PROPOSAL OF ROOF TOP RAIN WATER HARVESTING SYSTEM SANDEEP VIHAR, GH-79, SECTOR 20, PANCHKULA

1.0 General.

AWHO has constructed a Group Housing Society at Sandeep Vihar, Plot No GH-79, Sector 20, Panchkula. There are 556 No dwelling units of four categories viz Deluxe, Economical, Utility and Thrift. In addition a Banquet Hall, Club House, AWHO Office, Electrical Room etc have been provided. Plot Area of the Society is 13 acres. Out of 13 acres, green park area is less than 2 acres. About 11 acre area is covered by buildings, roads, footpaths and parkings. Location map of the Society is given in Annexure I-A & I-B. Domestic Water Supply of the Society is met through water mains laid by HSVP (earlier HUDA). For domestic sewage and rain water drainage separate sewer lines have been laid which drain into the Sewer Lines and storm water sewer laid by HSVP along the adjoining road. Storm water of the Society is draining into Sector's storm water sewer at three different locations.

2.0 Present Status of Rain Water Harvesting in Sandeep Vihar

At the time of construction it was not mandatory to provide the rain water harvesting structures in the Society. Accordingly the domestic sewage and storm water of the Society are draining into main sewer lines and storm water sewer lines laid by HUDA. Storm water of this sector lies in the catchment area of river Ghagger. Most of the area at ground is covered by Multistorey Towers, Club House, Community Centre, AWHO Office, Paved area of Roads, Footpaths, Ramps and Parkings. Area of Parks is less than 2.0 acre. Hence percolation of water in the Society has reduced considerably. It is well known fact that ground water is depleting at a faster rate as withdrawl of water for drinking, irrigation and industry is more than recharging of the ground water. Central Ground Water Board has carried out studies of Ground Water of the various States, Union Territories and Districts. In the following paras, two Reports prepared by Central Ground Water Board (CGWB) regarding ground water levels of Panchkula District are discussed.

2.1 Ground Water Information Booklet of Panchkula District of CGWB

Central Ground Water Board has published a Ground Water Information Booklet of Panchkula District in the year 2013. In the Booklet, some of the recommended points are given below:

(a) There are numerous streams through Kandi belt, which carry a lot of water during monsoon season. The rainwater can be collected in existing tanks/ponds and natural depressions and artificial surface reservoir to enhance the ground water recharge.

(b) The areas having heavy water level decline need to be mapped. People should be made aware of adopting conjunctive use of surface and ground water, rainwater harvesting and artificial recharge measures.

(c) Parts of Raipur Rani and Barwala blocks need special attention with regard to ground water management and development as these blocks are facing water level decline as well as level of development is comparatively higher.

2.2 Report of Central Ground Water Board Year 2017

CGWB has carried out a study on Aquifer Mapping and Management Plan of Panchkula District and submitted its report in the year 2017. It concluded with the following points:

(a) The district belongs to single aquifer system upto a depth of 300m.

(b) Dynamic ground water resources of the district are 0.146 bcm and fresh in storage ground water resources of Ambala district are 1.61 bcm. Thus total Ground water resources of Aquifer are 1.756bcm.

(c) There is not an over draft in the district but it is suggested that proposed artificial recharge measures and conserving ground water through laying of underground water pipelines will save 8.8 & 8.91 mcm of ground water respectively.

(d) Around 86% of the tube wells are in the depth range of upto 70 meters and

remaining are deeper (70-110 m depth) in the district. Thus majority of wells are tapping Aquifer group-I which is under stress due to overexploitation.

(e) Dynamic ground water resources (2013) indicate that Gross ground water draft for irrigation in Panchkula district is estimated at 88.62 MCM. It is expected that around 25% of over draft can be brought down by switching over to underground/surface pipeline based distribution system from the prevailing unlined open channels. Thereby draft will be reduced to the tune of 22.15 MCM assuming there is no crop diversification by the farmers.

(f) In addition to that by adopting artificial recharge to ground water 8.8 MCM of overdraft can be reduced.

