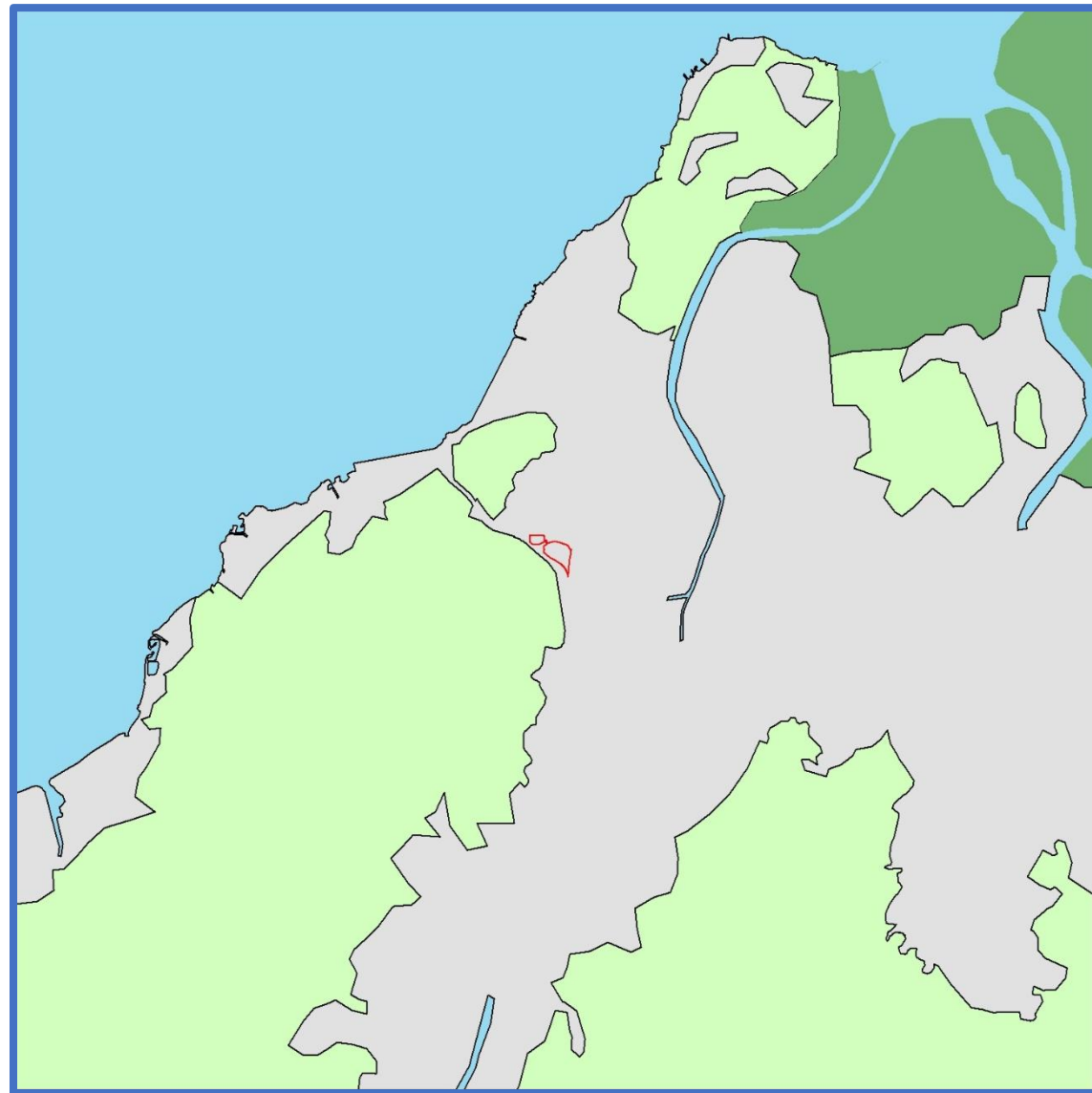


**Appendix 3.8 Determination of Surface Characteristics**

**Construction Phase**

**10km by 10km Region Centred on the Project Site**



**Legend**

- 10km by 10km Region Centered on the Project Site
- Project Site

**1km Boundary from Grid 2047**



**Legend**

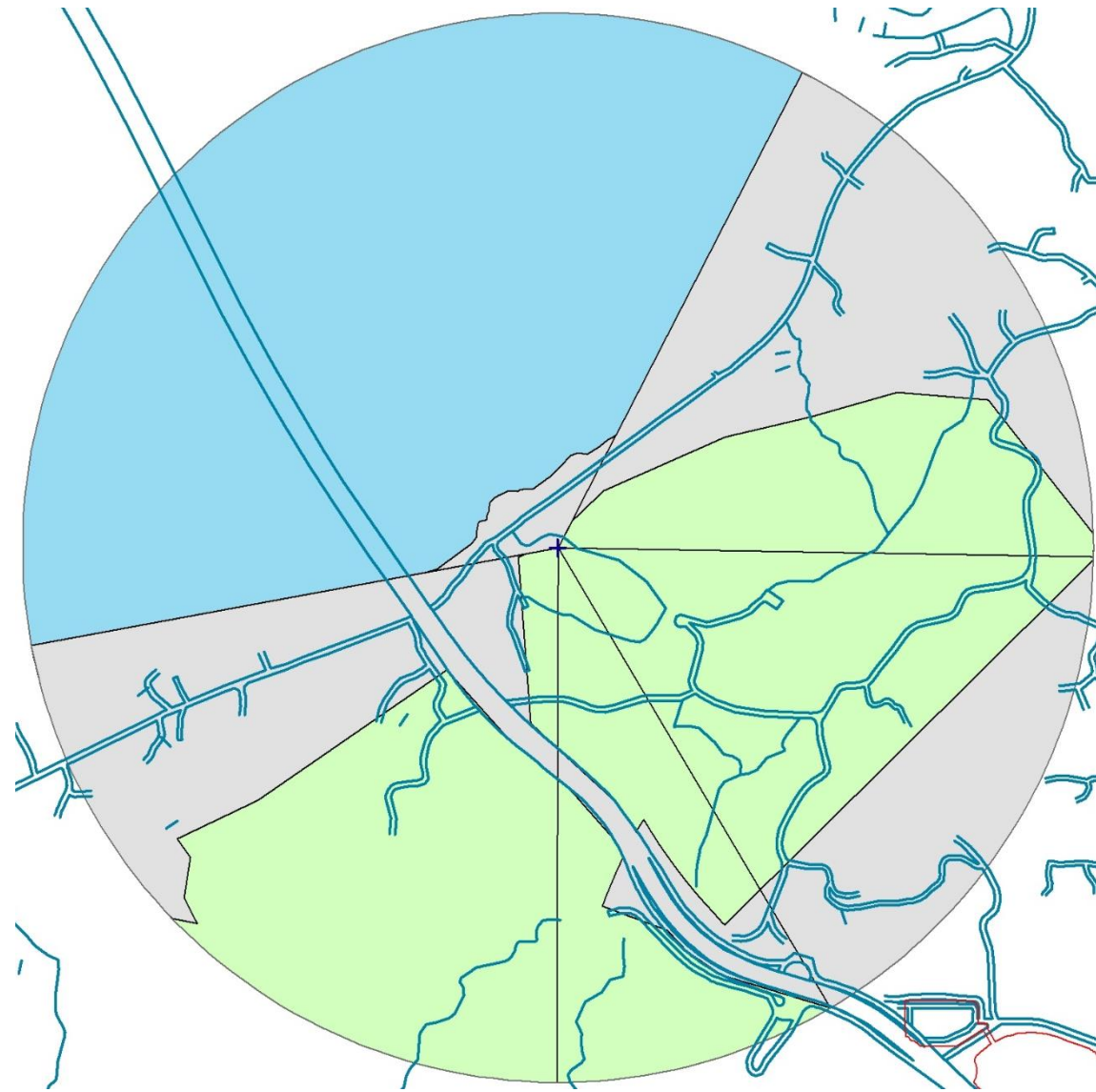
- Project Site
- 1km boundary from Grid 2047

Note: Grey area is classified as urban area. Blue area is classified as water area. Green area is classified as grassland area. Deep green area is classified as swamp.

