2.0 THE PHYSICAL ENVIRONMENT

2.1 Geography, Location and Area

The city of Pasay is located in the western coast of Metro Manila or the National Capital Region (NCR). It is bounded in the north by the city of Manila, in the northeast by the city of Makati and the municipality of Taguig, in the west by the city of Paranaque, and in the west by the Manila Bay (See Figure 2.1). The city is located approximately at latitude 14º32' and longitude 121º00'. In terms of area, Pasay is the third smallest political subdivision among the cities and municipalities of NCR. The area distribution of the city per Barangay is shown in Table 2.1.

Table 2.1
Area Distribution (in Hectares)

Brgy.	Area	Percent to Total (%)	Brgy.	Area	Percent to Total (%)	Brgy.	Area	Percent to Total (%)	Brgy.	Area	Percent to Total (%)
1	1.48	0.08	**51**	2.26	0.13	**101**	1.09	0.06	**151**	2.94	0.16
2	4.37	0.24	**52**	2.37	0.13	**102**	1.11	0.06	**152**	4.10	0.23
3	1.84	0.10	**53**	1.01	0.06	**103**	1.42	0.08	**153**	1.64	0.09
4	2.89	0.16	**54**	1.94	0.11	**104**	2.51	0.14	**154**	0.94	0.05
5	1.53	0.08	**55**	2.25	0.12	**105**	0.91	0.05	**155**	1.52	0.08
6	1.47	0.08	**56**	1.01	0.06	**106**	1.13	0.06	**156**	2.23	0.12
7	2.58	0.14	**57**	0.91	0.05	**107**	2.24	0.12	**157**	1.93	0.11
8	1.94	0.11	**58**	4.31	0.24	**108**	2.82	0.16	**158**	1.93	0.11
9	1.43	0.08	**59**	3.79	0.21	**109**	0.90	0.05	**159**	2.95	0.16
10	2.99	0.17	**60**	3.55	0.20	**110**	1.78	0.10	**160**	1.69	0.09
11	1.82	0.10	**61**	0.40	0.02	**111**	1.50	0.08	**161**	5.46	0.30
12	1.89	0.10	**62**	0.49	0.03	**112**	1.41	0.08	**162**	3.10	0.17
13	13.95	0.77	**63**	2.18	0.12	**113**	2.84	0.16	**163**	2.23	0.12
14	2.48	0.14	**64**	1.15	0.06	**114**	2.38	0.13	**164**	1.37	0.08
15	3.61	0.20	**65**	4.45	0.25	**115**	2.12	0.12	**165**	7.13	0.40
16	1.30	0.07	**66**	2.81	0.16	**116**	2.35	0.13	**166**	2.12	0.12
17	1.69	0.09	**67**	1.83	0.10	**117**	1.38	0.08	**167**	1.38	0.08
18	4.61	0.26	**68**	1.56	0.09	**118**	2.26	0.12	**168**	2.16	0.12
19	1.10	0.06	**69**	1.24	0.07	**119**	2.64	0.15	**169**	3.07	0.17
20	2.25	0.12	**70**	6.12	0.34	**120**	2.88	0.16	**170**	1.46	0.08
21	1.78	0.10	**71**	1.02	0.06	**121**	2.02	0.11	**171**	3.05	0.17
22	0.56	0.03	**72**	1.47	0.08	**122**	0.99	0.05	**172**	3.65	0.20
23	4.14	0.23	**73**	6.06	0.34	**123**	0.91	0.05	**173**	1.41	0.08
24	2.44	0.14	**74**	3.30	0.18	**124**	2.64	0.15	**174**	2.44	0.14
25	2.16	0.12	**75**	9.34	0.52	**125**	2.37	0.13	**175**	1.52	0.08
26	1.86	0.10	**76**	50.45	2.79	**126**	1.22	0.07	**176**	2.25	0.12
27	1.90	0.11	**77**	4.22	0.23	**127**	2.90	0.16	**177**	4.48	0.25
28	3.82	0.21	**78**	3.33	0.18	**128**	2.26	0.13	**178**	3.58	0.20
29	1.88	0.10	**79**	4.20	0.23	**129**	1.21	0.07	**179**	7.05	0.39
30	1.18	0.07	**80**	2.64	0.15	**130**	2.82	0.16	**180**	46.20	2.56
31	2.80	0.16	**81**	1.62	0.09	**131**	2.28	0.13	**181**	2.34	0.13
32	2.97	0.16	**82**	0.71	0.04	**132**	2.73	0.15	**182**	9.69	0.54
33	5.88	0.33	**83**	2.11	0.12	**133**	2.82	0.16	**183**	543.89	30.13
34	2.93	0.16	**84**	1.31	0.07	**134**	1.23	0.07	**184**	8.63	0.48
35	3.56	0.20	**85**	3.88	0.22	**135**	4.04	0.22	**185**	18.31	1.01
36	4.43	0.25	**86**	1.56	0.09	**136**	3.05	0.17	**186**	2.88	0.16
37	4.56	0.25	**87**	1.22	0.07	**137**	2.52	0.14	**187**	16.62	0.92
38	8.40	0.47	**88**	3.19	0.18	**138**	1.29	0.07	**188**	8.79	0.49
39	5.53	0.31	**89**	1.24	0.07	**139**	1.33	0.07	**189**	2.67	0.15
40	5.53	0.31	**90**	2.00	0.11	**140**	1.10	0.06	**190**	60.81	3.37
41	4.20	0.23	**91**	1.73	0.10	**141**	1.69	0.09	**191**	45.60	2.53
42	2.66	0.15	**92**	2.28	0.13	**142**	1.11	0.06	**192**	18.81	1.04
43	1.69	0.09	**93**	2.79	0.15	**143**	5.88	0.33	**193**	13.99	0.78
44	5.94	0.33	**94**	2.91	0.16	**144**	7.02	0.39	**194**	4.87	0.27
45	2.73	0.15	**95**	2.51	0.14	**145**	6.65	0.37	**195**	3.85	0.21
46	3.90	0.22	**96**	2.26	0.13	**146**	3.33	0.18	**196**	2.83	0.16
48	1.80	0.10	**98**	4.39	0.24	**148**	9.83	0.54	**198**	18.09	1.00

