Environmental & Socio-economic impacts of mass rapid transit using GIS

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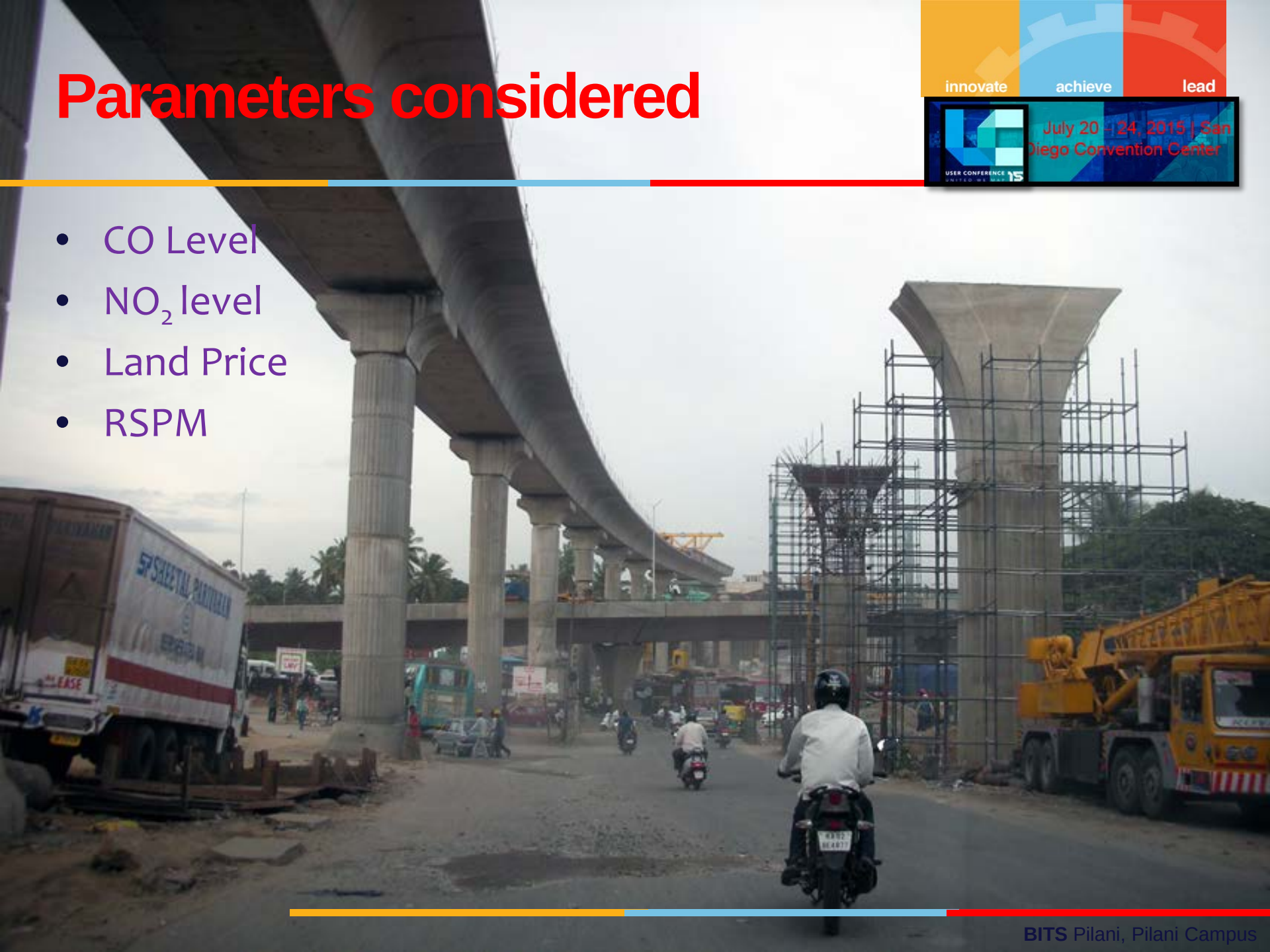
Motivation

- Increasing population and transportation in India
- Metro is must for the smooth and effective transportation at major cities
- Sustainable development
- Environmental and Socio – Economic Impacts

Methodology

- GIS (spatial Techniques):
- Acquiring Maps
- Geo-referencing,
- Digitization
- Attribute Table (parametric values)
- Symbology
- Interpolation (TIN), Buffering
- Clipping
- Comparison: Pre-Metro & Post metro

Parameters considered



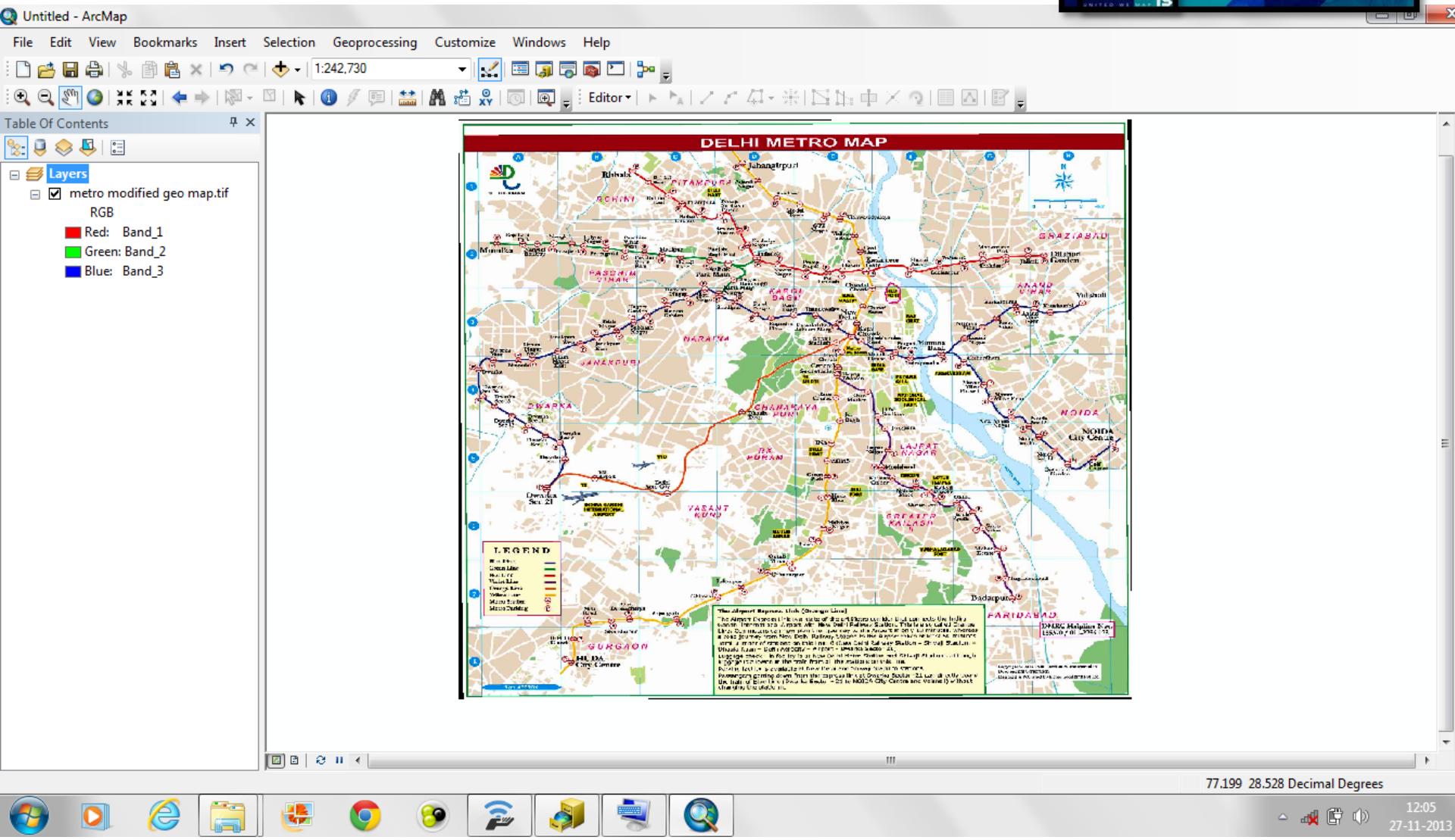
- CO Level
- NO_2 level
- Land Price
- RSPM

Parameters Considered

Attribute	How is it measured
CO	Using Non dispersive infrared spectroscopy. 24 hourly samples twice a week at 17 locations for one month, and 12 hourly samples of CO.
Noise Levels	Measured using precision sound level meter. The principle of propagation of sound waves was used to estimate the noise levels at various locations. On hourly basis for 24 hours, twice a week.
Air Quality Index	National Ambient Air Quality Standards- of the CPCB June'95, India.
Congestion Index	Index derived by Peak hour service volume (PSV) divided by Practical capacity (PC)
Residential land value increase	According to survey done by media and surveying agencies.
Commercial land value increase	According to survey done by media and surveying agencies.

Map and Geo-referencing

(geo-referencing with rectified map)



Digitization

(points (stations), line (path))

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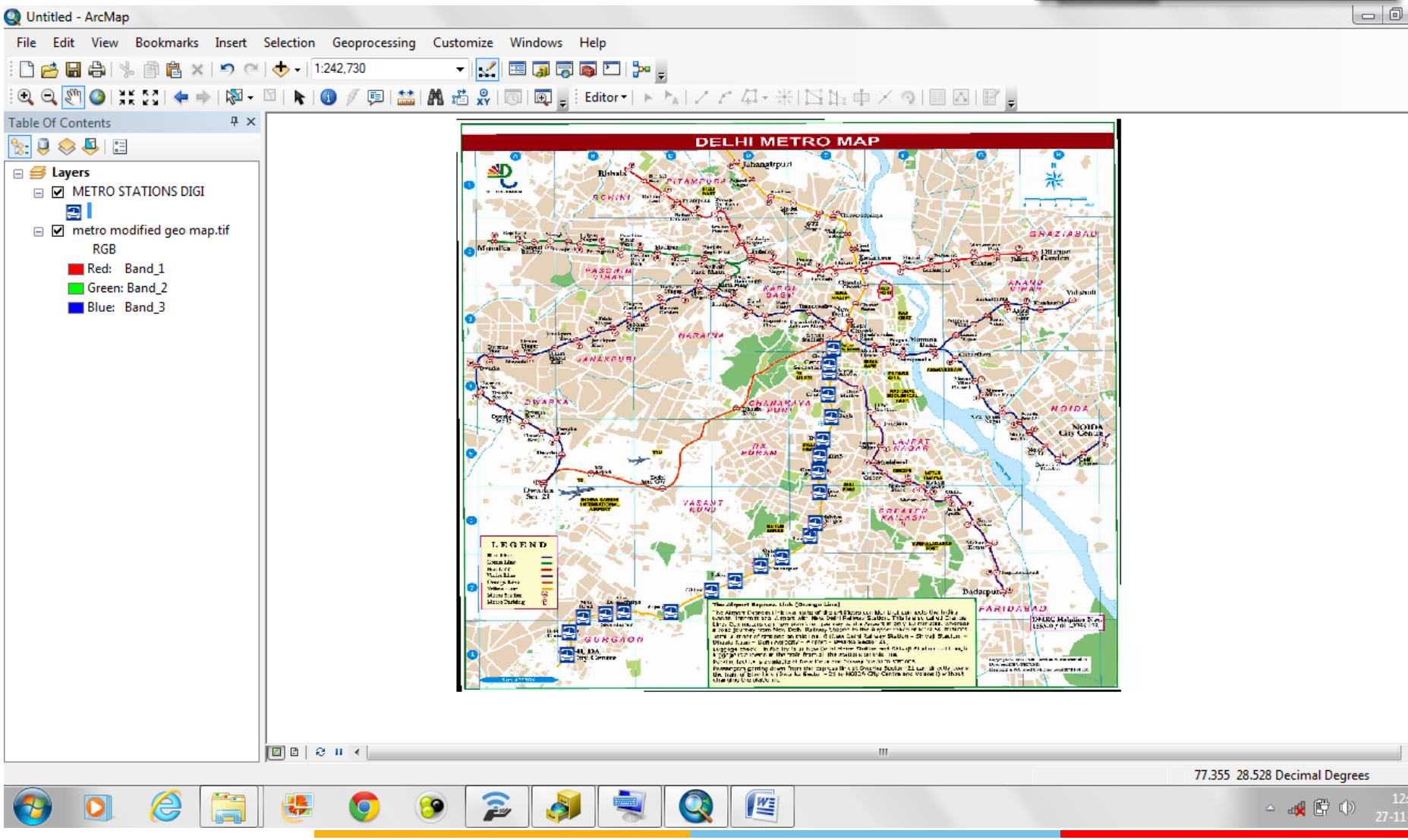
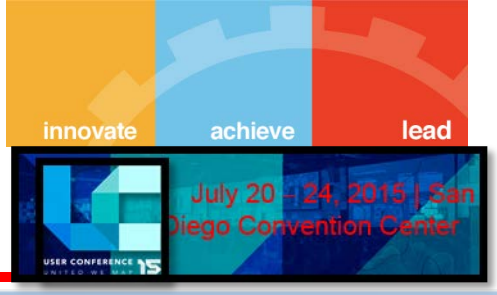


Attribute Tables
(Post Metro)

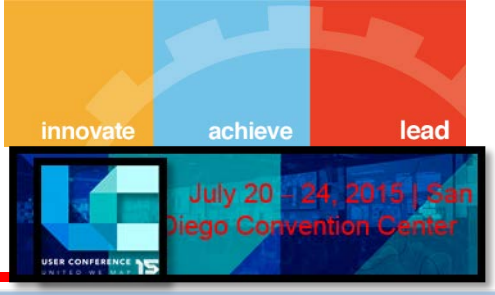


Table

Postmero

	FID	Shape *	METRO_STAT	FID_1	Sr	METRO_ST_1	Xcord	Ycord	N2_LEVELS	CO_LEVELS	LAND_PRICE	Unit	RSP
▶	0	Point	HUDA CITY CENTRE	0	1	HUDA CITY CENTRE	77.071935	28.459042	24	1300	8000	µg/m3	36
	1	Point	IFFCO CHOWK	1	2	IFFCO CHOWK	77.073115	28.471231	32	1600	3200	µg/m3	48
	2	Point	M.G.ROAD	0	0		0	0	34	1700	10000		51
	3	Point	SIKANDARPUR	2	3	SIKANDARPUR	77.093254	28.481206	34	1800	8000	µg/m3	54
	4	Point	GURU DRONACHARYA	3	4	GURU DRONACHARYA	77.103072	28.482053	36	1800	3000	µg/m3	54
	5	Point	ARJANGARH	0	0		0	0	34	1700	3500		51
	6	Point	GHITORNI	4	5	GHITORNI	77.150107	28.49372	36	1900	3000	µg/m3	57
	7	Point	SULTANPUR	5	6	SULTANPUR	77.162621	28.498974	34	1900	15000	µg/m3	57
	8	Point	CHHATTARPUR	6	7	CHHATTARPUR	77.176659	28.506933	38	1840	4000	µg/m3	55
	9	Point	QUTUB MINAR	7	8	QUTUB MINAR	77.188337	28.511644	38	1600	6000	µg/m3	48
	10	Point	SAKET	8	9	SAKET	77.203388	28.523489	36	1700	2500	µg/m3	51
	11	Point	MALVIYA NAGAR	9	10	MALVIYA NAGAR	77.206261	28.530268	32	1800	10000	µg/m3	54
	12	Point	HAUZ KHAS	10	11	HAUZ KHAS	77.208621	28.547011	34	1800	8000	µg/m3	54
	13	Point	GREEN PARK	11	12	GREEN PARK	77.20812	28.557843	36	1800	15000	µg/m3	54
	14	Point	AIIMS	12	13	AIIMS	77.208287	28.566471	28	1400	16000	µg/m3	42
	15	Point	INA	13	14	INA	77.210491	28.575266	30	1500	5000	µg/m3	45
	16	Point	JOR BAGH	14	15	JOR BAGH	77.215056	28.587434	36	1800	10000	µg/m3	54
	17	Point	RACE COURSE	15	16	RACE COURSE	77.213029	28.599801	34	1700	6000	µg/m3	51
	18	Point	UDYOG BHAWAN	16	17	UDYOG BHAWAN	77.213541	28.611813	30	1500	8000	µg/m3	45
	19	Point	CENTRAL SECRETARIAT	17	18	CENTRAL SECRETARIAT	77.213719	28.615522	26	1300	15000	µg/m3	39
	20	Point	PATEL CHOWK	18	19	PATEL CHOWK	77.216246	28.624139	36	1800	8000	µg/m3	54

Pre-Metro



Table

PreMero

FID	Shape *	METRO_STAT	Sr	METROSTA	RSPM_µg_m3	CO_µg_m3	LANDPRICE_	N02_µg_m3
0	Point	HUDA CITY CENTRE	1	HUDA CITY CENTRE	150	4847	4500	120
1	Point	IFFCO CHOWK	2	IFFCO CHOWK	120	3916	2200	90
2	Point	M.G.ROAD	0		100	3343	7000	120
3	Point	SIKANDARPUR	4	SIKANDARPUR	75	3259	6500	100
4	Point	GURU DRONACHARYA	5	GURU DRONACHARYA	80	2905	2500	130
5	Point	ARJANGARH	0		60	2500	3100	100
6	Point	GHITORNI	7	GHITORNI	60	2000	2700	90
7	Point	SULTANPUR	8	SULTANPUR	50	2688	10000	110
8	Point	CHHATTARPUR	9	CHHATTARPUR	50	2392	3800	90
9	Point	QUTUB MINAR	10	QUTUB MINAR	60	2500	4400	80
10	Point	SAKET	11	SAKET	75	2462	2200	70
11	Point	MALVIYA NAGAR	12	MALVIYA NAGAR	110	2850	9000	60
12	Point	HAUZ KHAS	13	HAUZ KHAS	90	2688	7000	70
13	Point	GREEN PARK	14	GREEN PARK	80	2905	11000	80
14	Point	AIIMS	15	AIIMS	110	3343	13000	100
15	Point	INA	16	INA	100	3259	4000	90
16	Point	JOR BAGH	17	JOR BAGH	90	3464	8000	110
17	Point	RACE COURSE	18	RACE COURSE	80	3200	4500	70
18	Point	UDYOG BHAWAN	19	UDYOG BHAWAN	100	3916	7000	90
19	Point	CENTRAL SECRETARIAT	20	CENTRAL SECRETARIAT	120	3800	9000	110
20	Point	PATEL CHOWK	21	PATEL CHOWK	150	4628	5500	130

Symbology

(three classes, NO_2)

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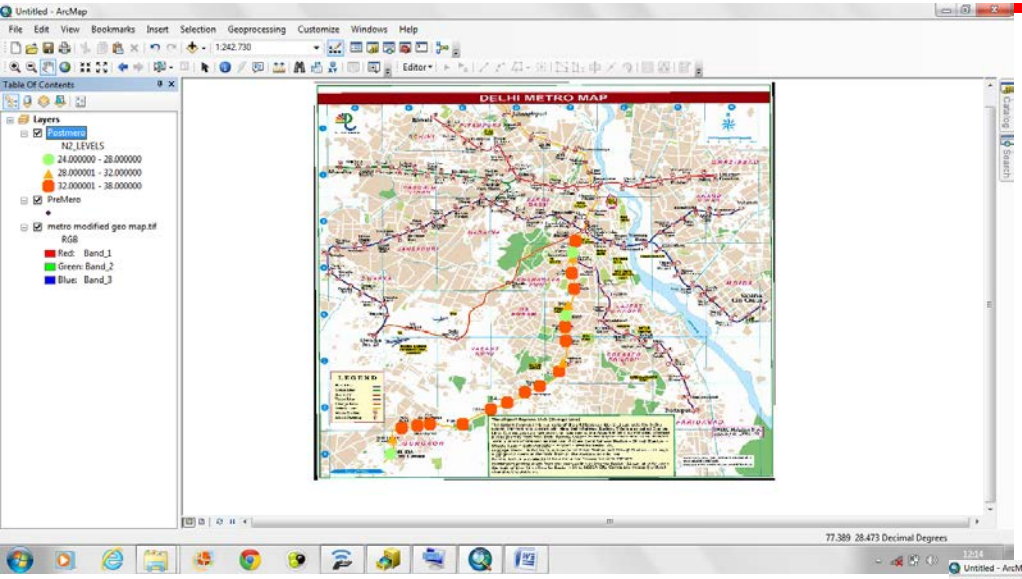
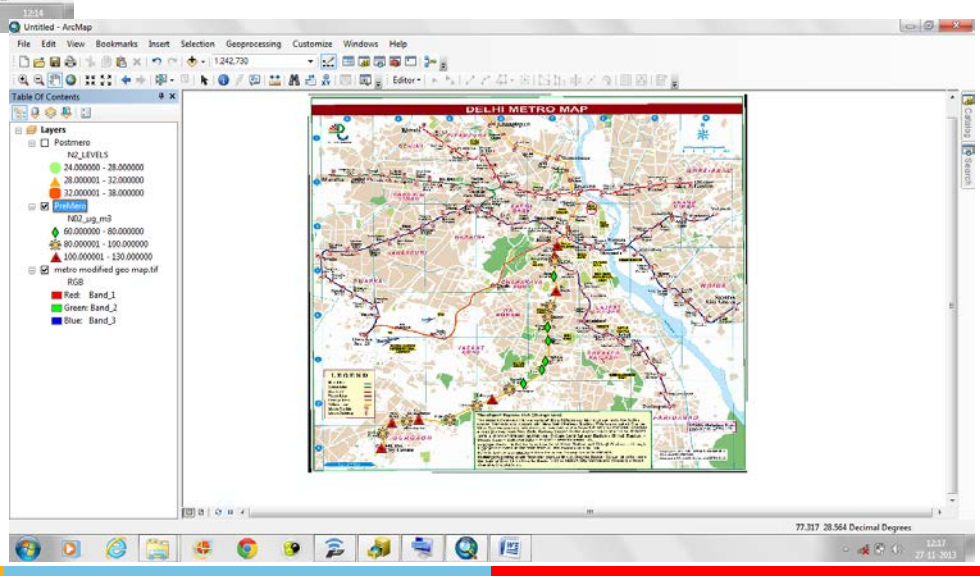
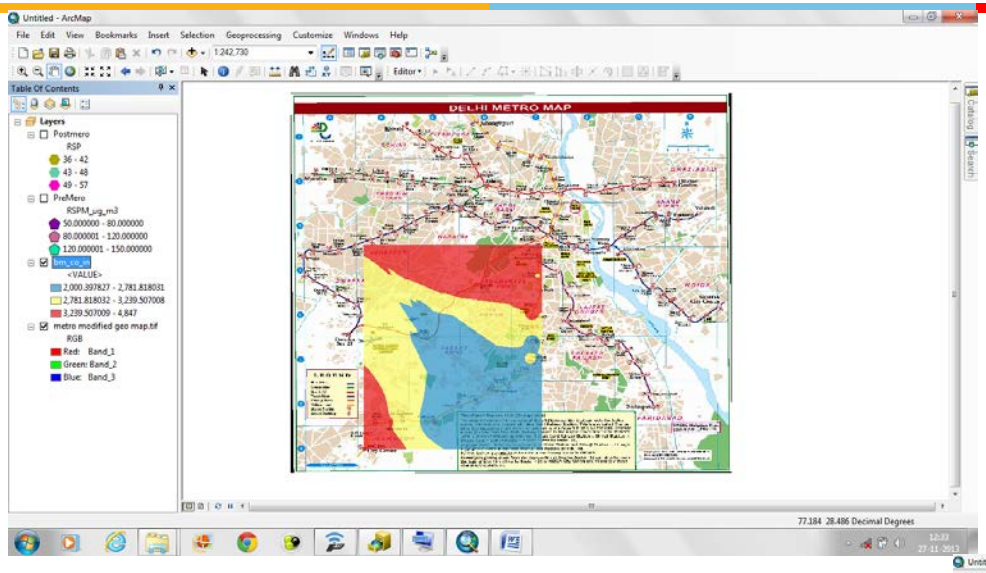




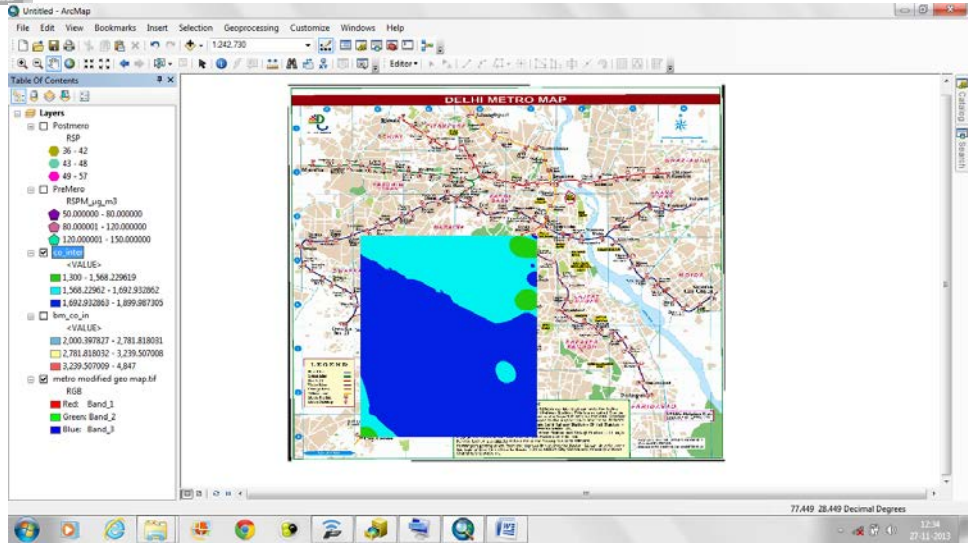
Interpolation

(geo-statistical, transparency 40-50%)

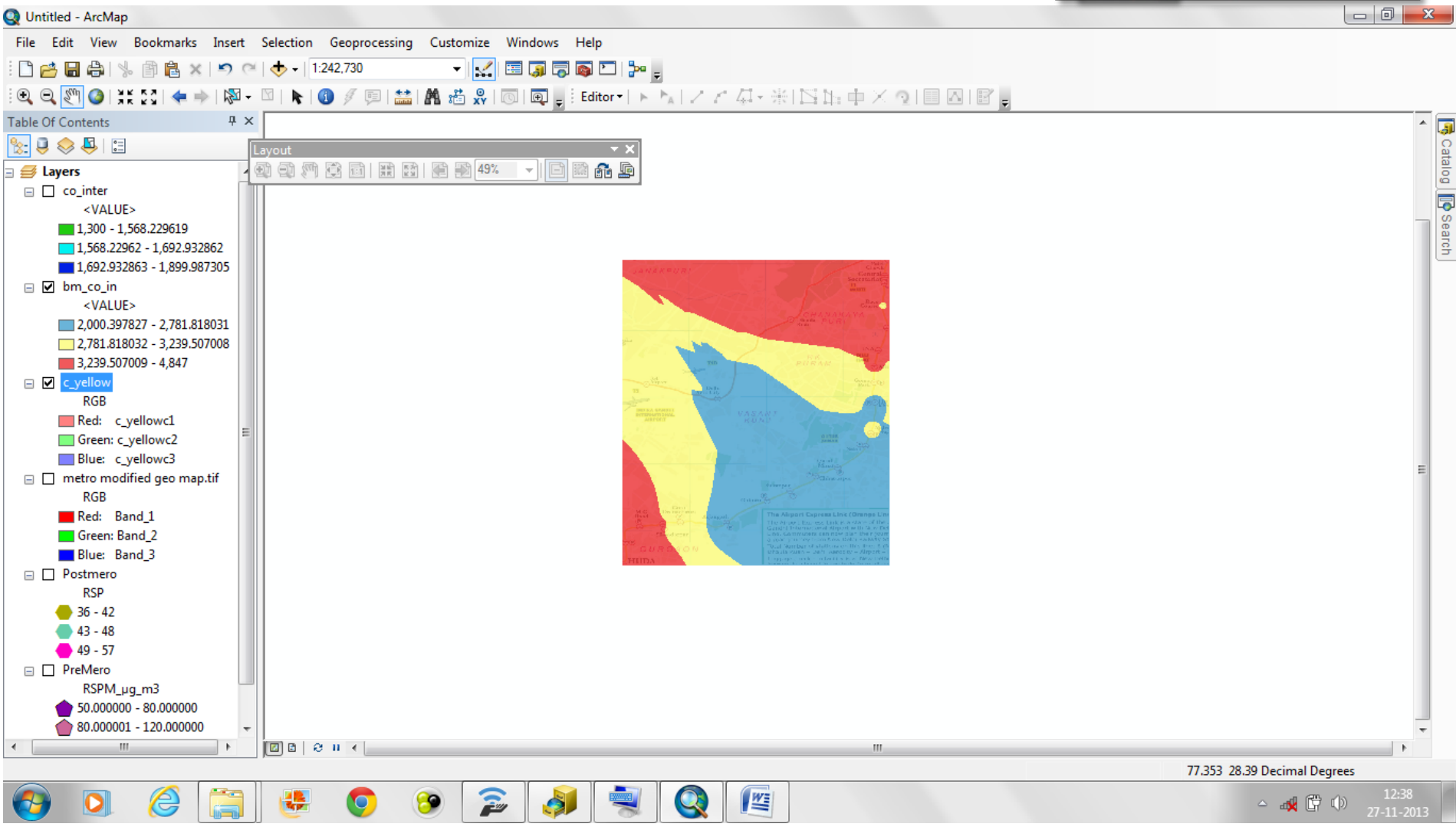


CO: Post Metro

CO: Pre Metro



Clipping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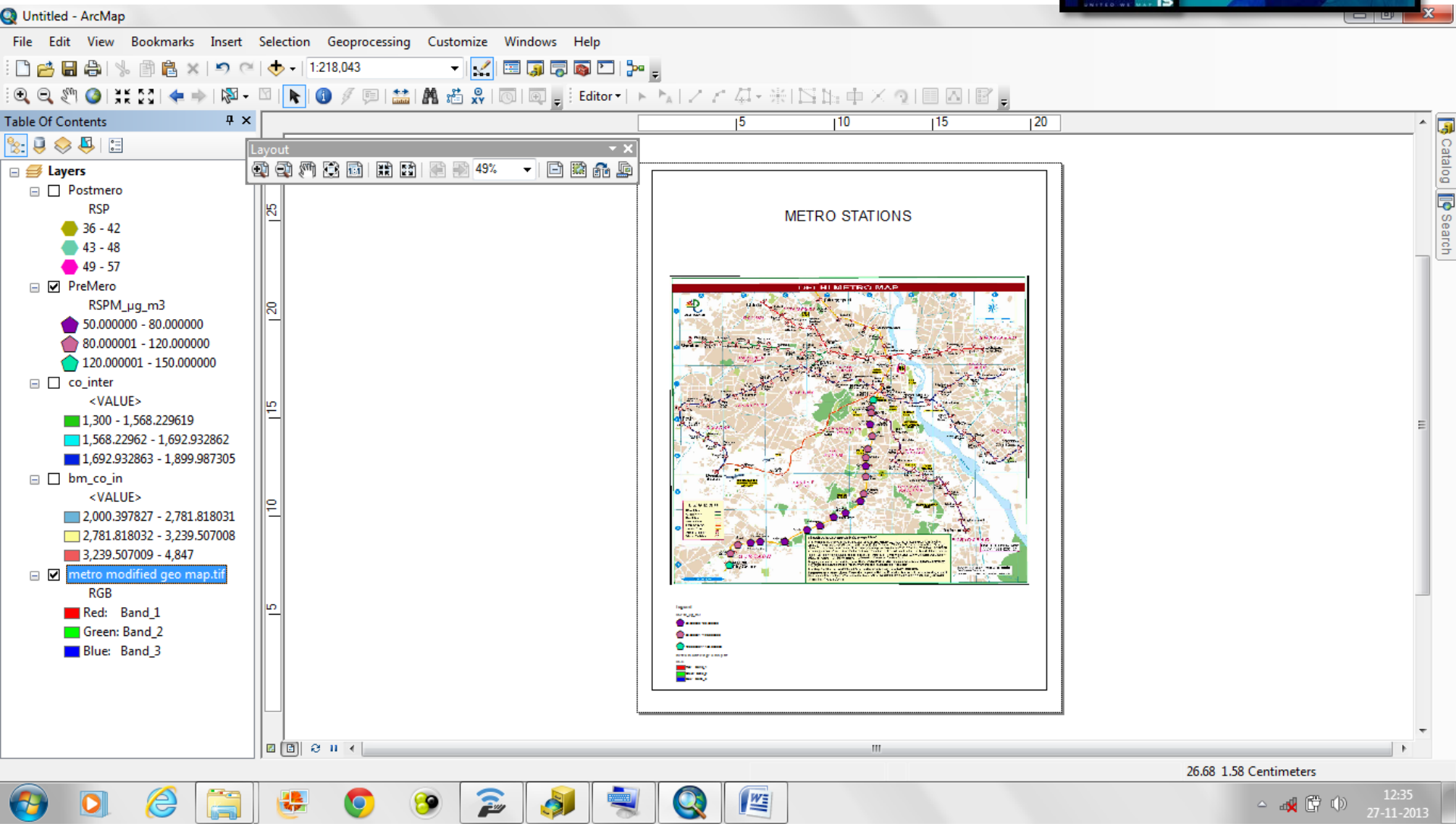
Comparison, layout



Conclusions

- Effect of metro at a certain radius from the alignment is observed in terms of environment and socio and economic effects.
- Considering a buffer area of 3 km is found to be appropriate for analysis.
- Effect of a metro in a metropolitan area can be modelled using the analysis done.

Significance of study

- Pre & Post metro effects: Policies formulation for Planners in sustainable way
- GIS representation: identification of critical areas, needs immediate attention
- A simple model to analyze the environmental impact
- Tool for comparison and creation of different scenarios

ARC INFO

- Fast access to large spatial databases
- Good number of In-built functions
- Integration with open visual CASE tools

Challenges

- Expensive and not very user friendly

- The number of records in a feature attribute table is unlimited, but in practice, it is constrained by disk space and processing time. The greater the number of bytes per record and the greater the number of records, the slower processing will be. There is one corresponding feature attribute record for each coverage feature.

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Thanks!