**Appendix 3.8 Determination of Surface Characteristics**

**Construction Phase**

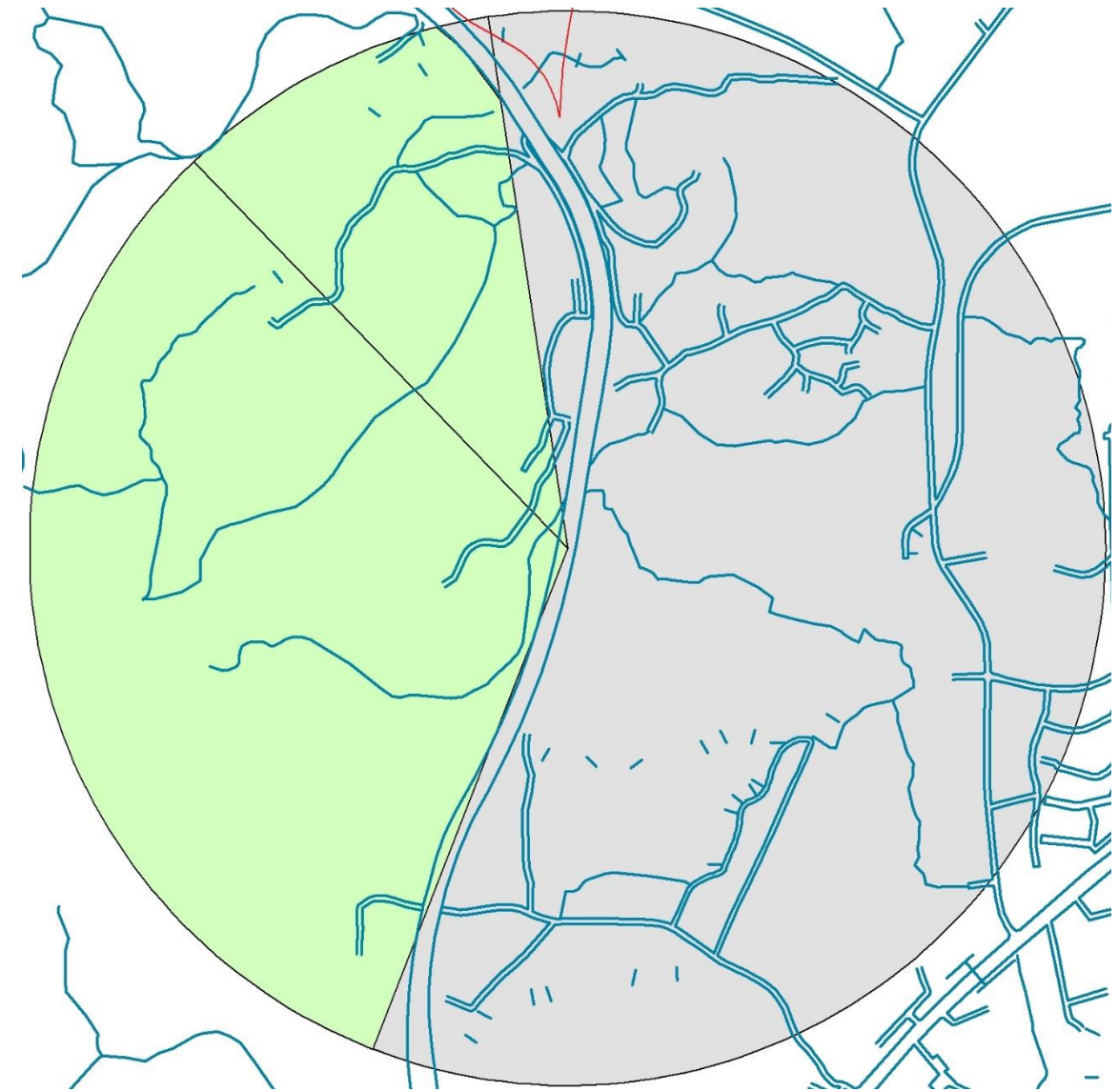
**1km Boundary from Grid 2048**



**Legend**

- Project Site
- 1km boundary from Grid 2048

**1km Boundary from Grid 2146**



**Legend**

- Project Site
- 1km boundary from Grid 2146

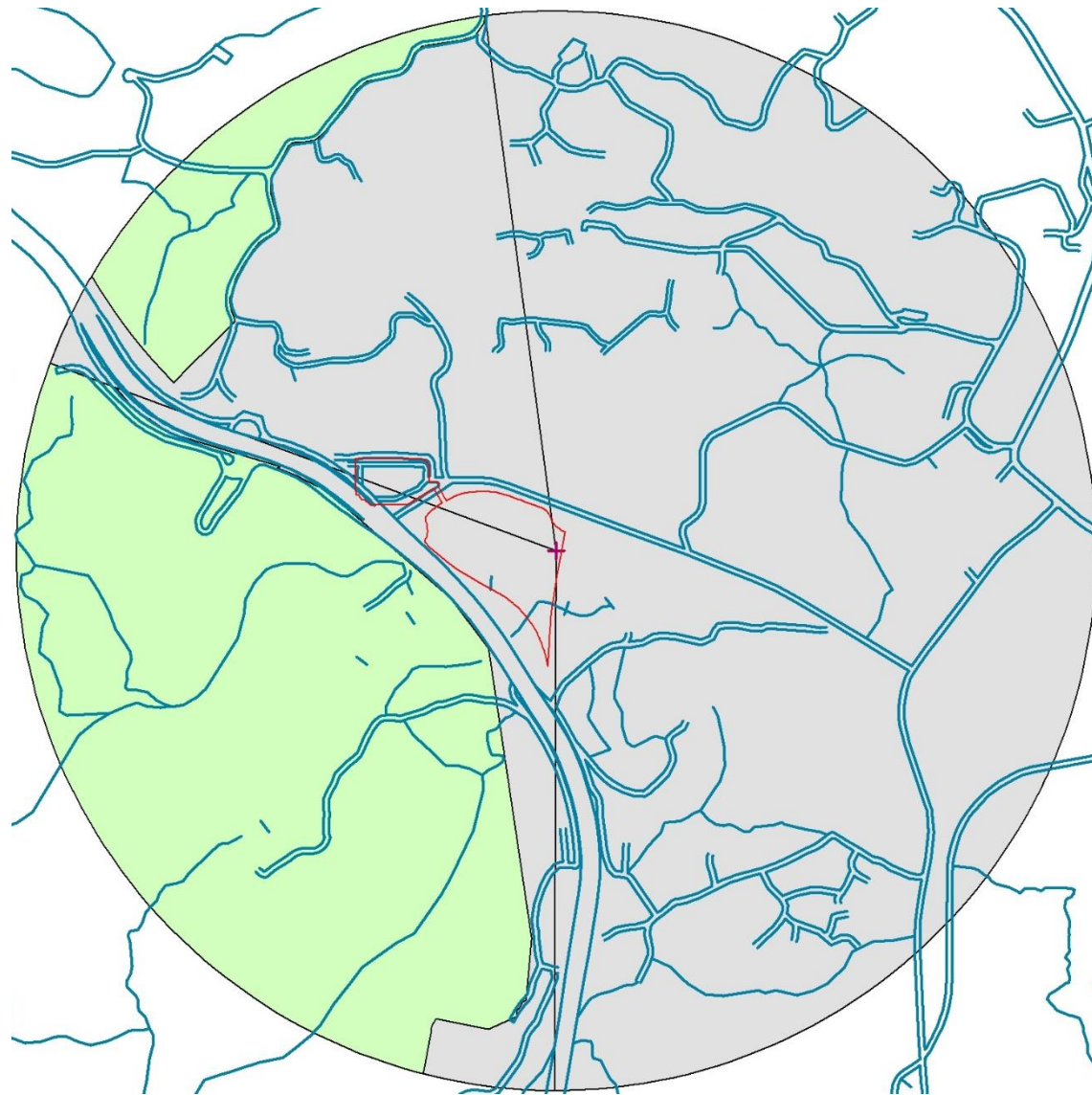
Note: Grey area is classified as urban area. Blue area is classified as water area. Green area is classified as grassland area. Deep green area is classified as swamp.