3.0 Proposal for Rain Water Harvesting

3.1 Present scenario of declining ground water table, climate change, global warming, inadequate rains or excess rains in short period, wheat/ rice cropping pattern, urbanization, etc has forced the planners to think that it is the time to recharge the ground water otherwise; this precious source of water will be lost. Shifting to less water consuming crops and using treated water from STPs for gardening, flushing toilets, etc would save ground water. For recharging of ground water, any of the following methods can be used:

(a) Rain Water Harvesting through Pits, Tanks, Ponds, Channels, Vertical Shafts, Dug Wells, abandoned Tubewells, etc

(b) Artificial Recharge from Canals, Ponds, Lakes, etc

(c) Increase in vegetation / green areas. This will help in preventing soil erosion and retaining of water in the soil

3.2 **Various Proposals for Rain Water Harvesting**. Members of the Executive Committee of the Society are aware of the situation and have decided to explore the possibility of Rain Water Harvesting within the existing storm water disposal system and within the limited budget of the Society. Accordingly the following possibilities were explored:

(a) **Proposal 1**. Roof Top Rain Water Harvesting for each Tower with a Desilting Chamber and a Recharging well in the central duct area of each tower.

(b) **Proposal 2**. Roof Top Rain Water Harvesting for each Tower / Building with a Desilting Chamber and a Recharging well near the outfall point of the storm water sewer into the Society's Internal Storm Sewer line.

(c) **Proposal 3.** Rain Water Harvesting from three number outfall points of Society's storm water sewer into the Sector's Main Storm water sewer line laid by HSVP with a provision of a Desilting Chamber, Oil and Grease Trap, Filter and a Recharging well. This proposal includes rain water of the paved area as well as rain water from roof top.

4.0 Merits and Demerits of each Proposal. The above proposals were studied and discussed in detail as appended below.

4.1 Details of Proposal 1. It was noted that Central Duct of each tower is paved and has a number of manholes to arrest the domestic sewer and storm sewer separately from various ducts of the flats and their lines are crossing each other till the respective sewers are merged into the main manholes from where it is carried to the Society's internal storm lines. Central Duct of the Tower E-12/E-13 was surveyed in detail and the sketch of existing manholes and their pipelines was prepared and studied. It was observed that for construction of Desilting Chamber and Recharge Well in the central duct, some manholes and their pipelines would need shifting.

4.2 Details of Proposal 2. Towers E-12, E-13, E-14 and E-15 were studied for implementation of Proposal 2 and it was observed that if a manhole is constructed just before the outfall of rain water sewer line of the Block E-12 /E-13 into internal sewer line of Society and water is directed to the desilting chamber to be constructed in the adjoining green belt between road and boundary wall. Thereafter, water from Desilting Chamber will be carried to the Recharge well of suitable size. A central borehole with perforated pipe will take

the water into sandy aquifer sufficiently below the NGL. An outflow pipe will be provided in the well to carry any surplus water into the nearest downstream chamber of storm sewer. The above proposal can be used in the Towers E-12 to E-15, Two Utility Towers and one Thrift Tower. Proposal 2 in the other buildings will be taken up after construction and success of above.

4.3 Details of Proposal 3. In this proposal rain water of paved area and rain water from rooftop area are included and the quantum of water is increased manifold as compared to water from the rooftop of single tower. As parking area is also included in the paved area, this water may also include some content of oil and diesel. Hence in addition to desilting chamber and Recharge well, Oil and Grease trap and filter are also required. As there are three outfall points only, discharge at each outfall points will be more and the space requirement for each recharge system would be more as compared to the discharge and space requirement for Proposal No 2

4.4 Recommendation.

(a) It was decided that since Proposal 1 would involve more time and expenditure on shifting of manholes and pipelines, it should be dropped. Further in Proposal 2, availability of area near outfall no 1 and outfall no 3 is very less, hence this proposal is not being considered for further development.

(b) Keeping the above in view and available time and funds requirement, Proposal 2 is recommended for implementation of ground water recharge.

5.0 Rainfall Data. Rainfall data as per CGWB Report is appended below:

The normal annual rainfall of the district is 1057 mm, which is unevenly distributed over the area in 49 days. The southwest monsoon sets in from last week of June and withdraws in end of September, contributed about 86% of annual rainfall. July and August are the wettest months. Rest 14% rainfall is received during non-monsoon period in the wake of western disturbances and thunderstorms.