49	4.02	0.22	**99**	1.88	0.10	**149**	1.19	0.07	**199**	5.25	0.29
50	0.95	0.05	**100**	3.38	0.19	**150**	1.89	0.10	**200**	4.81	0.27
									201	33.75	1.87
Area of Barangays 1 to 201								**1,399.50**		**77.53**	
Reclamation								**213.66**		**11.84**	
Cultural Center of the Philippines Complex								**191.95**		**10.63**	
TOTAL AREA								**1,805.11**		**100.00**	

The city has a total area of 1,805.11 hectares. The city proper or Barangays 1 to 201 occupies around 1,399.50 hectares or 77.53 percent the total area. The Cultural Center Complex occupies around 191.95 hectares (10.63%) while the rest of the reclamation area covers an area of 213.66 hectares (11.84 %). The Barangay Map is shown in Figure 2.2.

2.2 Geology

Pasay consists of two terrain units, an eastern undulating section and a western alluvial portion, which extends into the Manila Bay. The undulating to gently sloping terrain is underlain by a gently dipping sequence of pyroclastic rocks essentially made up of tuffs, tuffaceous sandstones and conglomerates belonging to the Guadalupe formation. This formation is represented by massive to thickly bedded lithic tuff and tuffaceous sandstone.

Based on the Geologic Map of Pasay (Figure 2.3), the two major geologic formations are:

- Quarternary Alluvial (QA1) which is comprised of detrital deposits mostly silt, sand and gravel; and

- Guadalupe formation (GF) of which the upper member (Diliman Tuff) is thin to medium bedded, fine-grained, vitric tuffs and welded volcanic breccias with subordinate amounts of tuffaceous, fine to medium grained sandstone.

Members of the Pleistocene Guadalupe Formation underlie almost half of the terrain where Pasay lies. These are mainly Alat Conglomerate and Diliman Tuff. Early Pleistocene to late Pleistocene conglomerate, silty mudstone and tuffaceous sandstone comprise the lower member while late Pleistocene well-bedded tuff units make up the upper member. The constituents of the Diliman Tuff were most likely derived from a volcano on the central lobe of Laguna de Bay to the south based on its aerial distribution pattern and lithological similarity with those in the northern vicinity of the central lobe of Laguna de Bay. On the other hand, Quartenary alluvial deposits of the Marikina Alluvial plain and Pasig River Delta plain cover western areas of the city. The presence of the marine sediments suggest that the quartenary alluvium was probably deposited after uplift of the Guadalupe formation.