**Appendix 3.8 Determination of Surface Characteristics**

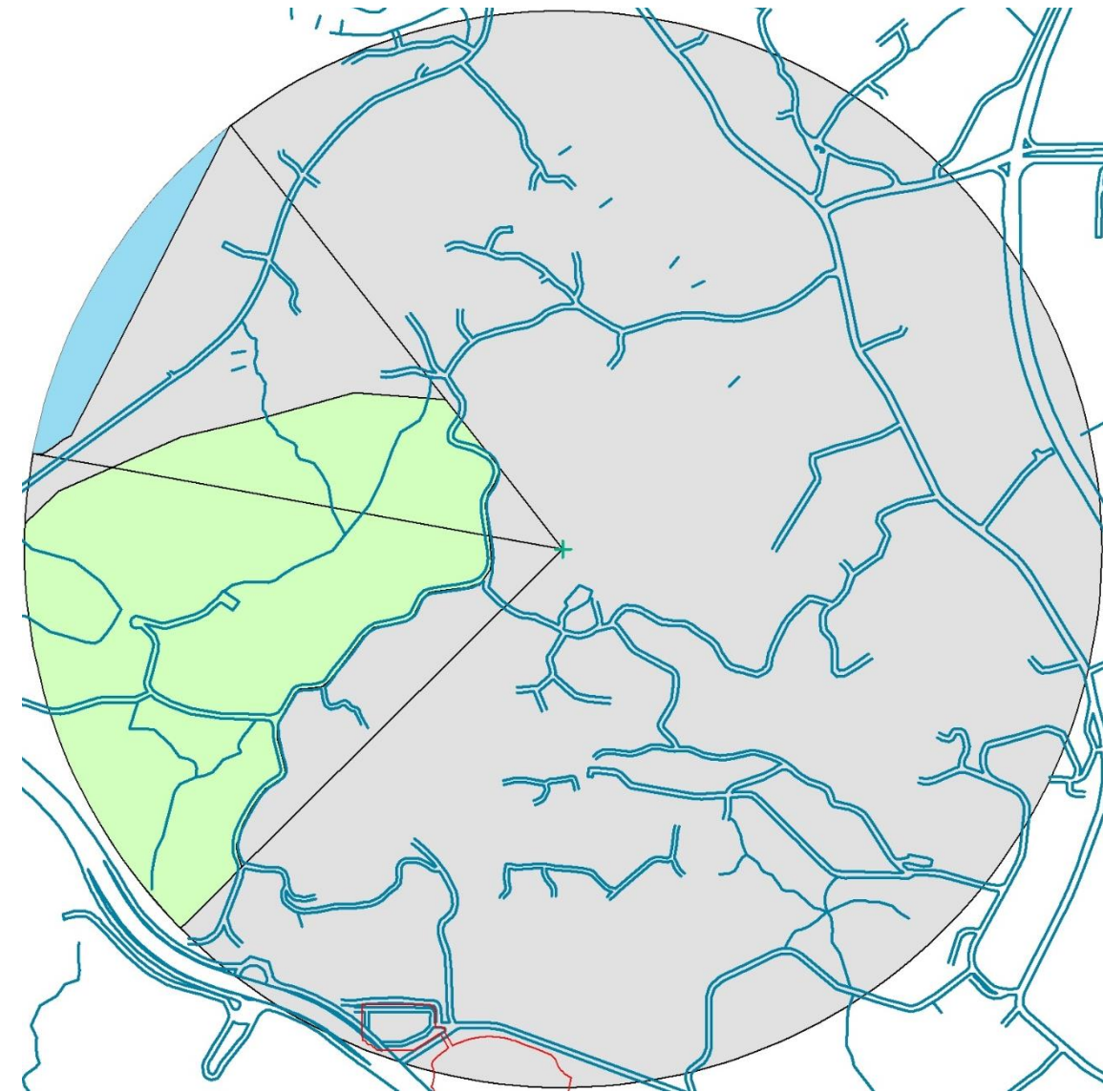
**Construction Phase**

**1km Boundary from Grid 2147**



- Legend**
- Project Site
  - 1km boundary from Grid 2147

**1km Boundary from Grid 2148**



- Legend**
- Project Site
  - 1km boundary from Grid 2148

Note: Grey area is classified as urban area. Blue area is classified as water area. Green area is classified as grassland area. Deep green area is classified as swamp.

**Appendix 3.8 Determination of Surface Characteristics**

Land Type	Season	Default Albedo from AERMET	Default Bowen Ratio from AERMET	Default Surface Roughness(m) from AERMET
Urban	Spring	0.14	1.00	1.0000
	Summer	0.16	2.00	1.0000
	Autumn	0.18	2.00	1.0000
	<b>Average</b>	<b>0.160</b>	<b>1.667</b>	<b>1.0000</b>
Grassland	Spring	0.18	0.40	0.0500
	Summer	0.18	0.80	0.1000
	Autumn	0.20	1.00	0.0100
	<b>Average</b>	<b>0.187</b>	<b>0.733</b>	<b>0.0533</b>
Water	Spring	0.12	0.10	0.0001
	Summer	0.10	0.10	0.0001
	Autumn	0.14	0.10	0.0001
	<b>Average</b>	<b>0.120</b>	<b>0.100</b>	<b>0.0001</b>
Swamp	Spring	0.12	0.10	0.2000
	Summer	0.14	0.10	0.2000
	Autumn	0.16	0.10	0.2000
	<b>Average</b>	<b>0.140</b>	<b>0.100</b>	<b>0.2000</b>