Normal Annual Rainfall	1057 mm
Normal monsoon Rainfall	911 mm
Temperature	
Mean Maximum (May &June)	39.1C
Mean Minimum (January)	6.1 C
Normal Rain days	49

5.1 Quantity of Water. Quantity of rain water for one hour maximum rainfall and Normal monsoon rainfall has been worked out for each cluster / building. Coefficient of runoff from roof top is taken as 0.9. Maximum Hourly rainfall has been assumed as 100 mm and the Normal monsoon rainfall is 911mm. Quantity of water to be recharged through 4 No Economy Blocks, 2 No Utility Blocks and 1 No Thrift Block with Average Normal Monsoon rainfall will be 2963 cum.

Table 1. Quantity of Water in One Hour Rainfall of 100 mm per Hour

SN	Particular	Area, sqm	Coeff. of Runoff	Max Rainfall m / hr	Volume of water, cum
1	Deluxe Cluster	695.5	0.9	0.1	62.6
2	Economy Cluster	600.2	0.9	0.1	54.0
3	Utility Cluster	473.4	0.9	0.1	42.6
4	Thrift Cluster	266.8	0.9	0.1	24.0
5	Banquet Hall	623.1	0.9	0.1	56.1
6	Club	643.2	0.9	0.1	57.9

Table 2. Quantity of Water of each Cluster in One Year with Average Monsoon Rainfall of 911mm

S N	Particulars	Area, sqm	Coeff. of Runoff	Max Rainfall, m per hr	Volume of water, cum
1	Deluxe Cluster	695.5	0.9	0.911	570.2
2	Economy Cluster	600.2	0.9	0.911	492.1
3	Utility Cluster	473.4	0.9	0.911	388.1
4	Thrift Cluster	266.8	0.9	0.911	218.7
5	Banquet Hall	623.1	0.9	0.911	510.9
6	Club	643.2	0.9	0.911	527.4

6.0 Quantity of Materials and Estimated Cost.

Manhole, Desilting Chamber and Recharge Well are proposed to be constructed in Brick Masonry. Top slab of these is proposed in RCC with a provision of manhole cover. Typical drawings to be adopted for E-12 to E-15 cluster are appended as Annexure-II and Annexure-III. Quantities of materials for one Recharge System have been worked out based on these typical drawings and estimate appended as Annexure IV. However, the quantities may change slightly as per site conditions, depth of storm water pipe below the road level and actual length of pipe required for each block. Estimate of one Recharge well system works out to Rs 1.75 Lakh. Estimate of seven number recharge well systems (for 4 No Economy, 2 No Utility and 1 No Thrift Cluster) works out to Rs 12.25 Lakh.