2.3 Physiography

Metro Manila's physiography is divided into six zones namely, the Manila Bay, the Coastal Margin, the Guadalupe Plateau, the Marikina Valley, the Laguna lowlands and the Laguna de Bay. Pasay City belongs to the Coastal Margin or the low lying flat strip of land east of Manila Bay with an elevation of less than 5 meters above mean sea level. This zone also occupies portions of Valenzuela,

Malabon, Caloocan, Navotas, Manila, Paranaque, Las Piñas and the reclaimed portion of Manila Bay

2.4 Topography, Elevation and Slope

The western part of Pasay City is level to nearly level while its southeastern part is gently sloping to gently undulating. It is characterized by coastal plains along the Manila Bay in the west and sloping areas extending in the south-east direction. Surface elevations range from 2 meters above the mean sea level on the coastal plains and 24 meters on the southeast part of the city.

2.5 Land and Associated Soil Characteristics

As per Metro Manila Land Resource Evaluation Project by BSWM, Pasay has the following land and soil characteristics (Figure 2.4):

Active Tidal Flats (Coastal Landscape)

Active tidal flats, with an almost flat relief, have an elevation that ranges from 0 to 1.5 meters, sometimes reaching up to 3 meters above the mean sea level. This land system has very poor drainage characteristics. Waterlogged areas may pose a corrosion problem to underground uncoated steel pipes or structural reinforcement. Poor drainage is also a problem in sewage disposal in areas which are not served by public sewer facilities. It is further characterized by slow permeability, high compressibility, and possible flooding during seasonal high water table. Soil texture or the different sizes of particles in the soil mass are clay, silty clay, and sandly clay loam. The parent materials of this land classification are tidal mudflats with muck and peat locally, alluvial sediments.

Former Tidal Flats (Coastal Landscape)

The former tidal flats consist of areas more inland and slightly higher than the active tidal flats. They occupy the almost flat plains, backswamps and depression of the coastal landscape formed from marine and flovio-marine deposits. Slightly lower then the alluvial plain, its elevation ranges from 2 to 5 meters. It has slow to moderate permeability and a soil texture of clay to silty clay loam. Moreover, it is poorly drained, prone to moderate seasonal flooding, highly compressible, and corrosive to uncoated steel. Its parent materials are alluvial sediments, former tidal mudflats underlain with peaty and mucky materials.

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2.6 Water Resources Characteristics

2.6.1 Surface Waters

Pasay City is bounded in the west by Manila Bay. It is traversed by two minor rivers that feed the Paranaque River namely the Estero de Tripa de Gallina and Maricaban Creek. The city lies within the Manila Bay Watershed area. The bay has a catchment area of about 17,000 square kilometers that is made up of about eight river basins, nearest of which to the city is the Parañaque-Las Piñas river basin. This river basin is subsequently made up of three major rivers, the Parañaque, Las Piñas and Zapote Rivers. These river systems essentially serve about 1,500 hectares of low-lying areas along the Manila Bay and functions as

the principal drainage channel of the area. The geomorphic setting of these low-lying areas and the hydraulic action of the Manila Bay basin and the South China Sea make the area vulnerable to flooding, a condition aggravated by the inadequate capacity and poor maintenance of the drainage facilities.

2.6.2 Groundwater

Pasay is situated on a delta which has produced locally-confined aquifers. Groundwater utilization, however, has resulted in significant draw-down causing much land subsidence and saline water intrusion particularly in the coastal areas. The groundwater basin contains several connected and interrelated aquifers, composed of tuffaceous sandstone and conglomerates belonging to the Guadalupe Formation. These facets of Guadalupe Formation in the southeastern part of the city have thickness of approximately 1,300 to 1,200 meters.

Recharge to the aquifers comes from rainfall and inflow from the extension of these aquifers. However, these are already over exploited due to uncontrolled pumping and excessive underwater withdrawal, a practice done principally by high-density residential, commercial and industrial establishments. This situation leads to a partial depletion of the aquifers resulting in the lowering of water levels and high pumping costs.

Almost 2000 wells have been drilled in the aquifers of the Guadalupe Formation for the commercial and residential users. Some of these wells go as deep as 300 meters. In 1990, total pumpage reached 339.6 million cubic meters.