**Appendix 3.8 Determination of Surface Characteristics**

**Construction Phase**

**Grid 2047**

Sector (degrees in Clockwise)	Land type	Area (m <sup>2</sup> )	Distance	Weighting ( Area Fraction/Distance)	Weighting Sum	Albedo	Bowen Ratio	Surface Roughness	Remarks
45-112	Grassland	253225	489.57	0.000884645	0.00163166	0.1554	0.4688	0.20409	Urban development and grassland from northeast to east
	Urban	331461	758.89	0.000747018					
	Total	584685	-	-					
112-273	Grassland	1404990	-	-	-			0.05333	Grassland from east to west
273-356	Grassland	481416	505.26	0.001315467	0.00171676			0.10582	Urban development and grassland from west to north
	Urban	242896	835.67	0.000401291					
	Total	724312	-	-					
356-45	Grassland 1	82260	303.86	0.000633101	0.00177184			0.07296	Urban development and grassland from north to northeast
	Urban	36760	453.83	0.000189423					
	Grassland 2	308586	760.19	0.000949315					
	Total	427606	-	-					

**Grid 2048**

Sector (degrees in Clockwise)	Land type	Area (m <sup>2</sup> )	Distance	Weighting ( Area Fraction/Distance)	Weighting Sum	Albedo	Bowen Ratio	Surface Roughness	Remarks
27-91	Grassland	206995	536.04	0.000691409	0.001593496	0.1554	0.4688	0.28032	Urban development and grassland from northeast to east
	Urban	351511	697.69	0.000902087					
	Total	558505	-	-					
91-149	Grassland	314524	550.88	0.001128032	0.001580106			0.12337	Urban development and grassland from east to southeast
	Urban	191621	837.45	0.000452074					
	Total	506145	-	-					
149-180	Grassland 1	89581	407.16	0.000813287	0.001701384			0.09089	Urban development and grassland at south
	Urban	57802	690.53	0.000309422					
	Grassland 2	123143	786.62	0.000578674					
	Total	270526	-	-					
180-259	Grassland 1	21180	180.90	0.000169832	0.001640262			0.19244	Urban development and grassland from south to west
	Urban	300256	606.52	0.00071808					
	Grassland 2	367968	709.44	0.000752351					
	Total	689405	-	-					
259-27	Urban	30779	93.33	0.00029524	0.002211917			0.00023	Water from west to north
	Water	1086232	507.36	0.001916677					
	Total	1117011	-	-					

**Appendix 3.8 Determination of Surface Characteristics**

**Construction Phase**

**Grid 2146**

Sector (degrees in Clockwise)	Land type	Area (m <sup>2</sup> )	Distance	Weighting ( Area Fraction/Distance)	Weighting Sum	Albedo	Bowen Ratio	Surface Roughness	Remarks
201-316	Grassland	1003564	-	-	-	0.1554	0.4688	0.05333	Grassland from south to northwest
316-352	Grassland	302958	621.45	0.001551764	0.001589717			0.05720	Urban development and grassland from northwest to north
	Urban	11202	939.49	3.79526E-05					
	Total	314159	-	-					
352-201	Urban	1823869	-	-	-			1.00000	Urban development from north to south

**Grid 2147**

Sector (degrees in Clockwise)	Land type	Area (m <sup>2</sup> )	Distance	Weighting ( Area Fraction/Distance)	Weighting Sum	Albedo	Bowen Ratio	Surface Roughness	Remarks
1-180	Urban	1570796	-	-	-	0.1554	0.4688	1.00000	Urban development from north to south
180-290	Urban	128040	387.45	0.000344263	0.00179142			0.09368	Urban development and grassland from south to west
	Grassland	831891	598.84	0.001447156					
	Total	959931	-	-					
290-1	Urban	404453	596.56	0.001109861	0.001522167			0.45205	Urban development and grassland from west to north
	Grassland	206412	819.54	0.000412306					
	Total	610865	-	-					

## Appendix 3.8 Determination of Surface Characteristics

### Construction Phase

#### Grid 2148

Sector (degrees in Clockwise)	Land type	Area (m <sup>2</sup> )	Distance	Weighting ( Area Fraction/Distance)	Weighting Sum	Albedo	Bowen Ratio	Surface Roughness	Remarks
225-280	Grassland	471791	637.41	0.0015421	0.001559997	0.1554	0.4688	0.05515	Urban development and grassland from southwest to west
	Urban	8174	953.19	0.0000179					
	Total	479966	-	-					
280-322	Grassland	117866	408.78	0.0007867	0.001673961			0.12113	Urban development, grassland, and water at northwest
	Urban	202334	732.16	0.0007540					
	Water	46319	948.18	0.0001333					
	Total	366519	-	-					
322-225	Urban	2295108	-	-	-			1.00000	Urban development from northwest to northwest

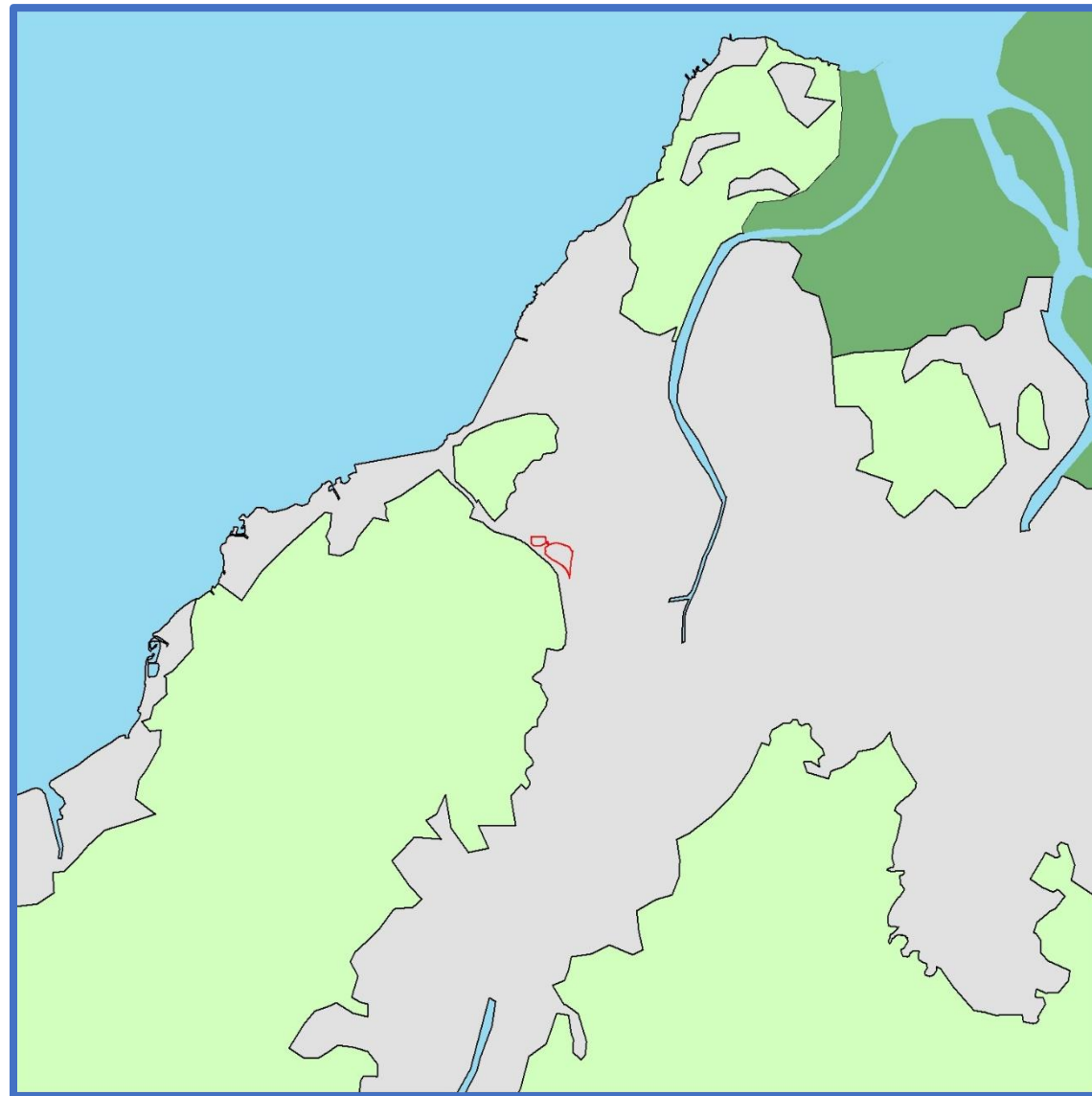
Note:

- Reference to AERMOD Implementation Guide, the determination of the Bowen ratio should be based on a simple unweighted geometric mean (i.e., no direction or distance dependency) for a representative domain, with a default domain defined by a 10km by 10km region centered on the measurement site.
- Reference to AERMOD Implementation Guide, the determination of the albedo should be based on a simple unweighted arithmetic mean (i.e., no direction or distance dependency) for the same representative domain as defined for Bowen ratio, with a default domain defined by a 10km by 10km region centered on the measurement site.
- Surface roughness length is based on an inverse distance weighted geometric mean for a default upwind distance of 1 kilometer relative to the grid.
- Land use within 10km by 10km region centered on the measurement site included 32.333406% urban (32333406 km<sup>2</sup>), 29.988904% water (29988904 km<sup>2</sup>), 31.889138% grassland (31889138 km<sup>2</sup>), and 5.788551% swamp (5788551 km<sup>2</sup>)
- For the parameters including albedo, Bowen Ratio and surface roughness, the default value for "Winter" is excluded from calculating the representative values.

**Appendix 3.8 Determination of Surface Characteristics**

**Operation Phase**

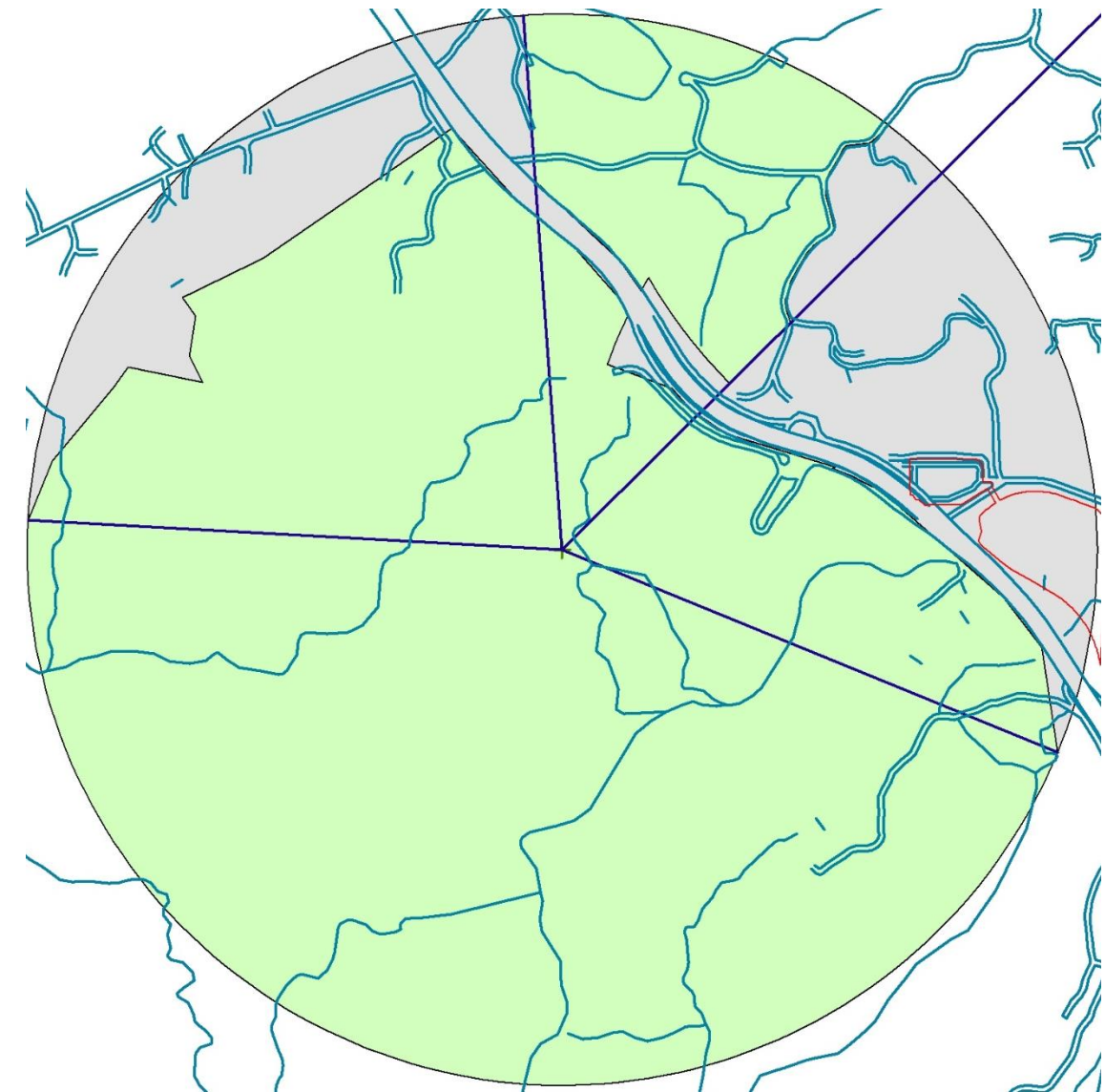
**10km by 10km Region Centred on the Project Site**



**Legend**

- 10km by 10km Region Centered on the Project Site
- Project Site

**1km Boundary from Grid 2047**



**Legend**

- Project Site
- 1km boundary from Grid 2047

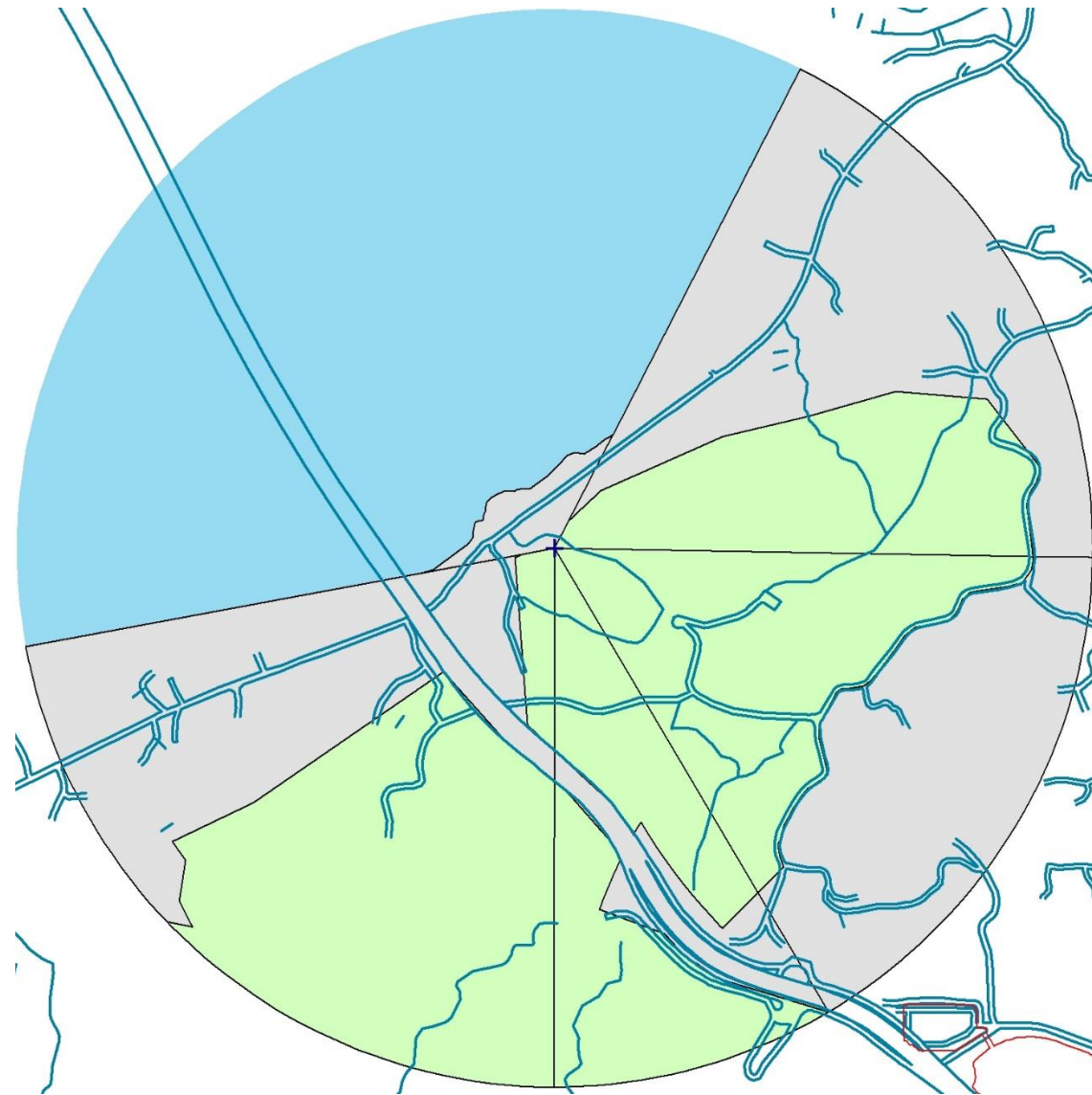
Note: Grey area is classified as urban area. Blue area is classified as water area. Green area is classified as grassland area. Deep green area is classified as swamp.



**Appendix 3.8 Determination of Surface Characteristics**

**Operation Phase**

**1km Boundary from Grid 2048**



**Legend**

- Project Site
- 1km boundary from Grid 2048

**1km Boundary from Grid 2146**



**Legend**

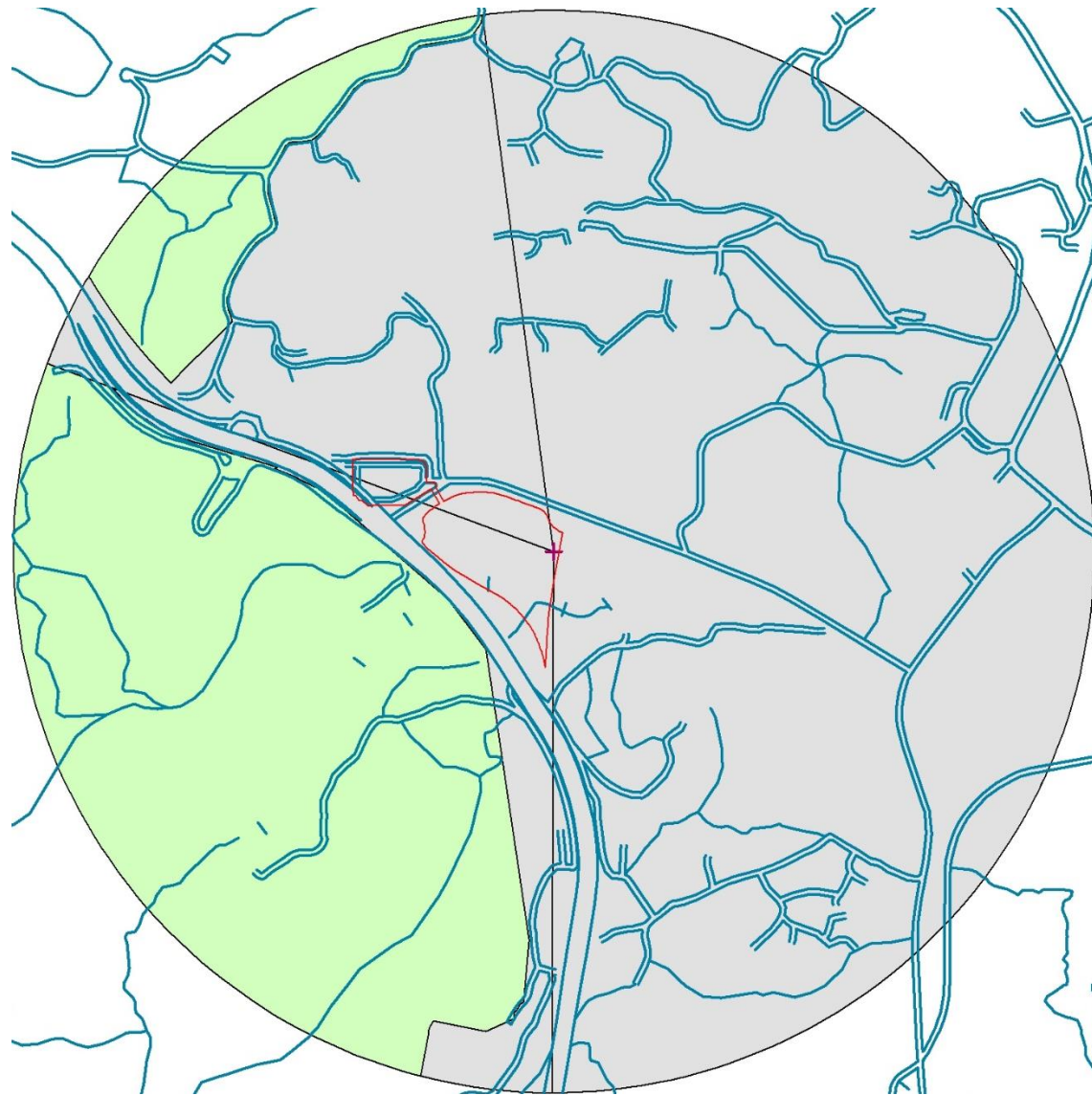
- Project Site
- 1km boundary from Grid 2146

Note: Grey area is classified as urban area. Blue area is classified as water area. Green area is classified as grassland area. Deep green area is classified as swamp.

**Appendix 3.8 Determination of Surface Characteristics**

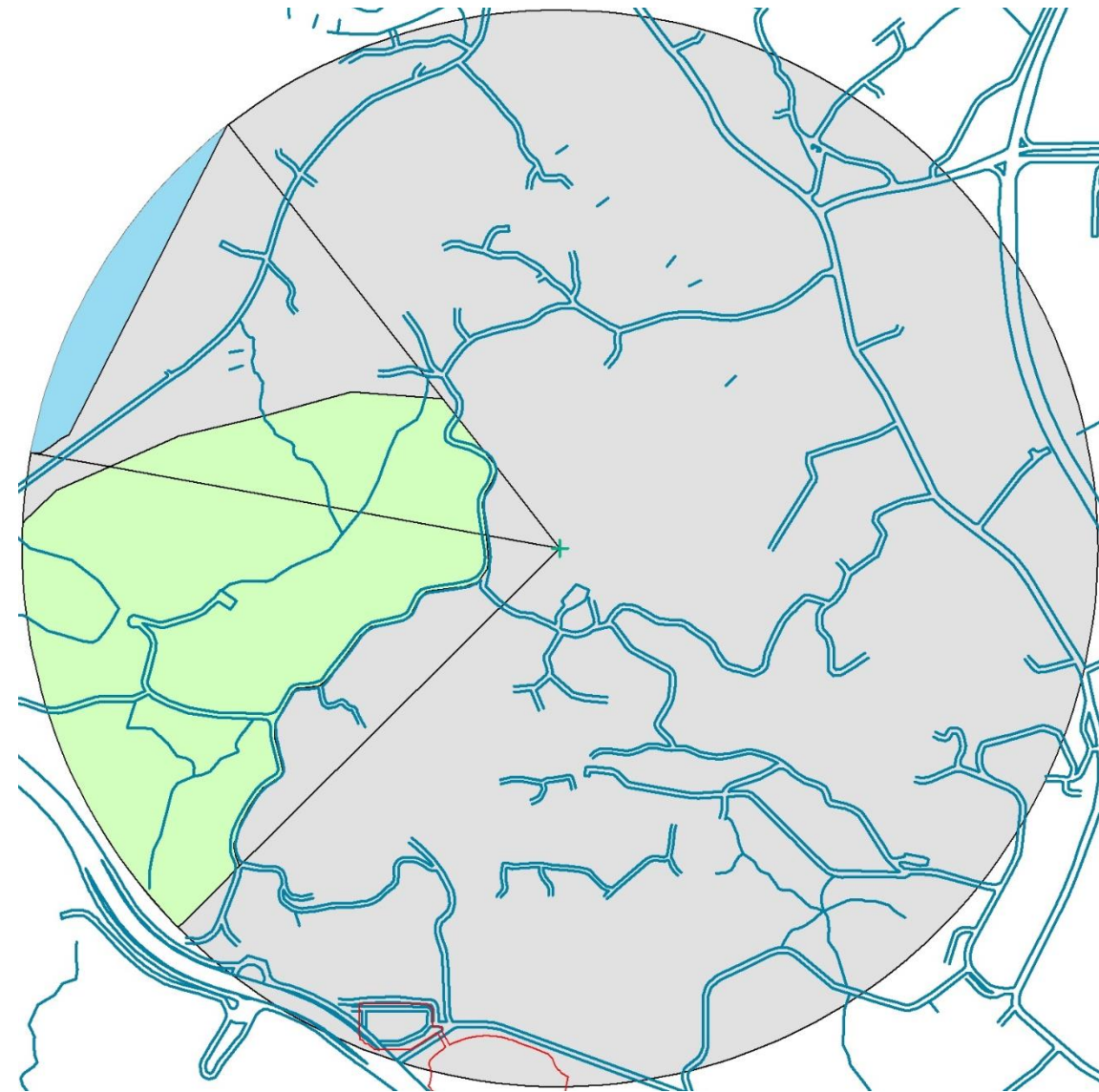
**Operation Phase**

**1km Boundary from Grid 2147**



- Legend**
- Project Site
  - 1km boundary from Grid 2147

**1km Boundary from Grid 2148**



- Legend**
- Project Site
  - 1km boundary from Grid 2148

Note: Grey area is classified as urban area. Blue area is classified as water area. Green area is classified as grassland area. Deep green area is classified as swamp.

**Appendix 3.8 Determination of Surface Characteristics**

Land Type	Season	Default Albedo from AERMET	Default Bowen Ratio from AERMET	Default Surface Roughness(m) from AERMET
Urban	Spring	0.14	1.00	1.0000
	Summer	0.16	2.00	1.0000
	Autumn	0.18	2.00	1.0000
	<b>Average</b>	<b>0.160</b>	<b>1.667</b>	<b>1.0000</b>
Grassland	Spring	0.18	0.40	0.0500
	Summer	0.18	0.80	0.1000
	Autumn	0.20	1.00	0.0100
	<b>Average</b>	<b>0.187</b>	<b>0.733</b>	<b>0.0533</b>
Water	Spring	0.12	0.10	0.0001
	Summer	0.10	0.10	0.0001
	Autumn	0.14	0.10	0.0001
	<b>Average</b>	<b>0.120</b>	<b>0.100</b>	<b>0.0001</b>
Swamp	Spring	0.12	0.10	0.2000
	Summer	0.14	0.10	0.2000
	Autumn	0.16	0.10	0.2000
	<b>Average</b>	<b>0.140</b>	<b>0.100</b>	<b>0.2000</b>



**Appendix 3.8 Determination of Surface Characteristics**

**Operation Phase**

**Grid 2047**

Sector (degrees in Clockwise)	Land type	Area (m <sup>2</sup> )	Distance	Weighting ( Area Fraction/Distance)	Weighting Sum	Albedo	Bowen Ratio	Surface Roughness	Remarks
45-112	Grassland	253225	489.57	0.000884645	0.00163166	0.1553	0.4698	0.20409	Urban development and grassland from northeast to east
	Urban	331461	758.89	0.000747018					
112-273	Grassland	1404990	-	-	-			0.05333	Grassland from east to west
273-356	Grassland	481416	505.26	0.001315467	0.00171676			0.10582	Urban development and grassland from west to north
	Urban	242896	835.67	0.000401291					
356-45	Grassland 1	82260	303.86	0.000633101	0.00176513			0.08633	Urban development and grassland from north to northeast
	Urban 1	36760	453.83	0.000189423					
	Grassland 2	272179	755.94	0.000842021					
	Urban 2	36407	846.48	0.000100584					
	Total	427606	-	-					

**Grid 2048**

Sector (degrees in Clockwise)	Land type	Area (m <sup>2</sup> )	Distance	Weighting ( Area Fraction/Distance)	Weighting Sum	Albedo	Bowen Ratio	Surface Roughness	Remarks				
27-91	Grassland	193977	500.26	0.000694266	0.00164612	0.1553	0.4698	0.29047	Urban development and grassland from northeast to east				
	Urban	364529	685.70	0.000951854									
	Total	558505	-	-									
91-149	Grassland	237544	492.04	0.000953825	0.00160522			0.1553	0.4698	0.17522	Urban development and grassland from east to southeast		
	Urban	268601	814.68	0.000651397									
	Total	506145	-	-									
149-180	Grassland 1	89581	407.16	0.000813287	0.00170311					0.1553	0.4698	0.09308	Urban development and grassland at south
	Urban	60447	690.53	0.000323583									
	Grassland 2	120497	786.62	0.000566244									
	Total	270526	-	-									
180-259	Grassland 1	21180	180.90	0.000169832	0.00163916	0.1553	0.4698					0.19001	Urban development and grassland from south to west
	Urban	297082	606.52	0.000710488									
	Grassland 2	371143	709.44	0.000758841									
	Total	689405	-	-									
259-27	Urban	30779	93.33	0.00029524	0.00221192			0.1553	0.4698	0.00023	Water from west to north		
	Water	1086232	507.36	0.001916677									
	Total	1117011	-	-									