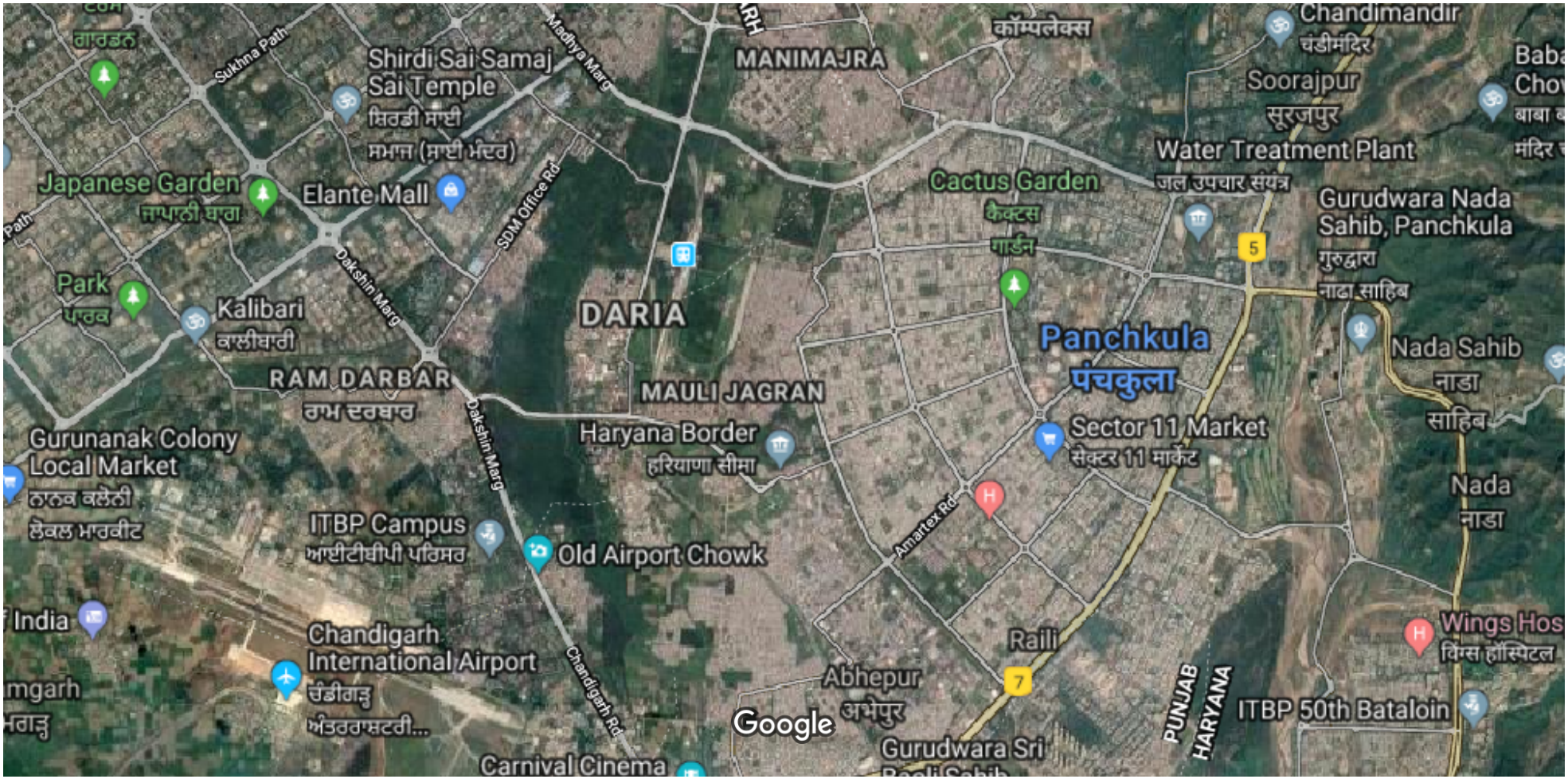
Annexure-IV

Estimate for the Roof Top Rain Water Recharge System for E-12/E-13 Block

S. No	Particulars	Unit	Quantity	Rate	Amount
1	Constructing brick masonry manhole in cement mortar 1:4 with RCC top slab with M-20 concrete, foundation concrete 1:4:8 mix, inside plastered with 12mm thick 1:3 CM finished with a floating coat of neat cement complete as per design (a) Inside size 4'x3' and 4' deep including CI cover with frame 500mm diameter internal diameter (medium duty).	No	1	25000	25000
2	Constructing brick masonry Desilting Chamber in cement mortar 1:4 with RCC top slab with M-20 concrete, foundation concrete 1:2:4 mix, inside plastered with 12mm thick 1:3 CM finished with a floating coat of neat cement complete as per design (a) Inside size 6'x3' and 4' deep including CI cover with frame 500mm diameter internal diameter (medium duty).	No	1	35000	35000
3	Constructing Recharge well in Brick masonry in cement mortar 1:4 with RCC top slab with M-20 concrete, foundation concrete 1:4:8 mix, inside plastered with 12mm thick 1:3 CM complete as	No	1	90000	90000