2.6.3 Water Quality

Available data from government agencies such as the DENR-EMB have indicated that the near-the-shore waters of Manila Bay, together with the major rivers in Metro Manila, are considered biologically dead. The water quality in Manila Bay has progressively deteriorated due to domestic, industrial and agricultural wastes being dumped uncontrollably in the waterways. This present state is likewise being attributed to inadequate drainage facilities and the discharge of untreated domestic and industrial wastewater due to inadequate wastewater collection, treatment and disposal facilities.

Based on the sampling conducted by the Department of Environment and Natural Resources (DENR) in each month of the year 2000, water quality as per dissolved oxygen, Biological Oxygen Demand (BOD) and the total suspended solid level in various stations of the Paranaque-Zapote River are shown in the following tables. Two stations were located within Pasay City, Tramo and MIA Road.

Table 2.3
Annual Dissolved Oxygen (mg/L) in the Parañaque-Zapote River System, 2000

Station	Location	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Annual
Tramo	Tramo, Pasay City	NS	0.21	NS	0.0	0	0.1	0.9	1.3	1.2	0	NS	0	0.4
MIA Road	MIA Rd., Pasay City	NS	0.06	NS	3.8	0	0	0.0	0.0	1.0	0	NS	0.0	0.5
La Huerta	Parañaque City	NS	0.51	NS	12.0	0	4.0	13.4	0.0	2.8	0	NS	0	3.6
Parañaque	Parañaque City	NS	4.89	NS	3.6	0	1.0	9.5	4.0	5.4	0	NS	4.2	3.6
Zapote	Las Piñas City	NS	0.1	NS	0.0	0	0.8	9.4	1.2	1.6	0	NS	0	1.5
Quirino	Parañaque City	NS	NS	NS	12.0	0	2.0	11.4	0.0	0.6	0	NS	0.0	3.3
Monthly Ave.		NA	1.15	NA	5.2	0	1.3	7.4	1.1	2.1	0	NA	0.7	2.1
Standard, mg/L		5	5	5	5	5	5	5	5	5	5	5	5	5

Table 2.4
Annual BOD (mg/L) in the Parañaque-Zapote River System, 2000

Parañaque	Location	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Annual
Tramo	Tramo, Pasay City	NS	10	NS	15	32	17	26	23	6	23	NS	17	19
MIA Road	MIA Rd., Pasay City	NS	17	NS	15	38	12	17	32	10	23	NS	13	20
La Huerta	Parañaque City	NS	16	NS	11	39	16	13	32	4	27	NS	20	20
Parañaque	Parañaque City	NS	7	NS	22	29	17	26	33	13	14	NS	10	19
Zapote	Las Piñas City	NS	30	NS	32	39	5	12	16	8	21	NS	33	22
Quirino	Parañaque City	NS	NS	NS	3	23	14	12	33	2	23	NS	15	16
Monthly Ave.		NA	16	NA	16	33	14	18	28	7	22	NA	18	19
Standard, mg/L		10	10	10	10	10	10	10	10	10	10	10	10	10

Table 2.5
Annual Total Suspended Solid Levels in the Parañaque-Zapote River System, 2000

Parañaque	Location	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Annual
Tramo	Tramo, Pasay City	NS	20	NS	20	10	10	20	30	40	40	NS	30	24
MIA Road	MIA Rd., Pasay City	NS	20	NS	80	30	20	30	30	40	40	NS	20	34
La Huerta	Parañaque City	NS	30	NS	100	30	10	30	20	30	40	NS	40	37
Parañaque	Parañaque City	NS	20	NS	70	30	20	20	30	30	30	NS	20	30
Zapote	Las Piñas City	NS	30	NS	60	20	10	70	30	30	30	NS	40	36
Quirino	Parañaque City	NS	NS	NS	50	10	20	50	40	40	30	NS	20	33
Monthly Ave.		NA	21	NA	63	22	15	37	30	35	35	NA	28	32

The sampling results show that dissolved oxygen levels in the two Pasay stations are way below the standards while the BOD concentrations are way above standard.

2.7 Atmospheric Characteristic

From the nearest PAGASA station at Ninoy Aquino International Airport (NAIA), climatological data from 1950-1995 were obtained. Tables 2.6 and 2.7 show some of the significant data.

2.7.1 Climate

The climate of Pasay is classified as Type 1 under the Corona classification used by Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) depending on rainfall pattern. It is characterized by two pronounced seasons: rainy season from May to October and dry season from January to April, when rainfall drops to 10-30-mm/ month. In general, Metro Manila is directly influenced by an average of 2 to 3 tropical cyclones per year.

2.7.2 Rainfall

The PAGASA station recorded an annual rainfall amount of 1,149.2 mm with a total of 113 rainy days between the years 1961-1995. The rainy months of May – October indicated monthly rainy days of 7- 20 with the month of July recording the highest at 20. The highest amount of rainfall for the period 1949-1995 was 427.4 mm recorded on February 1,1962.

2.7.3 Temperature

Pasay has an average normal annual temperature of 27.5 °C. The warmest months are April, May and June while the coldest months are December, January and February with the minimum temperature of 25-26°C. The highest

temperature was recorded on May 18,1969 at 38.1°C while the lowest was recorded at 14.6°C on February 1, 1962.

2.7.4 Relative Humidity

Relative humidity or the percentages of water vapor in the air ranges, in monthly values, from 66% to 81% with an annual average of 75%. These values indicate that Pasay is relatively humid.

2.7.5 Wind Speed and Direction

The annual prevailing wind direction in the area is towards the east. The average annual wind speed is 3.0 meters per second (mps). High wind speed occurs in March to April while low wind speed happens in September to November. The highest wind speed of 56 mps was recorded on November 14, 1977, going in a western direction.

Table 2.6
Climatological Normals

Month	Rainfall Amount	No. of Rainy Days	Temperature (°C)							Relative Humidity	MSL PRESS. (mbs)	Wind Speed and Direction		Cloud Cover (Octa)	Days TSTM	With LTNG
			Max	Min	Mean	Dry Bulb	Wet Bulb	Dew Point	VP (mbs)			Direction	Speed			
January	8.5	2	30.3	20.9	25.6	25.3	21.9	20.5	23.9	74	1013.5	E	3	4	0	0
February	2.9	1	31.2	21.2	26.2	26.0	22.0	20.3	23.7	70	1013.5	E	4	4	0	0
March	6.2	2	32.7	22.4	27.6	27.4	22.8	21.0	24.6	67	1012.7	E	4	3	0	1
April	13.2	2	34.3	24.0	29.1	29.0	24.0	22.1	26.4	66	1011.2	E	4	3	1	4
May	101.6	7	34.2	24.9	29.6	29.3	24.9	23.4	28.4	70	1009.4	E	4	5	7	16
June	244.5	15	32.5	24.5	28.5	28.2	25.0	23.9	29.5	77	1008.8	W	3	6	11	16
July	363.0	18	31.3	24.1	27.7	27.4	24.7	23.7	29.2	80	1008.3	W	3	6	12	16
August	414.1	20	30.8	24.0	27.4	27.0	24.7	23.9	29.5	83	1008.1	W	3	7	9	10
September	309.0	17	31.0	24.0	27.5	27.1	24.8	24.0	29.7	83	1008.9	W	2	7	11	15
October	221.4	13	31.1	23.5	27.3	27.0	24.3	23.3	28.5	80	1009.7	E	2	6	9	10
November	121.1	10	31.0	22.8	26.9	26.6	23.6	22.5	27.1	78	1011.0	E	2	5	2	3
December	43.7	6	30.3	21.7	26.0	25.7	22.7	21.5	25.5	77	1012.6	E	3	5	0	1
ANNUAL	1849.2	113	31.7	23.2	27.5	27.2	23.8	22.5	27.2	75	1010.6	E	3	5	59	92

Source: PAGASA
Note: Station at 429-NAIA (MIA), Pasay City, located at 14°31'N latitude and 121°01' longitude with elevation 21.0 m from period 1961-1995.

Table 2.7
Climatological Extremes

Month	Temperature (°C)				Daily Highest Rainfall (mm)		Wind (mps)			Sea Level Pressure			
	High	Date	Low	Date	Amount	Date	Speed	Direction	Date	High	Date	Low	Date
January	35.8	7-89	14.8	18-61	55.3	3-70	20	E-NE	12-86	1,022.30	27-87	1004.4	1-50
February	34.8	28-80	14.6	1-62	16.5	27-50	20	E	28-88	1021.4	1-62	1005.0	15-52
March	36.5	30-78	16	3-63	35.5	12-71	26	E	29-92	1021.1	2-87	1004.7	8-84
April	37.8	23-48	19.4	17-68	63	4-92	20	E	6-86	1019.9	23-87	1003.8	25-71
May	38.1	18-69	19.1	11-50	229.1	27-60	31	SW	22-76	1015.9	9-57	992.2	17-89
June	38	2-91	20	22-54	316.8	27-85	36	S	29-64	1015.9	6-66	974.2	29-64
July	36	6-91	18.3	28-48	472.4	20-72	36	W	8-86	1014.9	7-53	994.2	15-83
August	35.2	29-89	17.4	9-49	401.8	10-47	30	WSW	16-84	1015.2	12-58	992.8	24-78
September	34.9	9-79	19.1	15-50	228.8	8-63	26	NW	27-78	1015.2	20-65	988.9	30-95
October	36	24-76	18	23-81	274.5	9-78	27	W	18-85	1017	25-86	977.9	14-70
November	35.8	17-72	17.2	26-49	121.7	14-77	56	W	19-70	1019.4	3-89	899.4	3-95
December	34.2	28-79	16.3	18-55	110.5	30-50	25	NW	30-50	1020.9	8-60	996.2	15-64
ANNUAL	**38.1**	**5-18 1969**	**14.6**	**2-1 1962**	**472.4**	**7-20 1972**	**56**	**W**	**11-19 1970**	**1022.3**	**1-27 1978**	**899.4**	**11-3 1995**
Period of Record	**1947-1995**				**1949-1995**		**1950-1995**			**1950-1995**			

Source: PAGASA
*Notes: *Station at 429-NAIA (MIA), Pasay City, located at 14°31'N latitude and 121°01' longitude with elevation 21.0 m from period 1961-1995.*
**No record for the period 1941-1945*

2.8 Air Quality

Pasay City is already experiencing a deterioration of its air quality. This may be attributed to the congestion of people, improperly maintained vehicles servicing them, and the significant percentage of pollutive firms with inadequate air pollution control devices and facilities operating within the area.

The National Ambient Air Quality and Noise Standards are prescribed in Table 2.8 and Table 2.9 respectively.

Table 2.8
National Ambient Air Quality Standards for Source Specific Pollutants

*POLLUTANTS (a)	CONCENTRATION (c) ug/Ncm	ppm	AVERAGING TIME (min)	METHOD OF ANALYSIS/ MEASUREMENT (b)
1. Ammonia	200	0.28	30	Nesselcrization/Indo Phenol
2. Carbon Disulfide	30	0.01	30	Tischer Method
3. Chlorine and Chlorine compounds expressed as Cl_2	100	0.03	5	Methyl Orange
4. Formal dehyde	50	0.04	30	Chromotrophic acid method or MBTH-Colorimetric method
5. Hydrogen Chloride	200	0.13	30	Volhard Titration with Iodine solution
6. Hydrogen Sulfide	100	0.07	30	Methylene Blue
7. Lead	20		30	AAS[b]
8. Nitrogen Oxide	375 260	0.2 0.14	30 60	Griess-Saltzmans
9. Phenol	100	0.03	30	4-Amineantipyrine
10. Sulfur Dioxide	470 340	0.18 0.13	30 60	Colorimetric- Pararosaniline
11. Suspended particulate Matter – TSP *PM – 10*	 300 200		 60 60	 Gravimetric -do-

Table 2.9
DENR Standards for Noise in General Areas, dB(A)

AREA	DAYTIME	MORNING/EVENING	NIGHTTIME
Schools/hospitals	50	45	40
Residential	60	50	45
Commercial	65	60	55
Light Industrial	70	65	60
Heavy Industrial	75	70	60

2.9 Geologic and other Natural Hazards

No traced earthquake fault line traverses the city of Pasay. However, the city is not spared from other related geologic hazards such as tsunamis, ground shaking, and liquefaction.

Tsunamis are giant sea waves generated by under the sea earthquakes and volcanic eruptions. Not all submarine earthquakes, however, can cause the occurrence of tsunamis. Tsunamis can only occur when the earthquake is shallow-seated and strong enough (M 7.0) to displace parts of the seabed and disturb the water over it (PHIVOLCS). The coastal area of Pasay City is among the most hit by tsunamis and have a high potential for future tsunamis.

Typhoons and their associated hazards, such as strong winds, storm surges, and floods, are among the most recurrent and damaging calamities our country is

prone to. Some 20 typhoons pass the Philippine Area of Responsibility (PAR) every year. These are most frequent during the months of May to December with peak occurrences in the month of November. Of the total 325 typhoons recorded to have crossed the PAR from 1948 to 1978, about 20 passed through Metro Manila. One of these, Typhoon Yoling, was the most severe, registering a maximum wind speed of 200 kph and bringing 24-hour rainfall on the Metropolis. Residential areas, infrastructure, power systems, and other utility installations experienced heavy damages, some of which took months to restore.

2.10 Environmental Management

2.10.1 Water Management

To address the countrywide water crisis which adversely affects the health and well being of the population, food production and industrialization process, the National Water Crisis Act of 1995 was enacted. Some of the issues related to the water crises are: water supply, water distribution, financing aspects, privatization of state-run water facilities, the protection and conservation of watersheds, and pilferage of water, including the serious matter of graft and corruption in all the water agencies.

2.10.2 Air Quality Management

The Clean Air Act of 1999 recognizes that the responsibility of cleaning the habitat and environment is primarily area-based, thus, a local government concern. In terms of air quality management, it stipulates that:

LGUs shall share the responsibility in the management and maintenance of air quality within their territorial jurisdiction. LGUs shall implement air quality standards set by the Pollution Adjudication Board (PAB) in areas within their jurisdiction. Provided, however, that in cases where the board has not been duly constituted and has not promulgated its standards, the standards set forth in this Act shall apply. The Department of Environment and Natural Resources shall provide the LGUs with technical assistance, training and a continuing capability-building program to prepare them to undertake full administration of the air quality management and regulation within their territorial jurisdiction.

The LGU, for one, is responsible for attaining and maintaining the ambient air quality standards within their respective airsheds. The designation of airsheds shall be on the basis of, but not limited to, areas with similar climate, meteorology and topology which affect the interchange and diffusion of pollutants in the atmosphere, or areas which share common interest or face similar development programs, prospects or problems. The DENR bases such ambient air quality standards on World Health Organization (WHO) standards, but shall not be limited to nor be less stringent than such standards. The initial lists and values of the hazardous air pollutants are provided in the DENR mandate.

2.10.3 Land Management

All the barangays of the city have Cadastral Maps which are being used for taxation and other legal purposes. On the other hand, prior to this undertaking, a Zoning Ordinance in 1981 was being used to guide developments and land uses in the city.

2.10.4 Solid Waste Management (SWM)

At present, the city of Pasay disposes of its solid waste in the San Mateo Sanitary Landfill and the Payatas dumpsite. As per a JICA study on Solid Waste Management for Metro Manila involving government agencies such as DECS, DENR and MMDA, Pasay City along with Taguig, Pateros and the city of Makati shall be accommodated in the proposed Transfer Station within Fort Bonifacio and then dumped in an inland landfill site to be later specified. (Figure 2.5 refers)

All barangays are covered by solid waste collection, which is handled by the local government and private contractors. Solid wastes are collected daily on main thoroughfares and every other day in the rest of the city. However, the collection systems accommodate urgent requests by residents.

Table 2.10
Existing Solid Waste Disposal Methods

Method	Population Served	Responsible Agency/Entity	Equipment Facilities	Financing/ Operating Costs	Remarks
1. Push cart collection	Residents of each Barangay	Barangay Officials	Push Cart		Not recommended since collectors tend to throw their garbage anywhere
2. Collection by trucks, Transfer and Transport	Whole city	Private sector/ Solid Waste Contractors: • Excellent Trucking Services, • Greenline Onyx, • Leg Hauling, and • RM Maintenance Services	• Trucks (10 wheeler dump truck) • Open-Top Compactors • Pay loaders • Shovels • Sacks	• Presentations • Diesoline Expenses • Salaries of the personnel	
3. Experimental Waste Segregation	51 Families	SWM Compactors Office of the Mayor	Garbage Compactors	Diesoline Expenses Maintenance of the facilities	A project adopted by the Maryville Association

Source: Solid Waste Management Office

2.10.5 Drainage and Flood Control System

The Tripa de Gallina and Libertad pumping stations (PS), the Buendia and Libertad Outfalls or Channels are currently servicing the drainage requirement of the city. The Tripa de Gallina PS has a drainage area of over 1,700 hectares. Part of the storm runoff from the Estero de Tripa de Gallina enters the Libertad PS via the Buendia and Libertad Outfalls. The rest are discharged into the Parañaque River. The Estero, however, shows a fluctuation in profile due to the deposit of sediment and garbage, and insufficient improvement of the Buendia Channel. This condition is caused largely by poor sewerage and improper solid waste disposal. A considerable volume of wastes accumulates in the retention pond of the reclamation area. In areas along *esteros* and creeks occupied by a number of squatter shanties, wastes are directly discharged into the waterway. At present, the local government employs flood control measures such as annual

clearing of all waterways and sedimentation (desilting of riverbeds) accompanied by a proper garbage and waste disposal system.

The adjoining upstream areas of the Libertad Reclamation Area is being drained through the Libertad, Buendia, and EDSA outfalls. Their existing discharge capacities are much smaller than their design capacities due to siltation. Garbage inflow at the inlets of these outfalls aggravates the problem.

2.10.6 Disaster Management

The warning system for both typhoons and floods in Metro Manila are operated by the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA). It monitors the meteorological and hydrological conditions and issues periodic reports. This report contains a warning if the conditions entail risks to the population. The warning system for typhoons works separately from the warning system for floods.

2.11 Land Suitability Assessment

In coming up with an effective land utilization system, the physical and environmental attributes of Pasay City must be considered. Areas of physical constraint for further developments in the city should be delineated. Maps indicating the city's relevant physical and environmental attributes are generated and translated into degrees of concern. References used for this purpose include materials from the local government, BSWM, and PHIVOLCS.

Some of the environmental concerns such as flooding, drainage, river preservation, liquefaction hazard, and industrial zones were reflected in maps and discussed briefly. These are subsequently used to delineate the areas of various degrees of development suitability.

Flood Hazard Areas

Besides natural factors, other aspects that tend to aggravate flooding problems in Metro Manila include the following:

- Infrastructure development leading to the creation of more impervious areas, resulting to higher peak run-offs that usually cause standing floods;
- Inadequate or non-existent drainage system;
- Improper solid waste disposal that leads to the clogging of drainage systems, further lowering their water retaining capacity;
- Heavy siltation of rivers due to previous floods, indiscriminate dumping of garbage, encroachment of squatters and slum dwellers, and limited maintenance works; and
- Institutional problems and financial constraints which delay implementation of proper flood control measures.

Flooding within Pasay City are generally concentrated along Taft Avenue and the areas along the Estero de Tripa de Gallina and Maricaban Creek (Figure 2.6).

River and Coastal Preservation

As shown in Figure 2.7, the following are the river preservation zones of the city:

- Rivers and streams – These critical areas consist of easements of about 3 to 20 meters from both sides throughout the entire length of any river or stream. Areas within this range are subject to easement of public use in the interest of recreation, fishing, floatage, etc.

- Coastal Zone – This includes areas one kilometer from the coastline of the Manila Bay, which is city waters, and 200 meters from the coastline inland.

- Areas of no significance - Areas outside the range mentioned above are non-environmentally-critical areas.

Liquefaction Hazard

Liquefaction is associated with the phenomenon of quick-condition failure which is generally obtained when pore water in a liquefied layer rises into overlying near-surface sediments that results in a condition resembling quicksand. Areas that are prone to liquefaction are those underlain by water-saturated, thick fine to coarse sand layers such as those along the Pasig River Delta Plain, lake shore areas of Laguna de Bay and the shorelines of Manila Bay. Figure 2.8 shows the city's Liquefaction Hazard Map with potential zones classified into high, moderate and low based mainly on the presence of clay layers which help inhibit liquefaction.

Industrial and Airport Zones

The attribute features of this map are based on the constraints on acceptable noise and air pollution levels for developments around existing industrial establishments. These noise and air pollution levels conform with the DENR Guidelines (Figure 2.9).

- Development restriction guidelines for various noise zones are:
  - from 45 to 55 dBA. Section of contiguous areas which are primarily used for residential purposes.
  - from 55 to 65 dBA. Primarily for commercial area
  - from 60 to 70 dBA. Reserved as a light industrial area
  - from 65 to 75 dBA. Primarily reserved as a heavy industrial area.

- Development restriction guidelines for various source-specific air pollutants, such as emission of dust, dirt or fly ash based on DENR standards.