**Appendix 3.8 Determination of Surface Characteristics**

**Operation Phase**

**Grid 2146**

Sector (degrees in Clockwise)	Land type	Area (m <sup>2</sup> )	Distance	Weighting ( Area Fraction/Distance)	Weighting Sum	Albedo	Bowen Ratio	Surface Roughness	Remarks
201-316	Grassland	842530	594.04	0.001413268	0.001808388	0.1553	0.4698	0.10119	Urban development and grassland from south to northwest
	Urban	161034	406.11	0.00039512					
	Total	1003564	-	-					
316-352	Urban 1	11499	146.57	0.000249726	0.001682779			0.08803	Urban development and grassland from northwest to north
	Grassland	291459	665.00	0.0013951					
	Urban 2	11202	939.49	3.79526E-05					
	Total	314159	-	-					
352-201	Urban	1823869	-	-	-			1.00000	Urban development from north to south

**Grid 2147**

Sector (degrees in Clockwise)	Land type	Area (m <sup>2</sup> )	Distance	Weighting ( Area Fraction/Distance)	Weighting Sum	Albedo	Bowen Ratio	Surface Roughness	Remarks
352-180	Urban	1640609	-	-	-	0.1553	0.4698	1.00000	Urban development from north to south
180-290	Urban	157191	433.5	0.000377744	0.001760361			0.10004	Urban development and grassland from south to west
	Grassland	802741	604.83	0.001382617					
	Total	959931	-	-					
290-352	Urban	414947	620.65	0.001235681	0.00151008			0.58706	Urban development and grassland from west to north
	Grassland	126105	849.4	0.000274399					
	Total	541052	-	-					

## Appendix 3.8 Determination of Surface Characteristics

### Operation Phase

#### Grid 2148

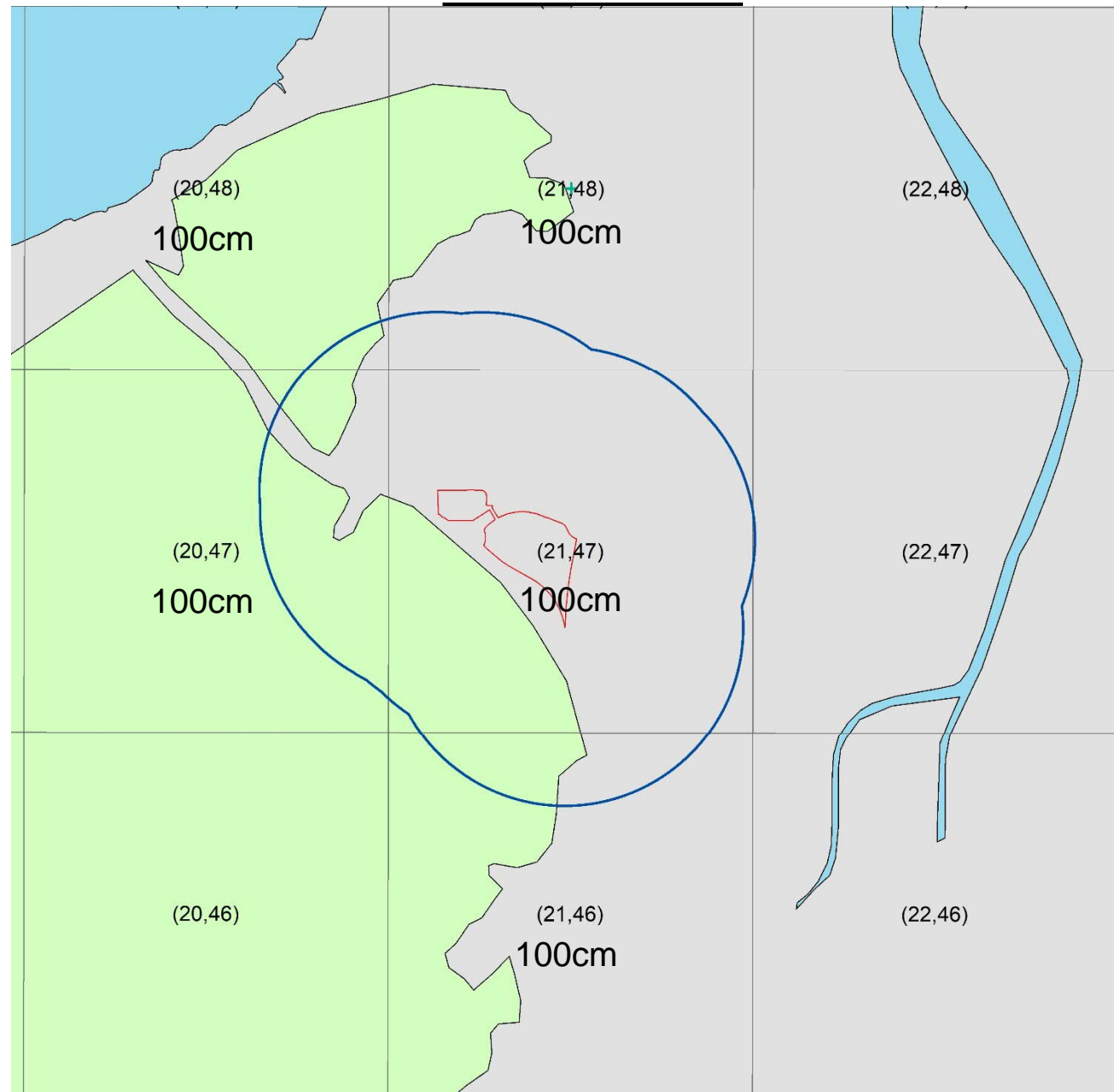
Sector (degrees in Clockwise)	Land type	Area (m <sup>2</sup> )	Distance	Weighting ( Area Fraction/Distance)	Weighting Sum	Albedo	Bowen Ratio	Surface Roughness	Remarks
225-280	Urban 1	84198	422.61	0.0004151	0.0016035	0.1553	0.4698	0.11775	Urban development and grassland from southwest to west
	Grassland	387452	689.83	0.0011702					
	Urban 2	8315	953.19	0.0000182					
	Total	479966	-	-					
280-322	Urban 1	12813	109.26	0.0003200	0.0018729			0.17999	Urban development and grassland from west to northwest
	Grassland	108174	435.99	0.0006769					
	Urban 2	199212	731.79	0.0007427					
	Water	46319	948.18	0.0001333					
	Total	366519	-	-					
322-225	Urban	2295108	-	-	-			1.00000	Urban development from northwest to south west

Note:

- Reference to AERMOD Implementation Guide, the determination of the Bowen ratio should be based on a simple unweighted geometric mean (i.e., no direction or distance dependency) for a representative domain, with a default domain defined by a 10km by 10km region centered on the measurement site.
- Reference to AERMOD Implementation Guide, the determination of the albedo should be based on a simple unweighted arithmetic mean (i.e., no direction or distance dependency) for the same representative domain as defined for Bowen ratio, with a default domain defined by a 10km by 10km region centered on the measurement site.
- Surface roughness length is based on an inverse distance weighted geometric mean for a default upwind distance of 1 kilometer relative to the grid.
- Land use within 10km by 10km region centered on the measurement site included 32.598540% urban (32598540 km<sup>2</sup>), 29.988904% water (29988904 km<sup>2</sup>), 31.624004% grassland (31624004 km<sup>2</sup>), and 5.788551% swamp (5788551 km<sup>2</sup>)
- For the parameters including albedo, Bowen Ratio and surface roughness, the default value for "Winter" is excluded from calculating the representative values.

Surface Roughness adopted in CALINE4 of Modelling Grid

**Construction Phase**



**Operation Phase**