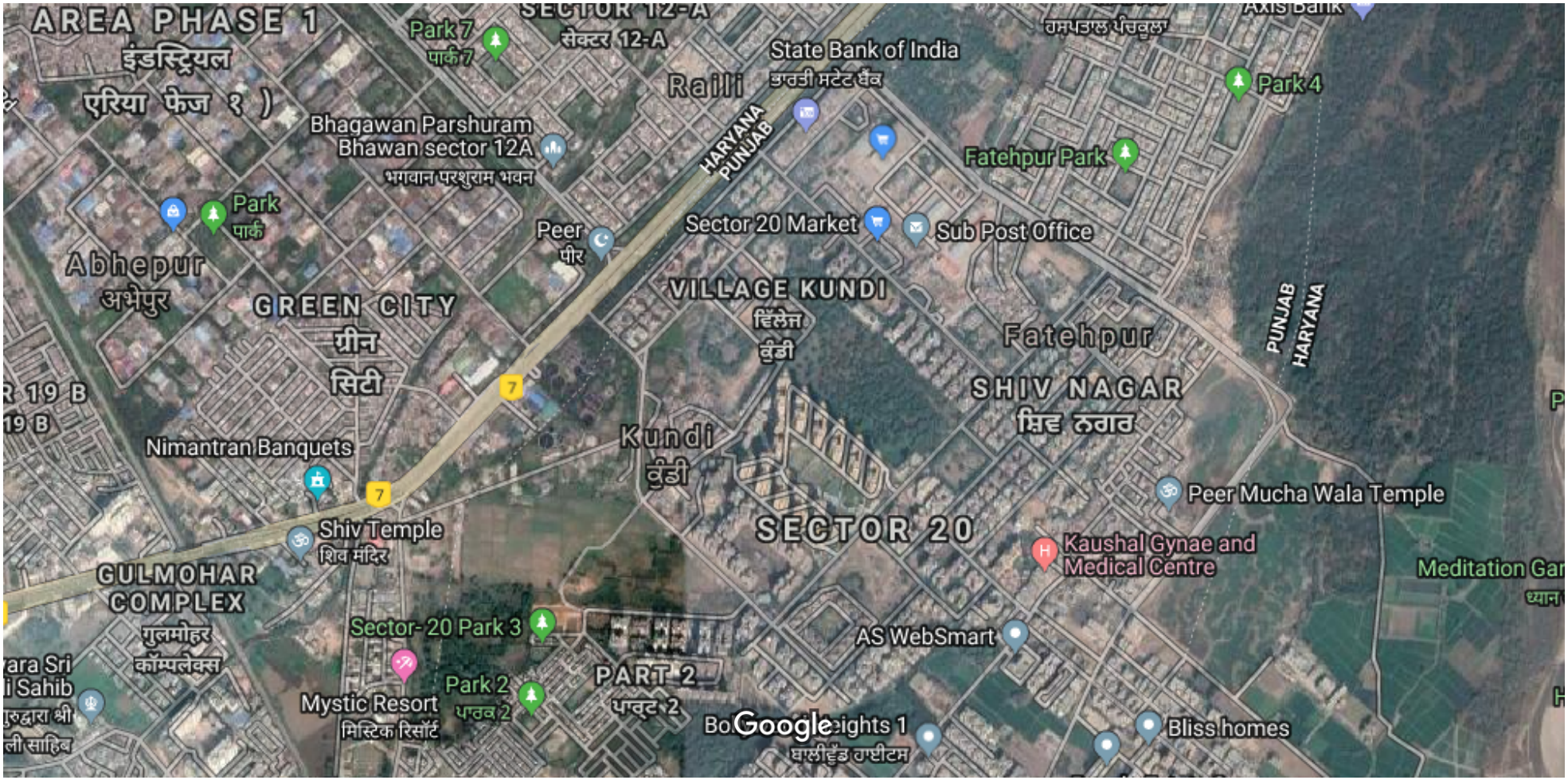
	per drawing having inside diameter 10' and 12' deep including CI cover with frame 500mm diameter internal diameter (medium duty). 3" thick brick floor over 6" thick PCC1:4:8. Filter shall be of 3' deep sand, 1'-9" deep gravel and 1'-9" deep boulders, drilling of 12" diameter borehole atleast 40' deep, including 6" diameter uPVC Pipe of 28 feet (blind) in borehole and 18' in well and above and 12' strainer length as shown in the drawing.				
4	Providing and laying of NP-2 class (light duty) 250mm diameter RCC pipes with collars jointed with stiff mixture of 1:2 CM including testing of joints complete.	M	30	550	16500
5	Providing MS footrests with 20mm diameter round bar	No	28	300	8400
				Total	174900
				say	1.75 Lakh

