

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and serve as passive recreation space as well as to provide considerable visual delight by its color and texture unique to flora. Incidentally, lawns are used in the berms that separate the internal circulation streets from individual homes as well as in the spaces between homes.

Resources for Green Infrastructure in Gated Communities

From the above study the following have been identifiable as the **main resources** for the development of green infrastructure in these privately developed gated communities:

1. Land with soil to support vegetation
2. Water for sustenance of plants
3. Funds for the development of the green infrastructure assets
4. Micro climate or conducive environmental conditions
5. Plant material - Seeds and saplings
6. Specific Manpower needed for development and maintenance

Land with soil to support vegetation

The Bangalore Development Authority approves and sanctions the development of gated communities through the residential development plan. The residential development plan is defined as “Plan containing proposal for construction of one or more residential buildings on a plot measuring more than 20,000 sq m in extent.”

One of the significant elements in regulations for the Residential Development Plan is 10 % of the land has to be reserved for Park & Open space. The open space (park) shall be relinquished to the authority free of cost and the same may be allowed to be maintained by the local residents association (registered), if the Authority so desires. This regulation legally ensures the provisioning of land for the development of green infrastructure. It also secures man-power for its development and maintenance through the local residents association.

Water for sustenance of plants

Water is a key resource for the development and maintenance of green infrastructure. The gated community could be viewed as an opportunity for rain water harvesting, use of bio-swales, as well as waste water re-cycling. Rain water harvesting is the collection and storage of rain water for use before it reaches the aquifer. It is a mandatory requirement in the Land Use Zoning Regulations of the RCDP 2015.

Visual survey of the gated communities reveals that the collected rainwater is used predominantly for maintaining the green infrastructure of the community. The water collected is also redirected to a deep pit with provision for percolation.

The harvested water has been used for domestic purposes where the storage tanks can be accessed and cleaned as and when needed. However, neither the developers of the gated communities nor the resident welfare associations appear to be in favor of use of harvested water for domestic purpose. Thus, the entire resource was utilized for the maintenance of the green infrastructure assets of the community.

Funds for the Development and Maintenance of the Green Infrastructure Assets

The gated communities being privately developed the residents themselves should generate funds for the development and maintenance of the community's green infrastructure assets. Raheja Jade Garden, an upscale lifestyle residential layout, fully gated posh community, was developed by K Raheja Group in the 1990s. It is located off the 6 Lane highways to the Bangalore International airport. Jade Garden has truly captured nature for great living. Tree lined walkways, serene open space for a variety of outdoor family activities, parks and beautiful homes sheltered by a canopy of shady trees. The Jade Garden Plot Owners Association works hard on improving and maintaining the community facilities including its green infrastructure

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assets. A Contingency Fund of Rs 10,000.00 per plot is collected at the time of association membership which is used to build up the Reserve Fund. Maintenance charges per annum are collected from the plot owners by the association for the betterment of the layout including the maintenance of the parks, green areas, avenue planting, hedges in addition to other maintenance work.

Micro-climate and conducive environmental conditions

Bangalore provides a salubrious climate and has been historically referred to as the Garden City because of its numerous public parks of varying scales as well as privately maintained gardens.

The climatic conditions are conducive for a wide variety of flowering and non-flowering plants as well as sustaining biodiversity. The construction process of the gated community should ensure that the local environmental conditions and microclimate are not polluted which would be detrimental to the development of green infrastructure. Since the developers benefit from the development of green infrastructure by an enhanced selling rate they are generally inclined to develop it professionally.

Plant Materials: Seeds and Saplings

The peoples' efforts at augmenting their community's green infrastructure assets have departmental as well as institutional support. The Karnataka State Horticulture Department along with the Bangalore Mahanagara Palike offers horticultural services to the citizens. The BBMP has 12 small nurseries located in the three zones, East Zone, West Zone and South Zone and a large nursery in *Bommanahalli*. The request for saplings can be made at 12 small nurseries located in 3 zones as well as one large nursery located at *Bommanahalli*. In addition there are several private nurseries from where seeds and plant material can be procured.

Manpower for development and maintenance

The initial development initiative of the green infrastructure lies with the developer of the gated community. The per sq. ft selling cost increases directly with the nature and kind of amenities provided including parks and open spaces or green infrastructure. The developer commissions professional consultants like landscape architects and agencies providing green infrastructure development services for the initial development of the community's green infrastructure.

Later the responsibility of maintaining and further developing the community's green infrastructure assets lies with the resident welfare association. The gated communities being privately developed the resident welfare associations play a vital role in the development of green infrastructure. The Laughing Waters community is one of the oldest planned/gated communities in Ramagondanahalli, Whitefield, Bangalore. It was developed by Prestige Builders in 1994 and consists of 360 households. It has a total area of 48 acres with 2 acres of common area developed as a park. The effort of the Laughing Waters Owners and Residents Association (LWORA) is a good example of man trying to reestablish harmony with nature through the development of the community's green infrastructure assets. Tree planting is undertaken for greening the precincts and recharging groundwater. The children of LW have formed a group EcoLife and have started planting trees along the roads and plan to plant trees in the vacant slots. There are 1,188 trees and the goal is to plant 2,000 trees. The trees include *Gul Mohrs, Flame of the Forest, Asoka, Indian Cork Tree, Red Silk Cotton, Wild Almond, Jacaranda, Java Plum, Neem, Temple Tree, Mountain Ebony, Jack Fruit Tree, Pongam (Honge), Banyan Tree, Peepul, Drumstick Tree, Golden Champa, Goose Berry, Terminalia arjuna.*

CONCLUSION

Land with soil is the key resource for the development of the gated community's green infrastructure. The bye-laws mandate that 10% of the total area be developed as parks and open spaces. In addition there is a mandatory set-back that has to be provided. This area has also been used for the development of the communities' green infrastructure assets. There is however a need of a bye-law for the ratio of pervious to impervious surface and also soil to paved surface. Water for the maintenance of the greenery is ensured by rain water harvesting and waste water recycling. The recycled water is entirely used for the maintenance of the green infrastructure assets of the community. The initial green infrastructure development is by the developer/promoter of the community who benefits from enhanced selling rates. Later the resident welfare association raises the funds on a pro-rata basis for the development and maintenance of the green infrastructure assets. Bangalore embodies a salubrious climate throughout the year conducive for a wide variety of flowering and non-flowering plants. Plant material can be procured from state nurseries. Since the community members are the primary beneficiaries of the green infrastructure assets there is enthusiasm and active participation often in their development and maintenance as also a sense of pride and community identity.

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