Google Maps

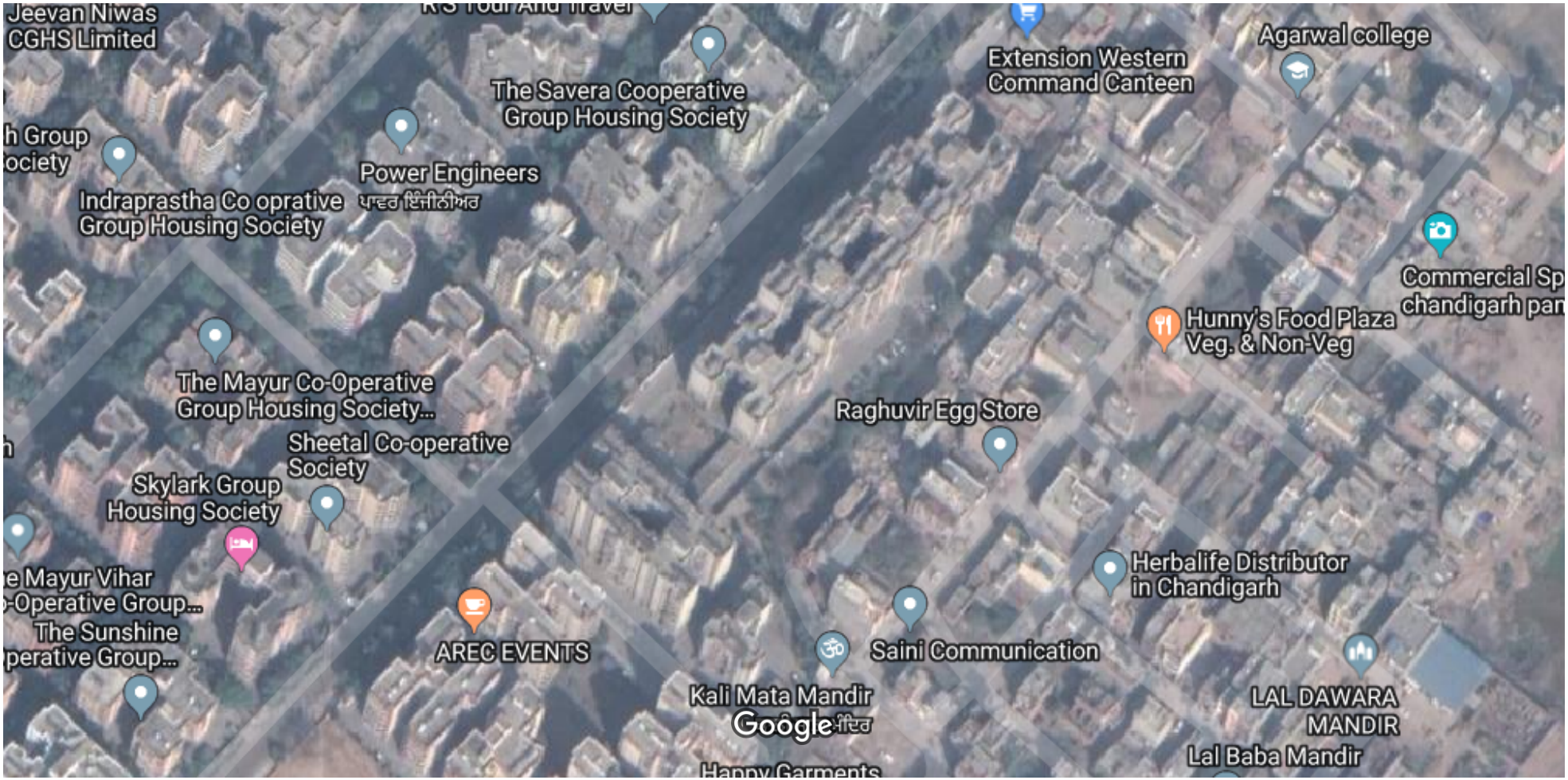


Imagery ©2019 CNES / Airbus, Landsat / Copernicus, Maxar Technologies 1 km

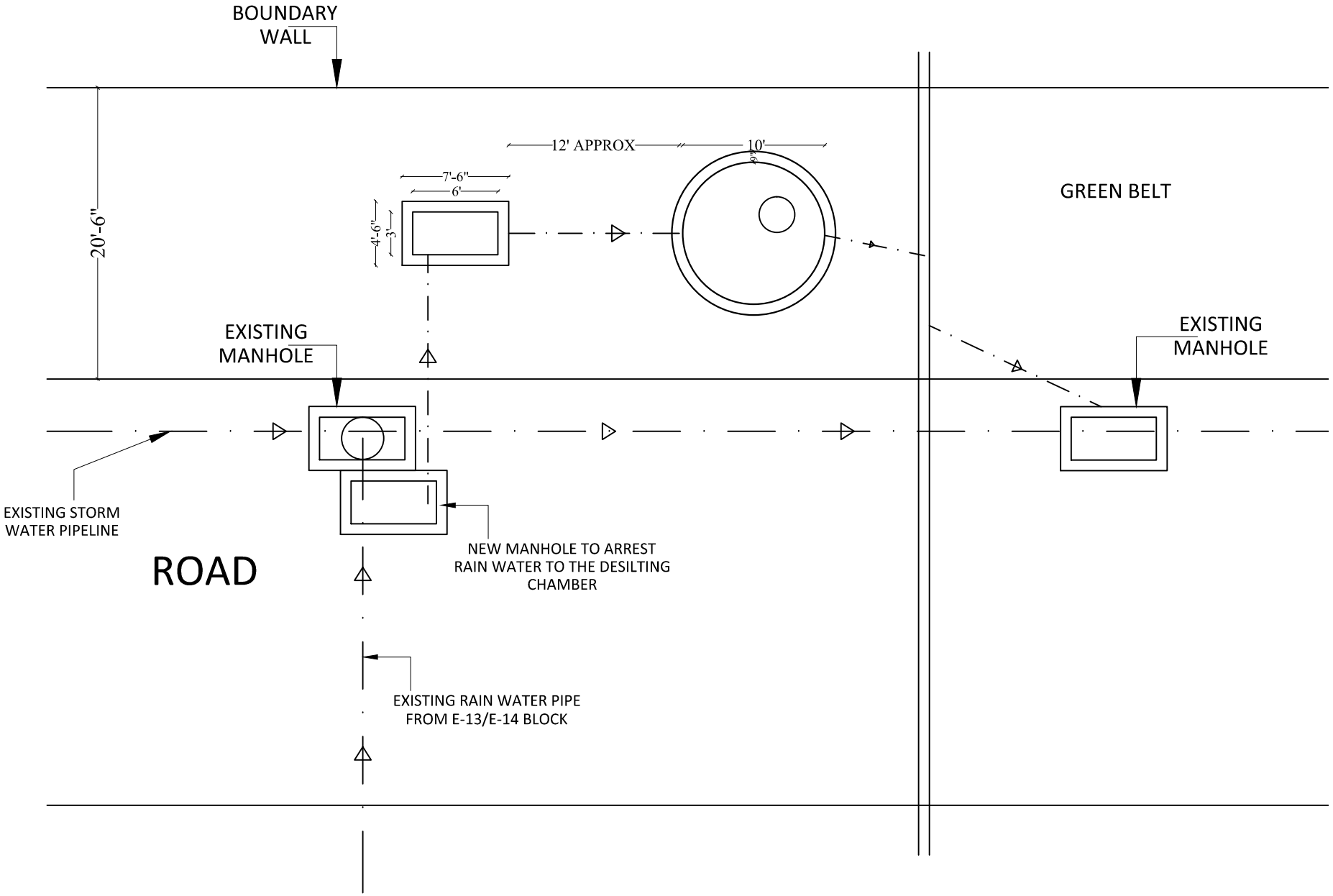
Google Maps Sector 20 Panchkula



Google Maps E12 to E15

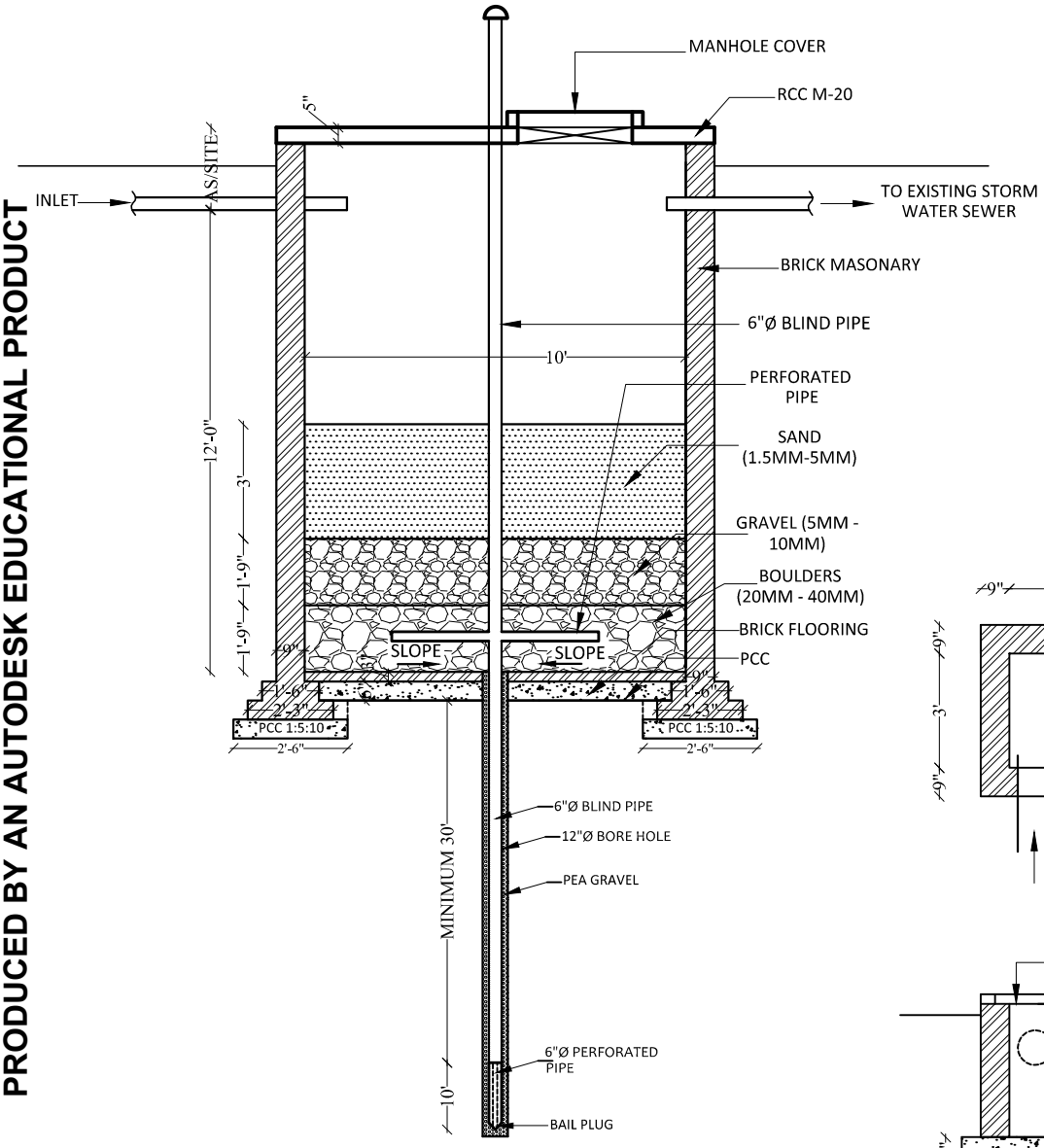


Imagery ©2019 CNES / Airbus, Maxar Technologies 50 m

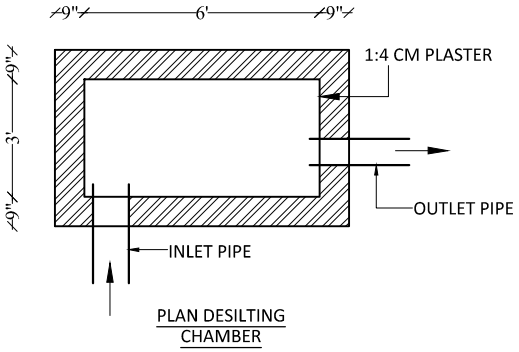


TYPICAL RAIN WATER HARVESTING PLAN
FOR E-12,E-13,E-14'&E-15 BLOCK

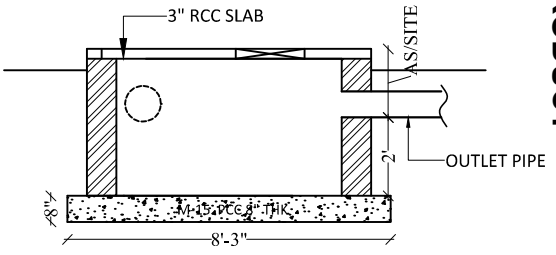
PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT
PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT



SECTION OF RECHARGE WELL



PLAN DESILTING CHAMBER



SECTION THROUGH DESILTING CHAMBER

PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT

PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT