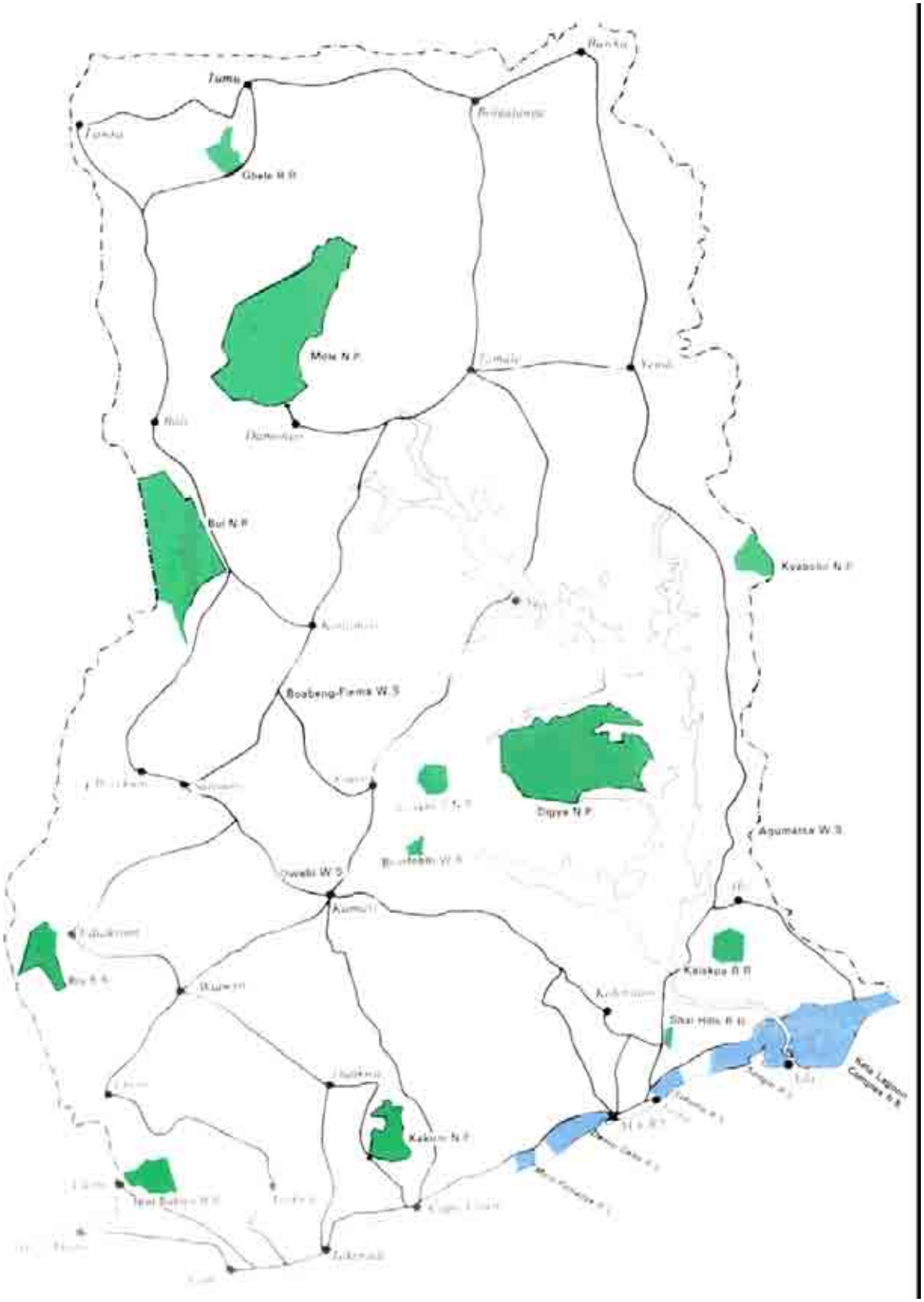
添付資料 8.1

ガーナの保護区マップ



（出所）林業委員会（FC）野生生物課（Wildlife Division）資料

環境保全上脆弱な地域（Environmentally Sensitive Areas）

1　法律により国立公園、流域保護区、野生生物保護区、および野生生物保護区（宗教的に重要な森林を含む。）として定められた地域

2　潜在的に観光地としての可能性を秘めた地域

3　絶滅の危機に瀕している固有種の野生生物（動植物）の生息・生育地

4　特有の歴史的、考古学的または科学的に重要な地域

5　固有の文化を有するコミュニティによって伝統的に所有されている地域

6　自然災害に侵されている地域（自然災害の頻発地、洪水、豪雨、地震、地すべり、火山活動など）

7　森林火災の頻発地

8　限界斜面を含む丘陵地帯

9　もともと農地として区分された地域

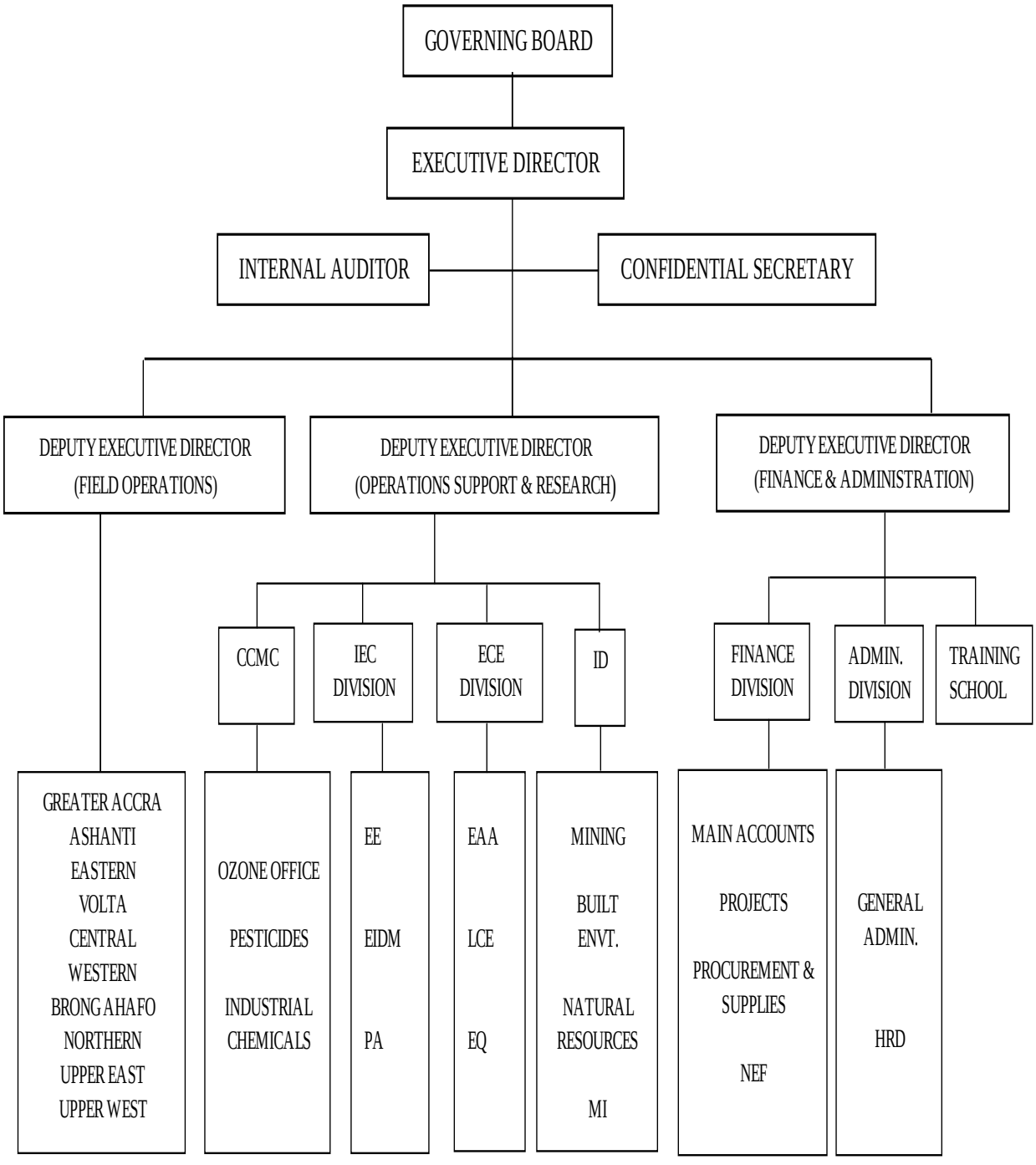
10　帯水層への水源涵養地帯

11　次のいずれか又は複数に該当する水域
- a. 家庭用水として開発された水域
- b. 管理又は保護された水域
- c. 野生生物や漁業資源の涵養のための水域

12　次のいずれか又は複数に該当するマングローブ生育地
- a. 原始の状態で群生している地域
- b. 主要な河川の河口に隣接する地域
- c. 伝統的な漁場の近辺または隣接地
- d. 海岸侵食、強風または高潮に対する自然緩衝として機能している地域

(出所) ガーナ環境評価規則別表 5

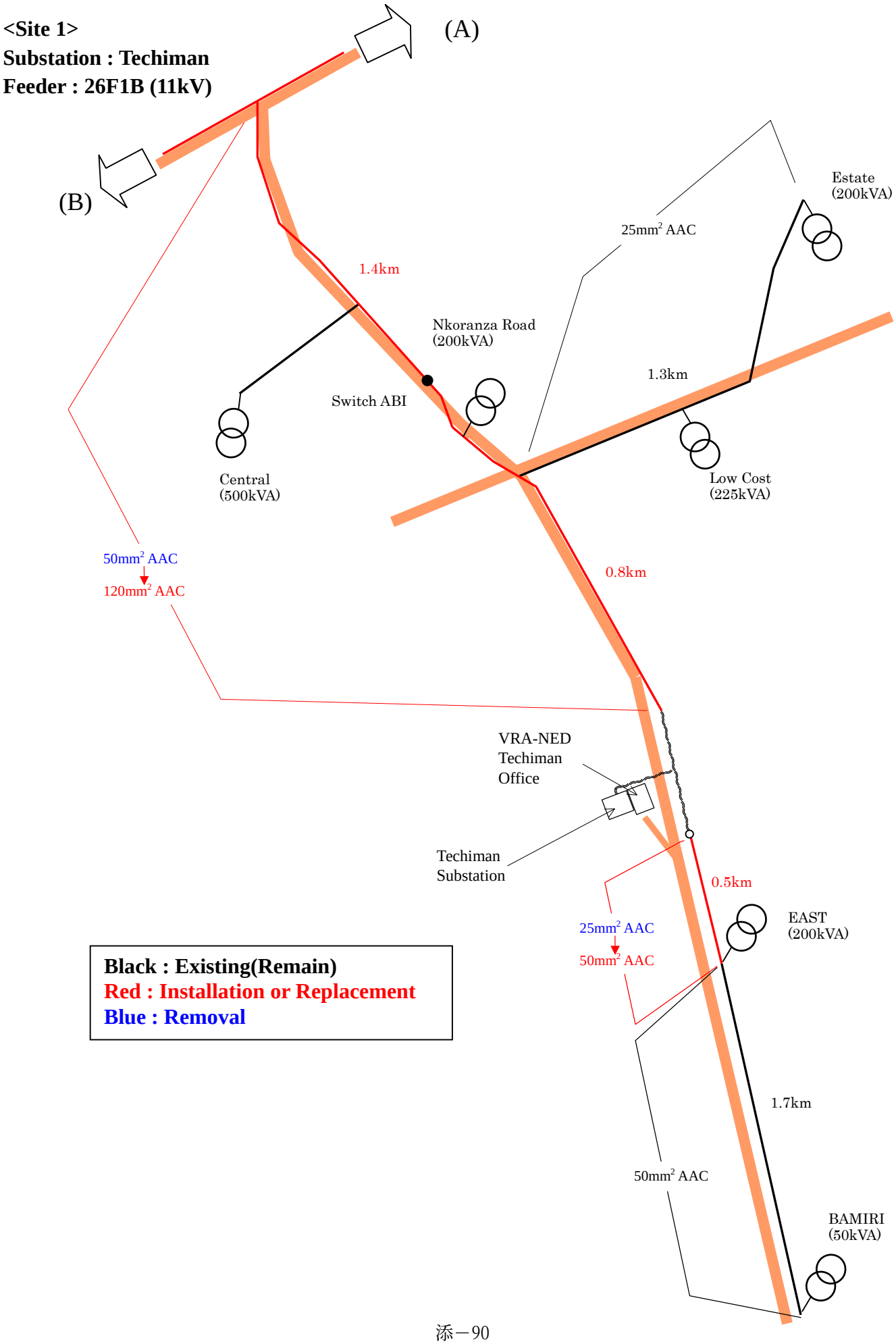
環境保護庁の組織図



CCMC – Chemical Control and Management
IEC – Information Education and Communication
ECE – Environmental Compliance and Enforcement
EE – Environmental Education
EIDM – Environmental Information and Data Management
PA – Public Affairs
EAA – Environmental Audit and Assessment
LCE – Legal Compliance Enforcement
EQ – Environmental QualityHRD – Human Resource Development
ID – Intersectoral Division
MI – Manufacturing Industries

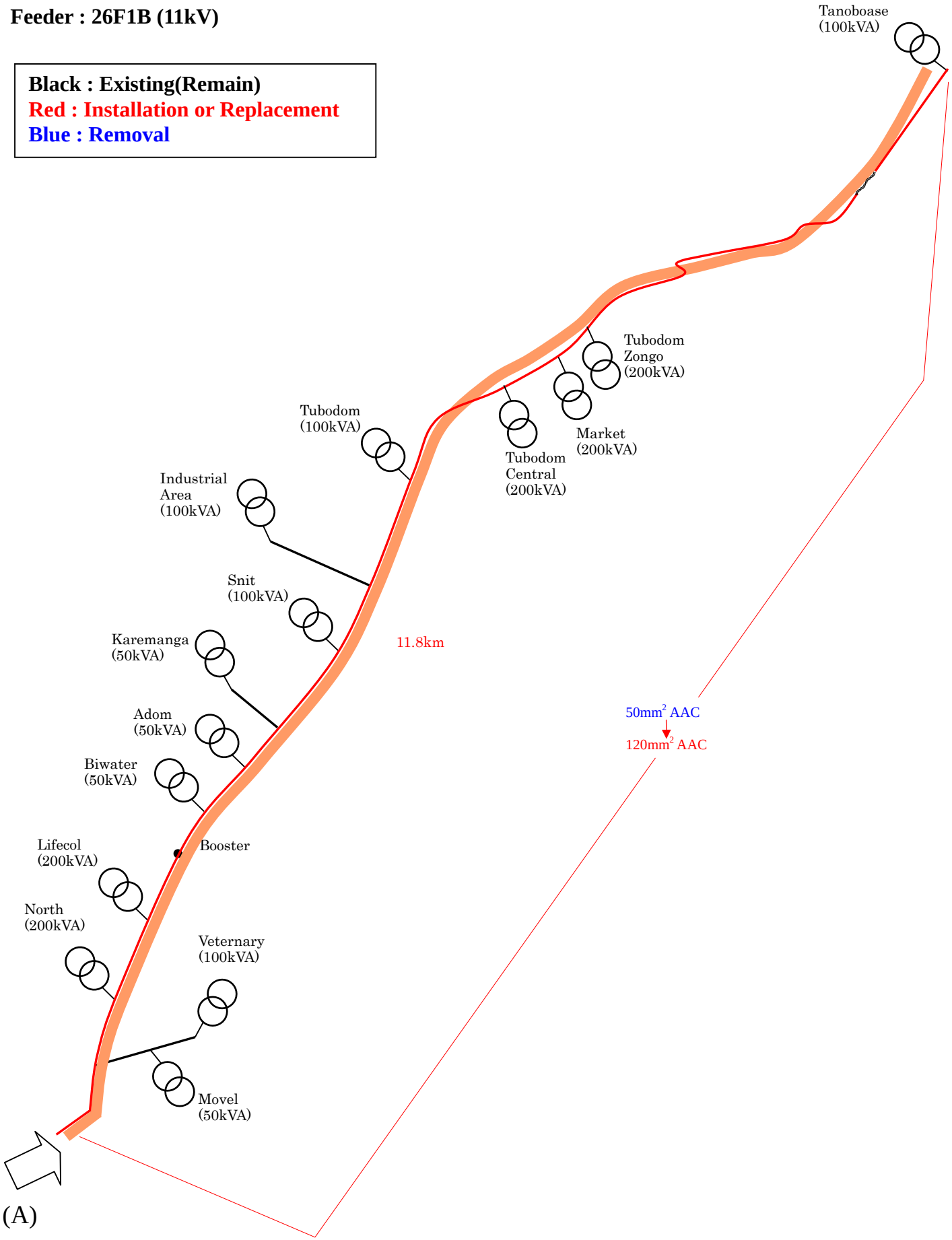
出典：EPA資料

【Example of drawing(Case Study inside Techiman City (VRA Techiman Office))】

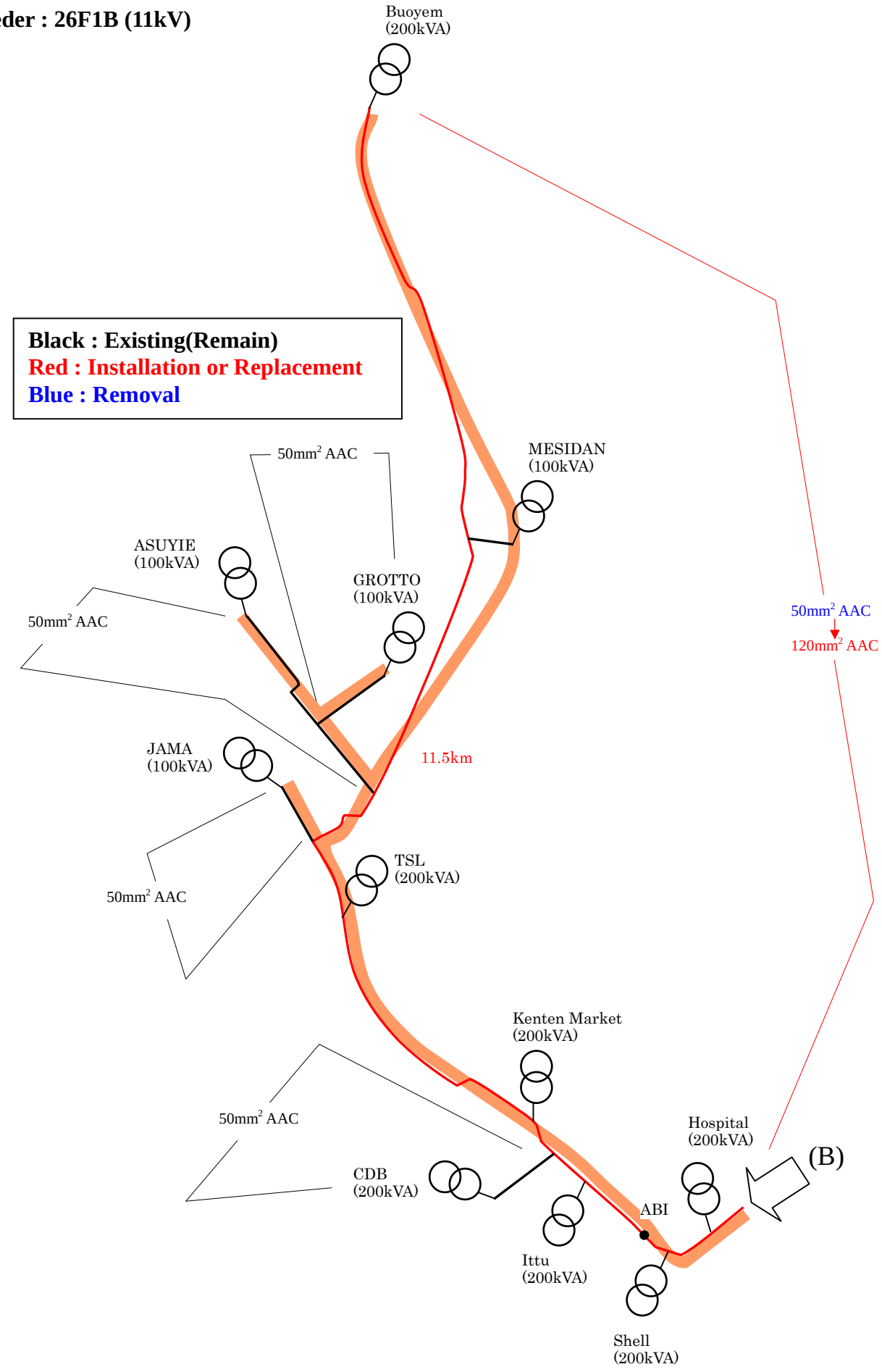


<Site 1>
Substation : Techiman
Feeder : 26F1B (11kV)

Black : Existing(Remain)
Red : Installation or Replacement
Blue : Removal

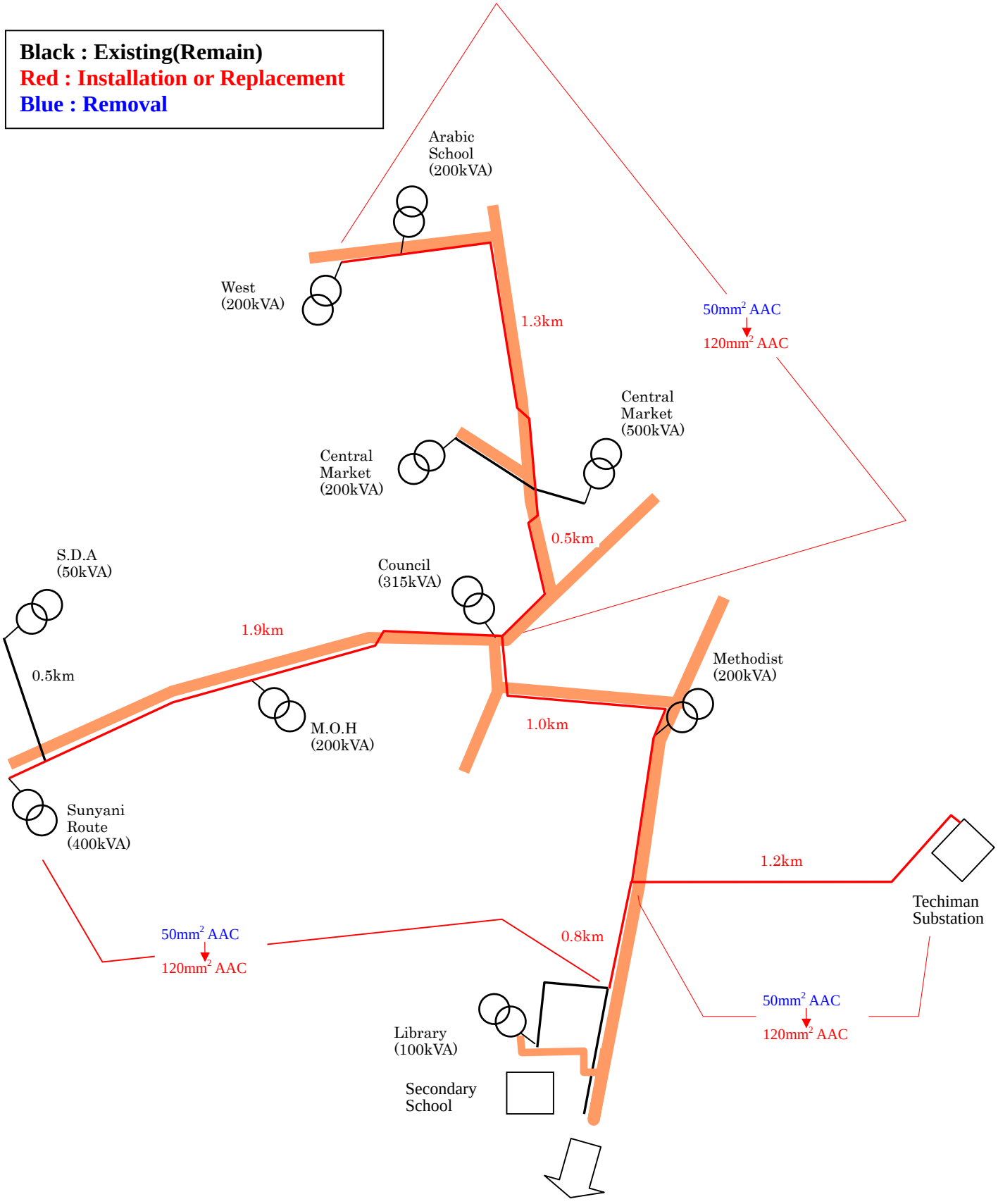


<Site 1>
Substation : Techiman
Feeder : 26F1B (11kV)



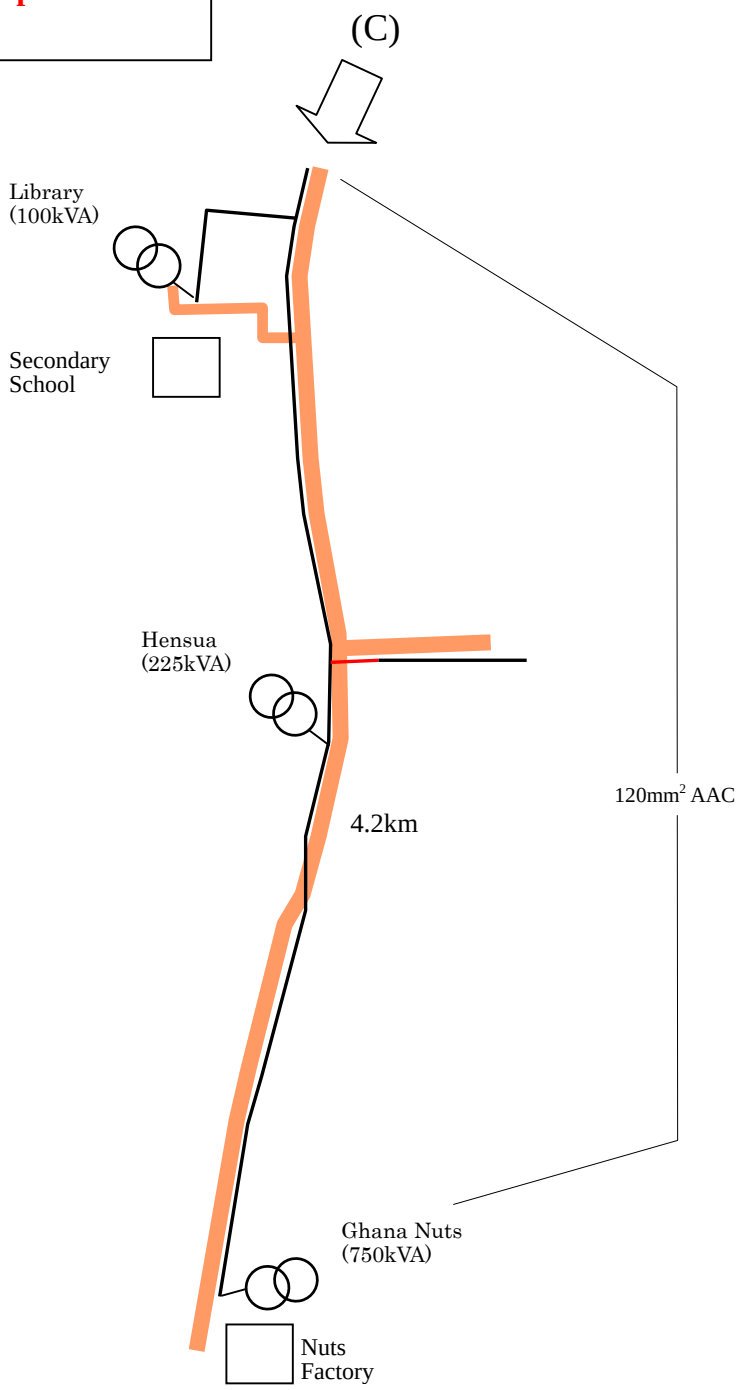
<Site 2>
Substation : Techiman
Feeder : 26F2B (11kV)

Black : Existing(Remain)
Red : Installation or Replacement
Blue : Removal



<Site 2>
Substation : Techiman
Feeder : 26F2B (11kV)

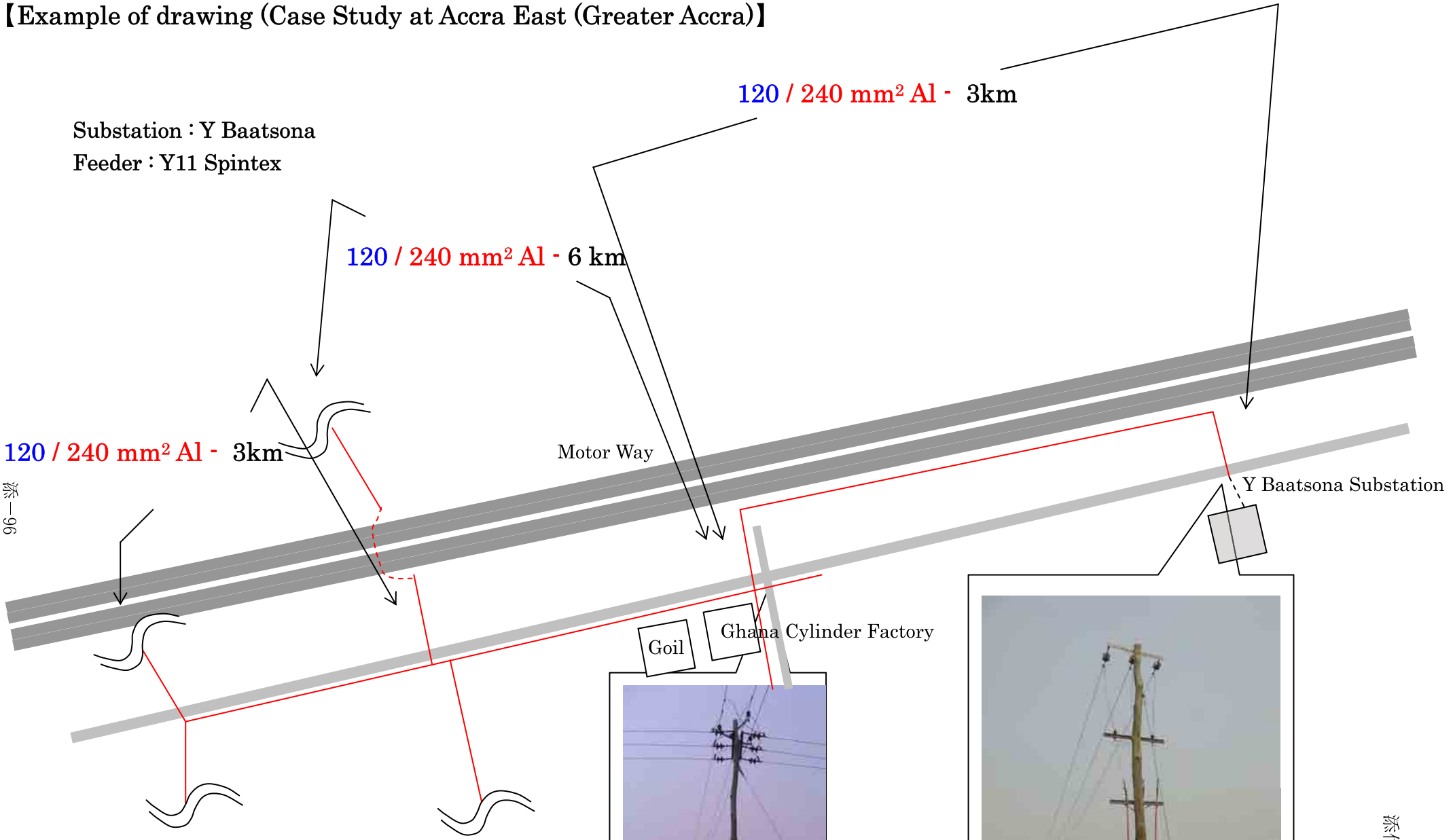
Black : Existing(Remain)
Red : Installation or Replacement
Blue : Removal



<Cost Estimation>

Site	Installation of Facilities	Removal of Facilities	Total Cost (US$)
<Site 1> Substation : Techiman Feeder : 26F1B(11kV)	120mm^2 AAC (without pole construction) 25.5km 50mm^2 AAC (without pole construction) 0.5km 5,106.24(US$/km) x 25.5(km) +3,969.34(US$/km) x 0.5(km) =132,193.8(US$)	50mm^2 AAC (without pole construction) 25.5km 25mm^2 AAC (without pole construction) 0.5km 1,075.11(US$/km) x 25.5(km) 1,075.11(US$/km) x 0.5(km) =27,952.86(US$)	160,147
<Site 2> Substation: Techiman Feeder: 26F2B(11kV)	120mm^2 AAC (without pole construction) 7.2km 5,106.24(US$/km) x 7.2(km) =36,764.93(US$)	50mm^2 AAC (without pole construction) 7.2km 1,075.11(US$/km) x 7.2(km) =7,740.792(US$)	44,506

【Example of drawing (Case Study at Accra East (Greater Accra)】



double-T-off point

First take-off point

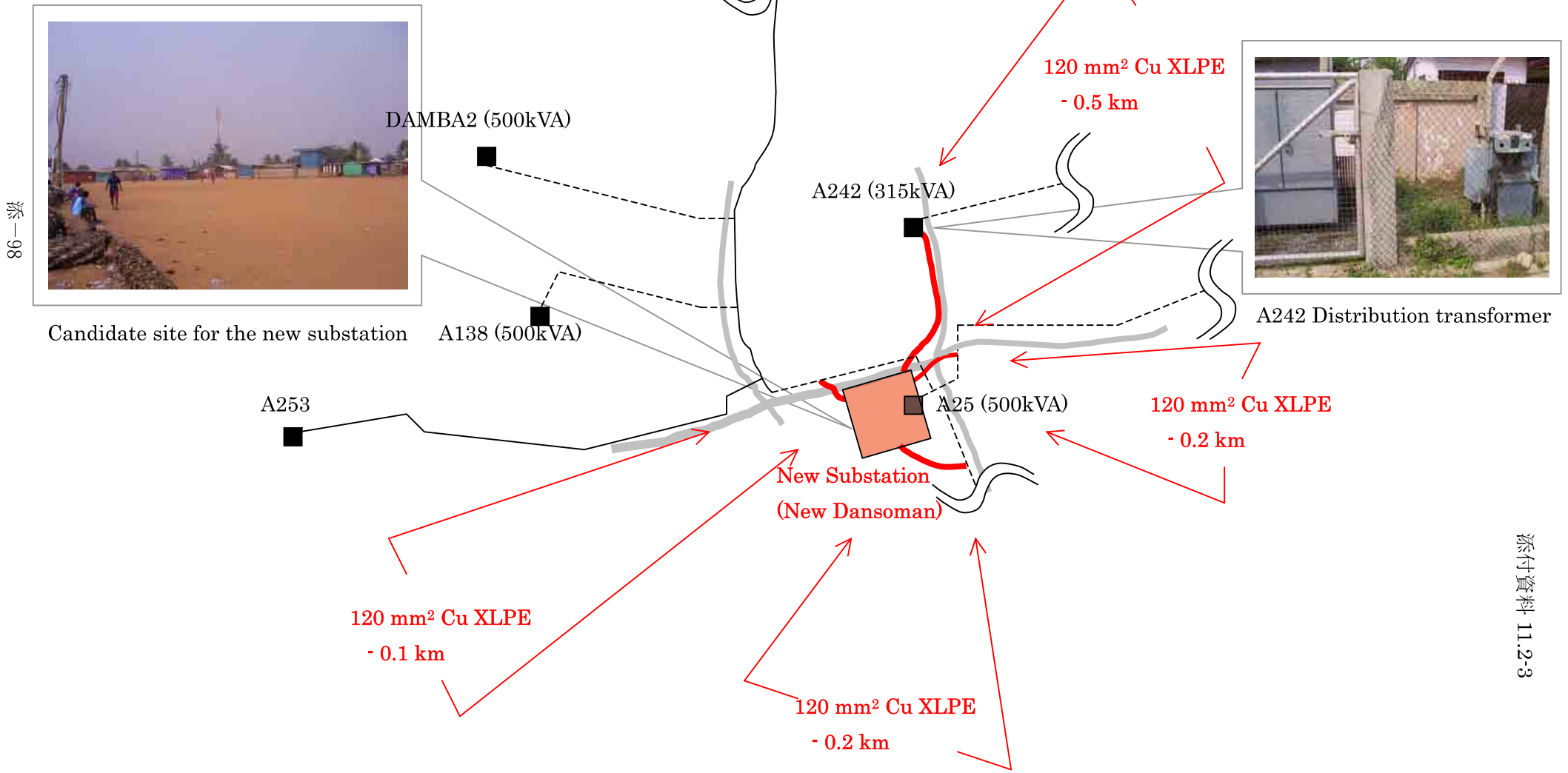
<Cost Estimation>

Site	Installation of Facilities	Removal of Facilities	Total Cost (US$)
<Site 1> Substation : Y Baatsona Feeder : Y11 Spintex	240mm^2 AAC (without pole construction) 12km 7,111.92(US$/km) x 12(km) =85343.0(US$)	120mm^2 Cu (without pole construction) 12km 1,117.87(US$/km) x 12(km) =13,414.4(US$)	98,757

【Example of drawing (Case Study at Accra East (Greater Accra)】

Substation : V Dansoman
Feeder : V10

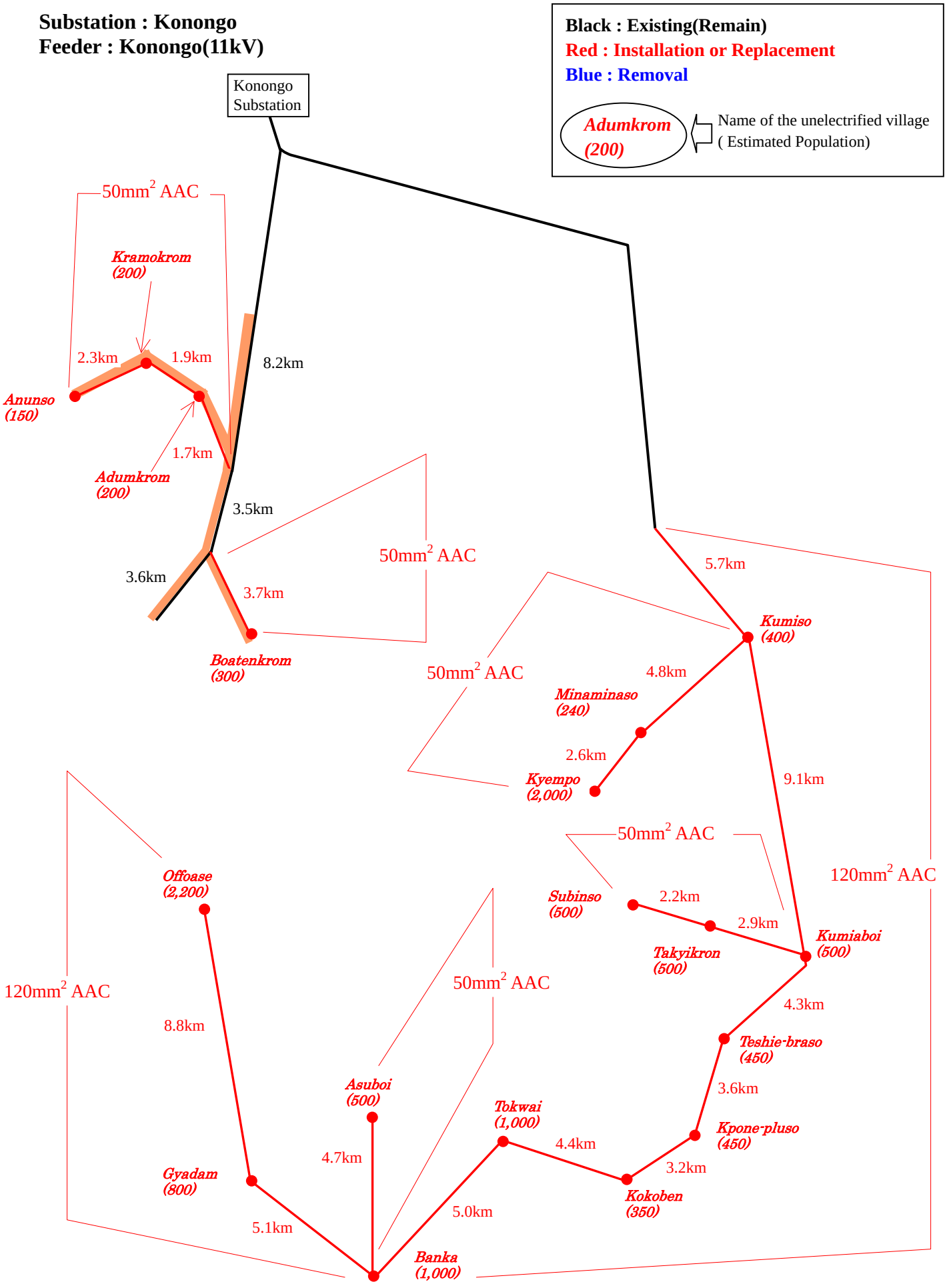
Black : Existing(Remain)
Red : Installation or Replacement
Blue : Removal



<Cost Estimation>

Site	Installation of Facilities	Removal of Facilities	Total Cost (US$)
<Site 1> Substation : V Dansoman Feeder : V10	2 × 20/26MVA Substation 33/11kV (outdoor) 120mm^2 Cu XLPE 1km 2,500,000(US$) x 1(place) +32,913.2(US$/km) x 1(km) =2,532,913(US$)	nothing	2,532,913

【Example of drawing(Case Study at Konongo Area(Ashanti-East Region)】



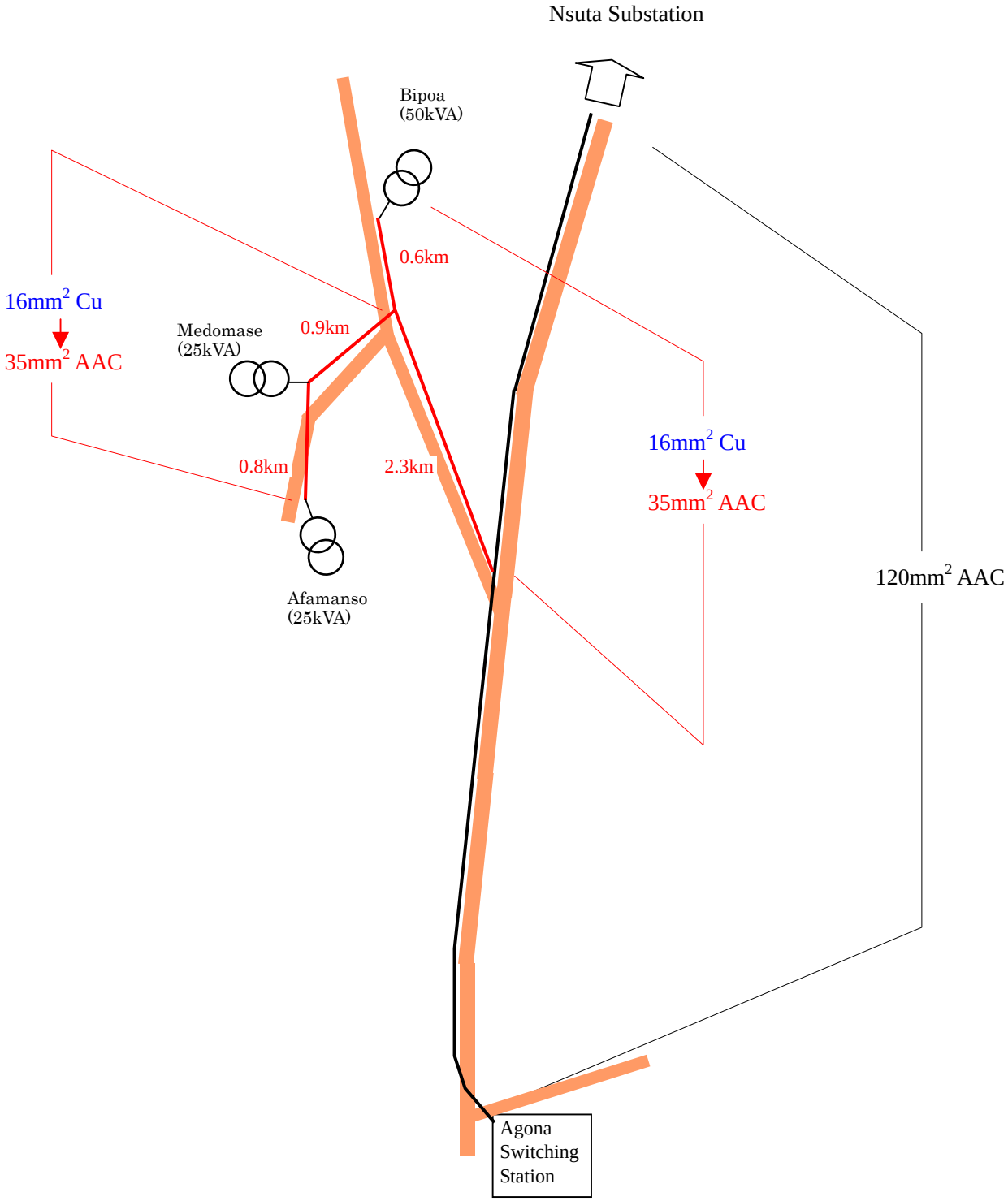
<Cost Estimation>

Site	Installation of Facilities	Removal of Facilities	Total Cost (US$)
Substation : Obuasi Substation Feeder : 12F4 (11kV)	120mm^2 AAC (with pole construction) 49.2km 50mm2 AAC (with pole construction) 26.8km 25,168.65(US$/km) x 49.2(km) + 23,262.31(US$/km) x 26.8(km) =1,861,727(US$)		1,861,727

【Example of drawing(Case Study at Nsuta＆Manpong Area(Ashanti-East Region)】

<Site 1>
Substation : Agona
Feeder : Nsuta (33kV)

Black : Existing(Remain)
Red : Installation or Replacement
Blue : Removal

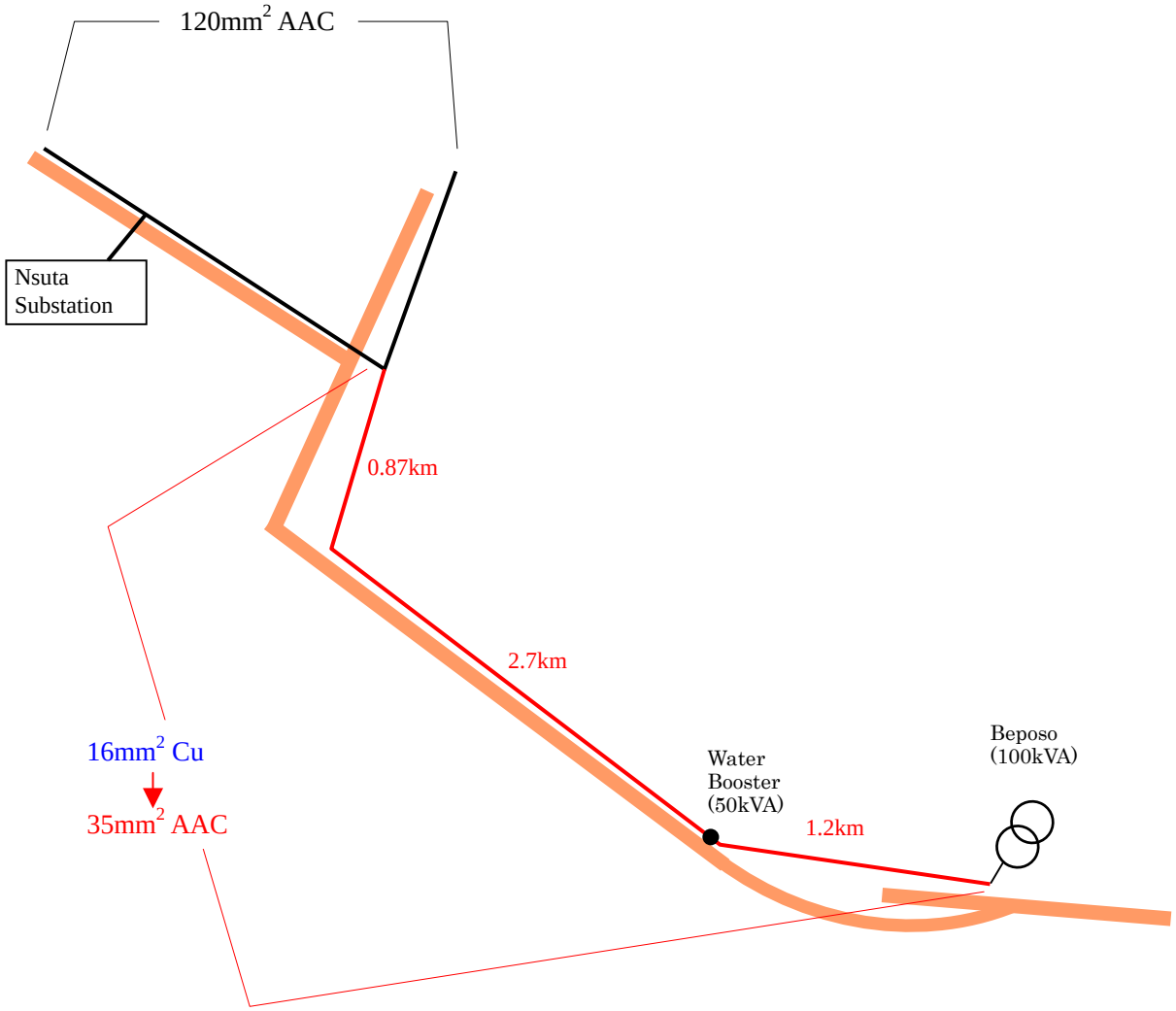


<Site 2>

Substation : Nsuta

Feeder : Nsuta (11kV)

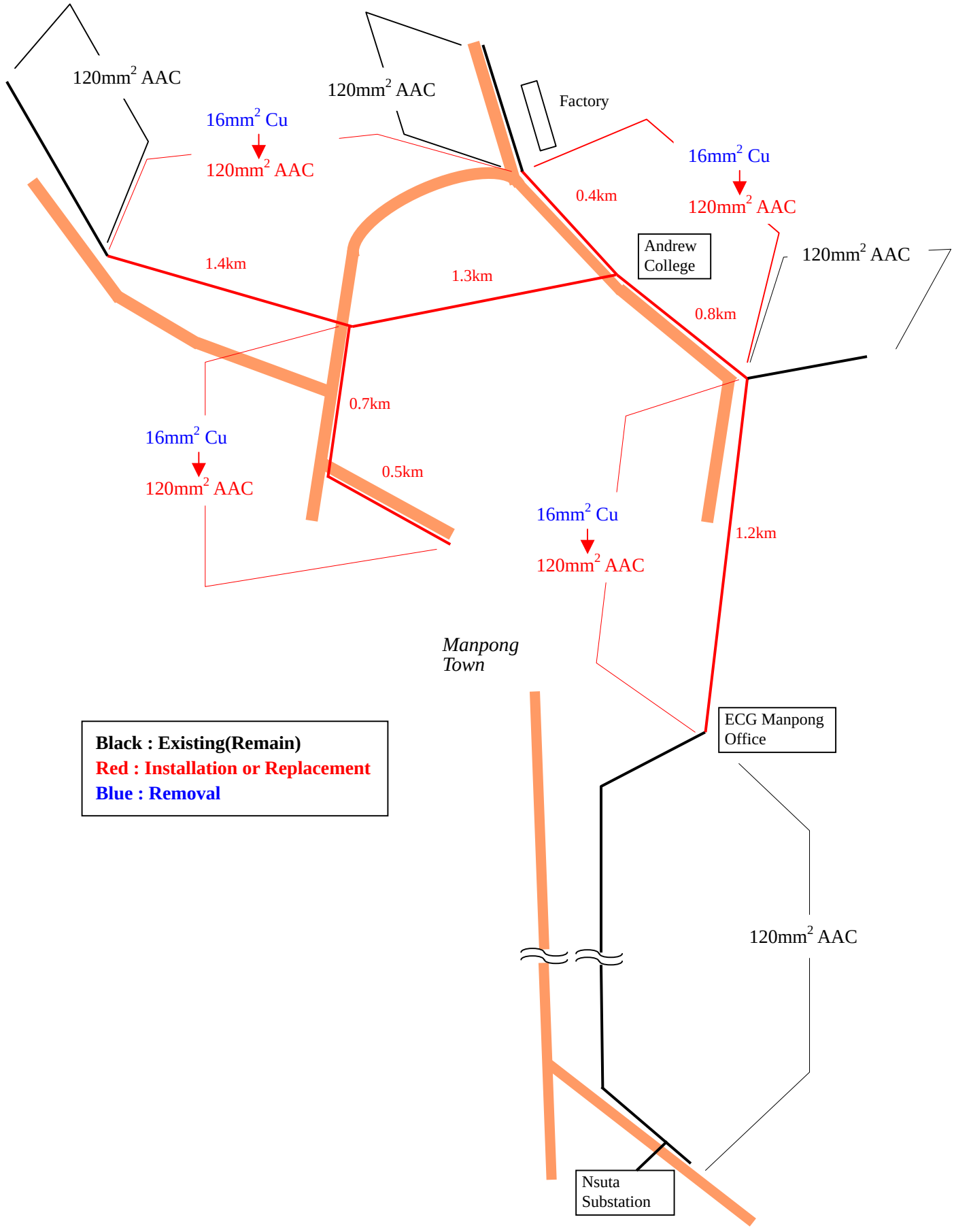
Black : Existing(Remain)
Red : Installation or Replacement
Blue : Removal



<Site 3>

Substation : Nsuta

Feeder : Nsuta (11kV)



<Cost Estimation>

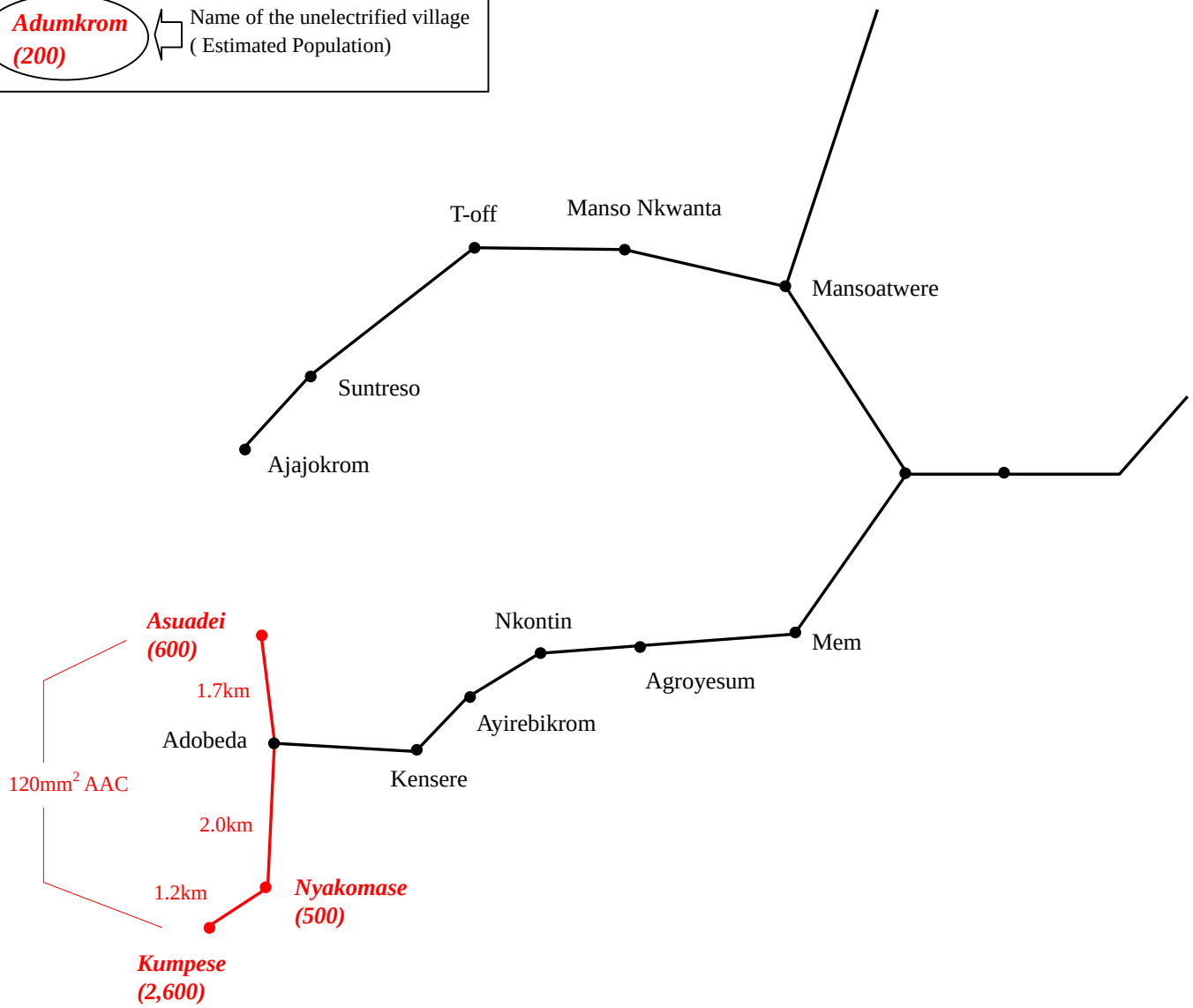
Site	Installation of Facilities	Removal of Facilities	Total Cost (US$)
<Site 1> Substation : Agona Feeder : Nsuta (33kV)	35 mm^2 AAC (without pole construction) 4.6km 3,969.34(US$/km) x 4.6(km) = 18,258.96(US$)	16 mm^2 AAC (without pole construction) 4.6km 1,075.11(US$/km) x 4.6(km) = 4,945.5(US$)	23,204
<Site 2> Substation : Nsuta Feeder : Nsuta (11kV)	35 mm^2 AAC (without pole construction) 3.6km 3,969.34(US$/km) x 3.6(km) = 14,289.6(US$)	16 mm^2 AAC (without pole construction) 3.6km 1,075.11(US$/km) x 3.6(km) = 3,870.4(US$)	18,160
<Site 3> Substation : Nsuta Feeder : Nsuta (11kV)	120mm^2 AAC (without pole construction) 6.3km 5,106.24(US$/km) x 6.3(km) = 32,169.3(US$)	16 mm^2 AAC (without pole construction) 6.3km 1,075.11(US$/km) x 6.3(km) = 6,773.2(US$)	38,943

【Example of drawing(Case Study at Manso Nkwanta Area(Ashanti-West Region)】

Substation : MAIN B Substation
Feeder : Manso Nkwanta Feeder(33kV)

Black : Existing(Remain)
Red : Installation or Replacement
Blue : Removal

Adumkrom (200) ⇦ Name of the unelectrified village (Estimated Population)



<Cost Estimation>

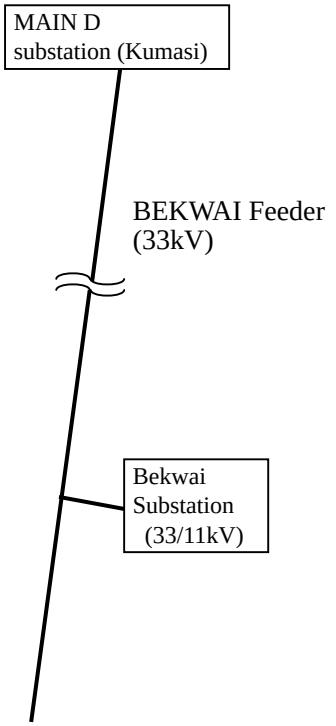
Site	Installation of Facilities	Removal of Facilities	Total Cost (US$)
Substation : Obuasi Substation Feeder : 12F4 (11kV)	120mm^2 AAC (with pole construction) 4.9km 25,168.65(US$/km) x 4.9(km) =123,326.4(US$)		123,326

【Example of drawing(Case Study at Bekwai, Obuasi Area(Ashanti-West Region)】

Substation : Bekwai Substation(from MAIN D Substation)
Feeder : KOKOFU Feeder(11kV)

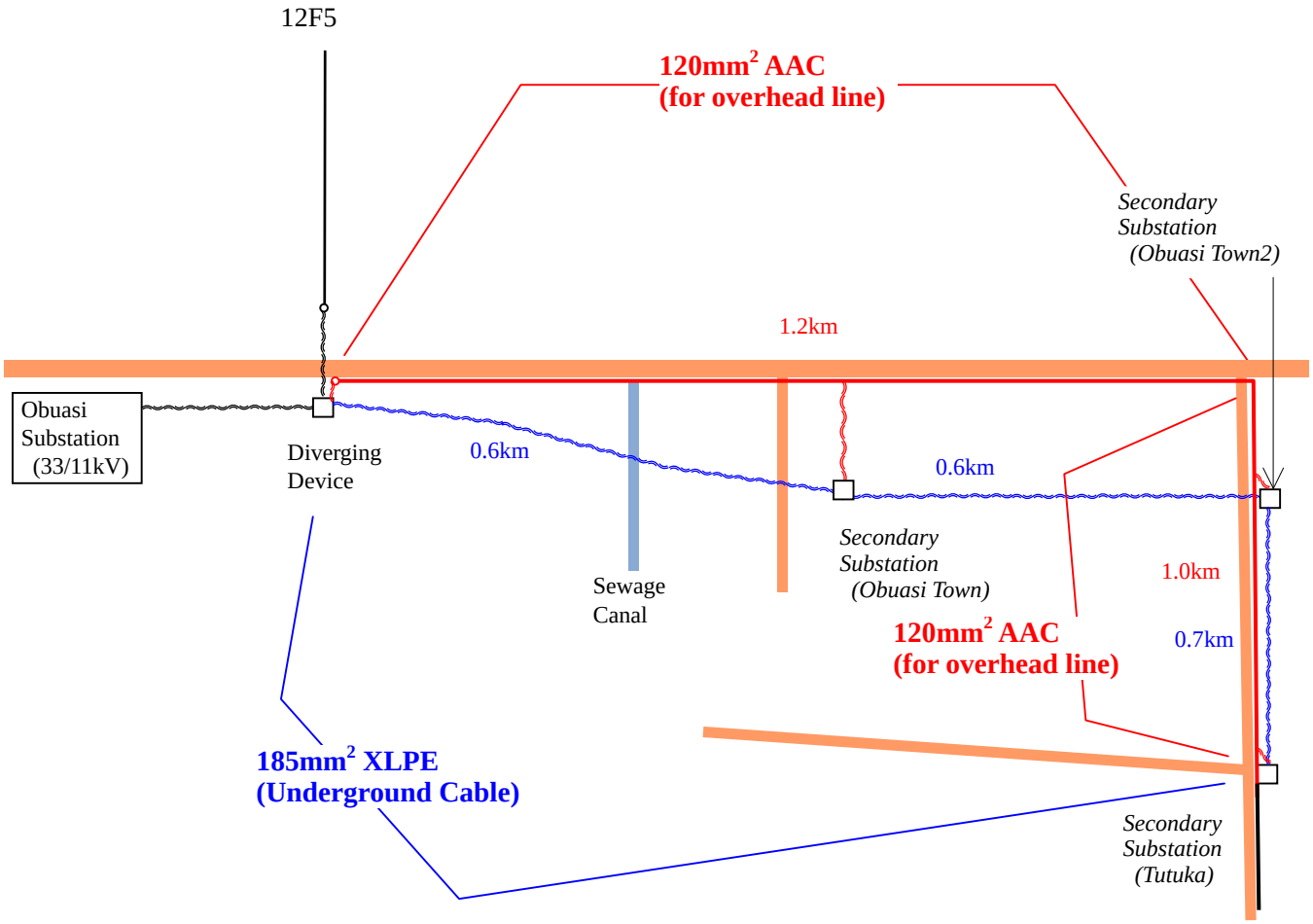
Black : Existing(Remain)
Red : Installation or Replacement
Blue : Removal

Adumkrom (200) ⇦ Name of the unelectrified village (Estimated Population)



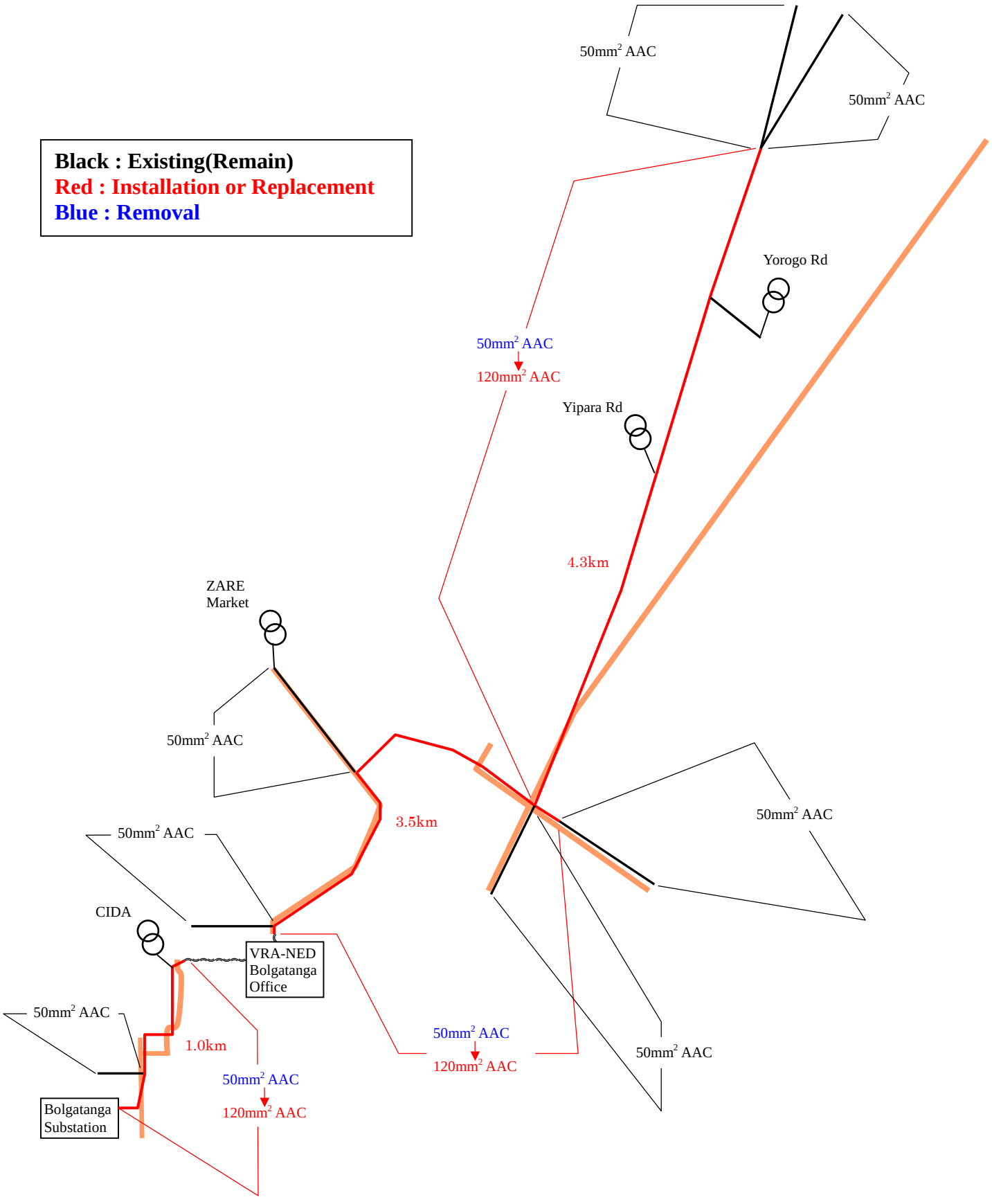
Substation : Obuasi Substation
Feeder : 12F4 (11kV)

Underground cables are along the road in direct buried type, but they will interfere with new road construction. So 11kV over-head lines will be newly constructed and the distribution line will be re-routed.

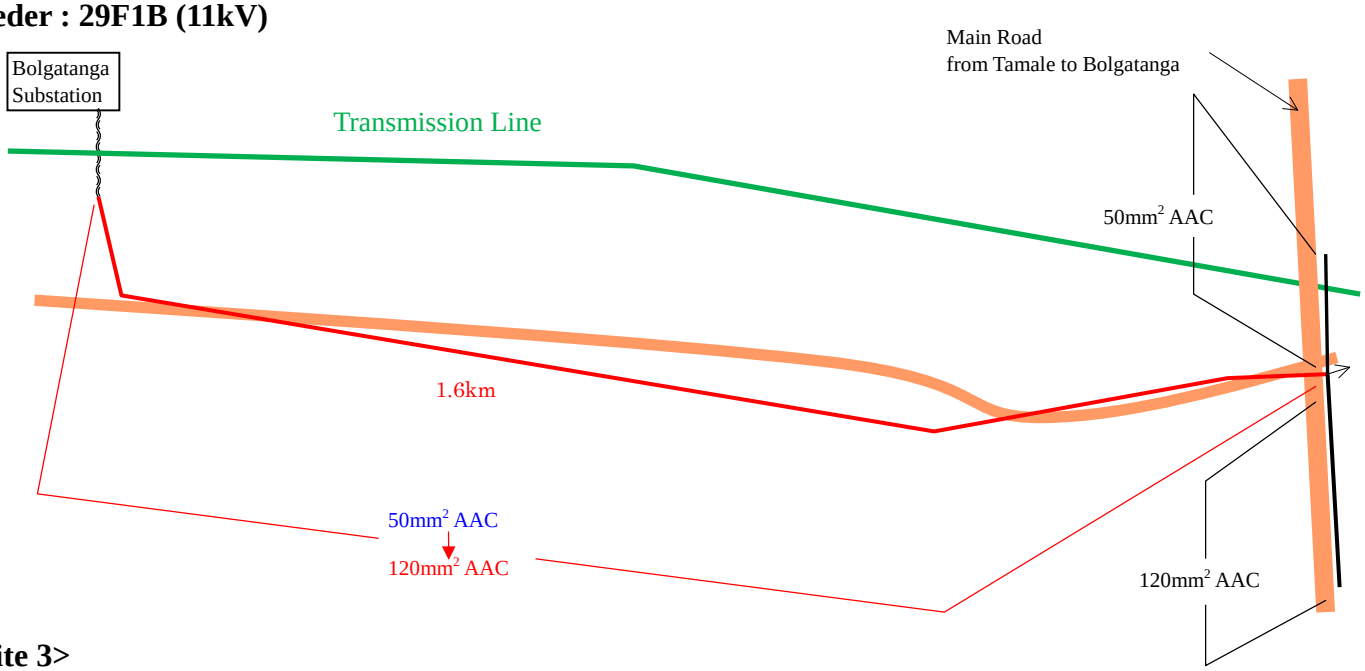


【Example of drawing(Case Study at Bolgatanga Area (VRA Bolgatanga Office))】

<Site 1>
Substation : Bolgatanga
Feeder : 29F6B (11kV)



<Site 2>
Substation : Bolgatanga
Feeder : 29F1B (11kV)



<Site 3>
Substation : Bolgatanga
Feeder : 29F4B (11kV)

Black : Existing(Remain)
Red : Installation or Replacement
Blue : Removal

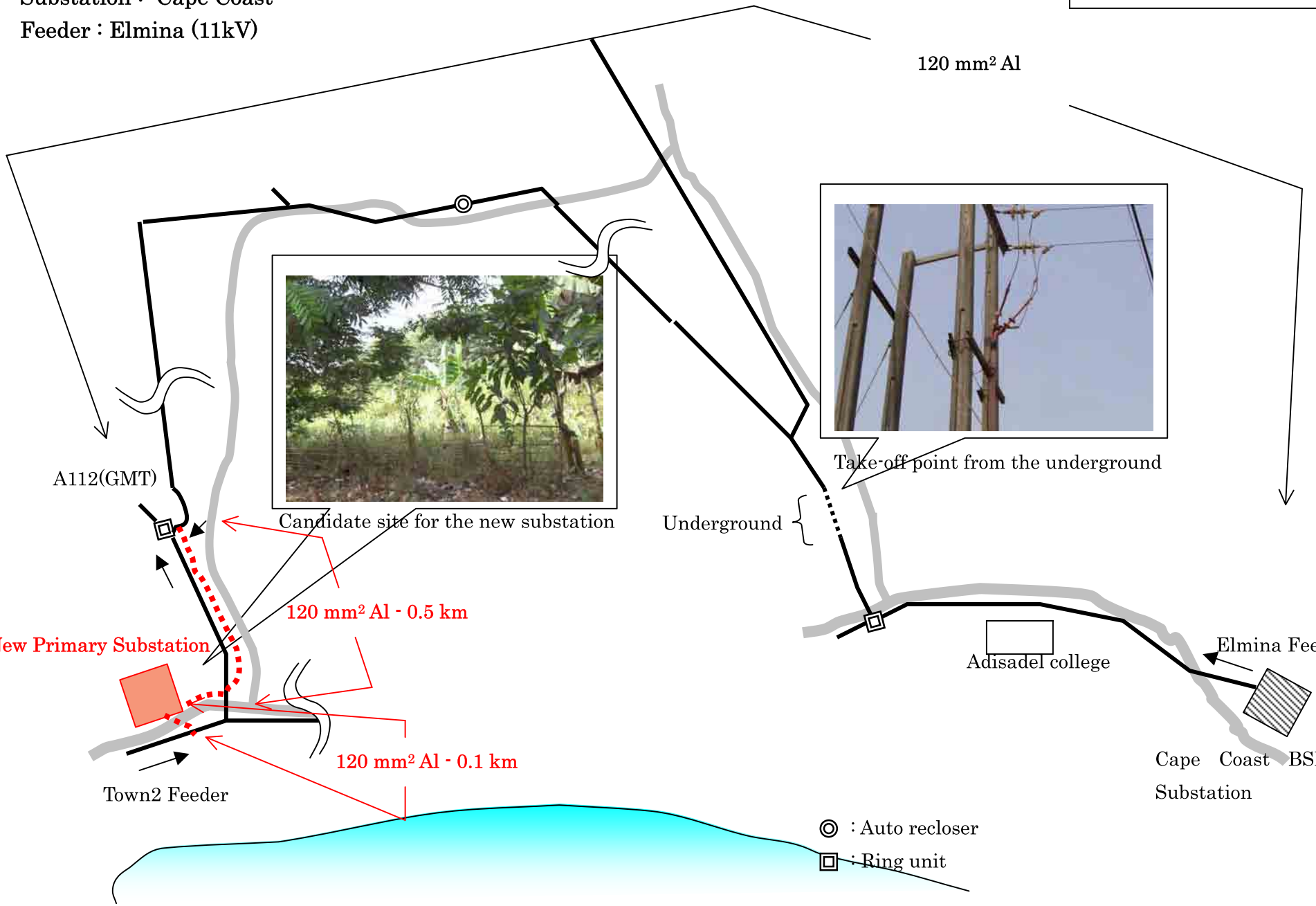
<Cost Estimation>

Site	Installation of Facilities	Removal of Facilities	Total Cost (US$)
<Site 1> Substation : Bolgatanga Feeder : 29F6B(11kV)	120mm^2 AAC (without pole construction) 8.8km 5,106.24(US$/km) x 8.8(km) =44,934.91(US$)	50mm^2 AAC (without pole construction) 8.8km 1,075.11(US$/km) x 8.8(km) =9,460.968(US$)	54,396
<Site 2> Substation : Bolgatanga Feeder : 29F1B(11kV)	120mm^2 AAC (without pole construction) 1.6km 5,106.24(US$/km) x 1.6(km) =8,169.984(US$)	50mm^2 AAC (without pole construction) 1.6km 1,075.11(US$/km) x 1.6(km) =1,720.176(US$)	9,890
<Site 3> Substation : Bolgatanga Feeder : 29F4B(11kV)	120mm^2 AAC (without pole construction) 4.0km 5,106.24(US$/km) x 4.0(km) =20,424.96(US$)	50mm^2 AAC (without pole construction) 4.0km 1,075.11(US$/km) x 4.0(km) =4,300.44(US$)	24,725

【Example of drawing (Case Study at Cape Coast (Central)】

Black : Existing(Remain)
Red : Installation or Replacement
Blue : Removal

Substation： Cape Coast
Feeder : Elmina (11kV)



<Cost Estimation>

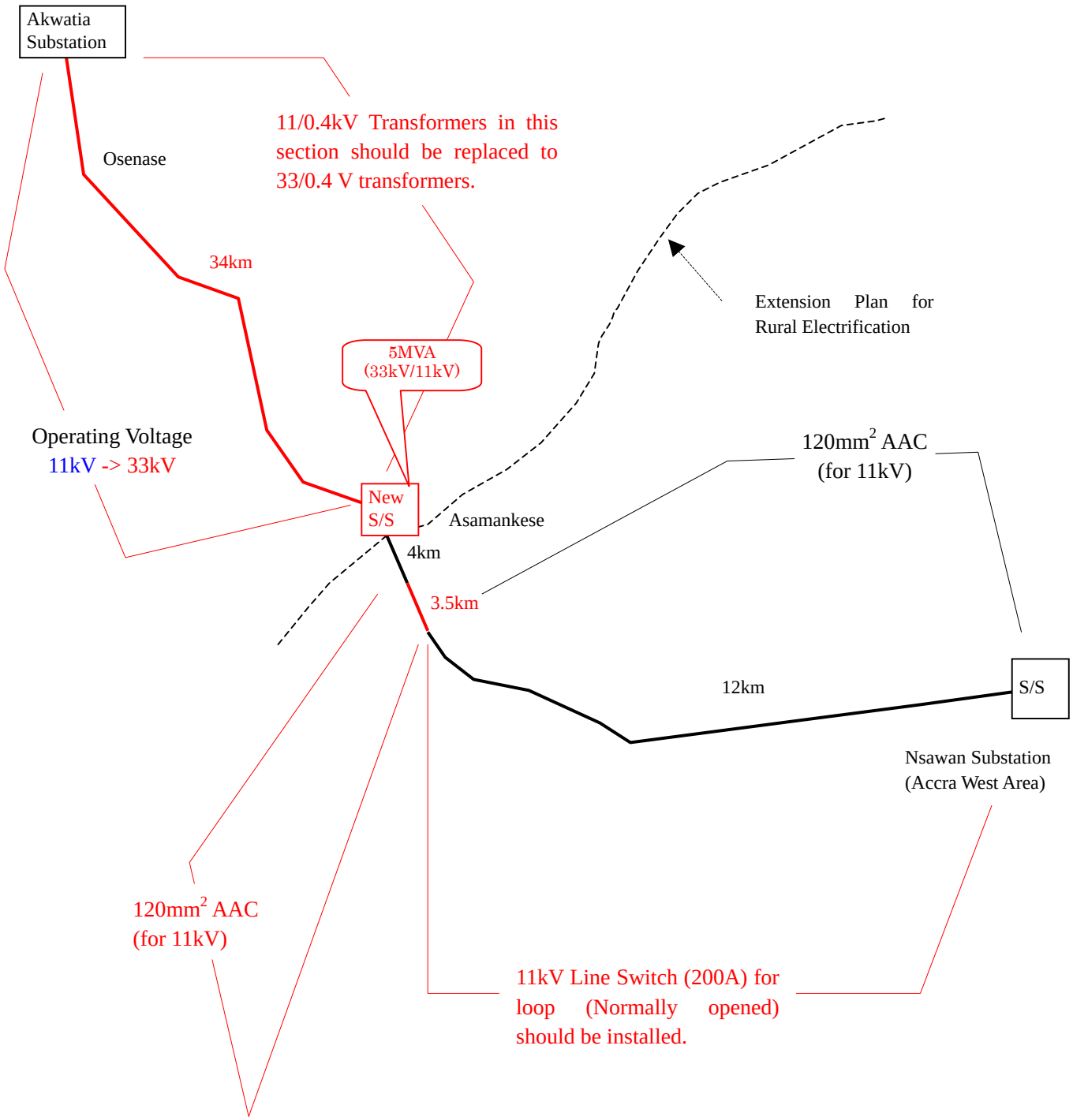
Site	Installation of Facilities	Removal of Facilities	Total Cost (US$)
<Site 1> Substation : Cape Coast Feeder : Elmina (11kV)	2×20/26MVA Substation 33/11kV (outdoor) 120mm^2 AAC (with pole construction) 0.6km 2,500,000(US$/km) x 1(place) +21,323.94(US$/km) x 0.6(km) =2,512,794 (US$)	nothing	2,512,794

【Example of drawing(Case Study at Akwatia＆Asamankese Area (Eastern Region)】

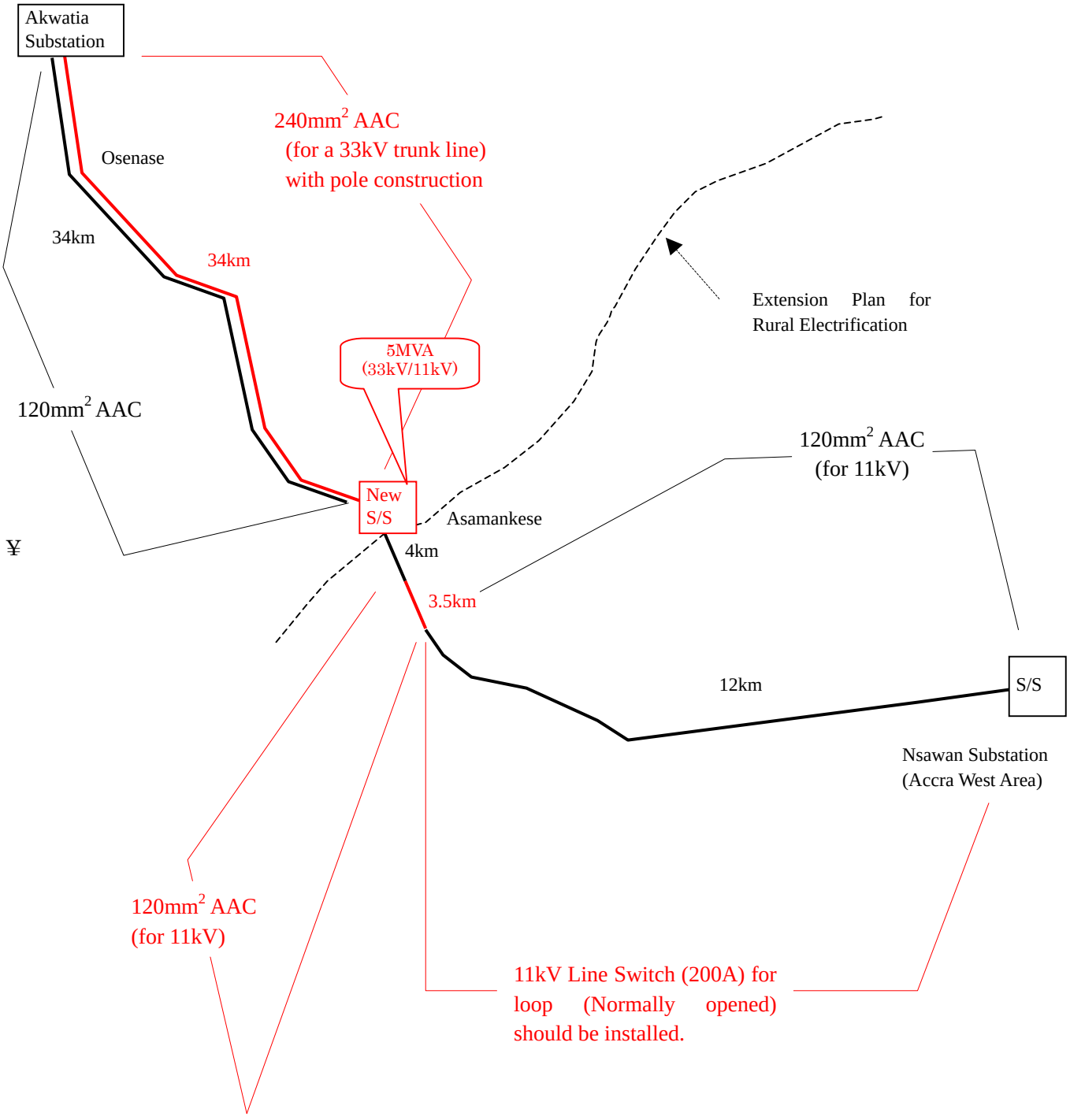
<Site 1>
Substation : Akwatia
Feeder : Asamankese (11kV)

Black : Existing(Remain)
Red : Installation or Replacement
Blue : Removal

<Plan 1> Reuse of the existing line as a 33kV trunk line



<Plan 2> Newly Construction of the 33kV trunk line



<Cost Estimation>

Site	Installation of Facilities	Removal of Facilities	Total Cost (US$)
Substation : Akwatia Feeder : Asamankese (11kV)			
<Plan 1> The voltage of the section whose length is 34km is to be upgraded from 11kV to 33kV. And all transformers of this section are to be replaced to “33kV/0.4kV transformers”.	Insulators for 33kV, 34km 137,511(US$) Transformer <33kV/0.4kV> 500kVA : 2 315kVA : 1 200kVA : 3 100kVA : 5 50kVA: 2 25kVA : 1 265,217(US$) 33kV/11kV Substation (5MVA) 1,000,000(US$) 120mm^2 AAC (with pole construction), 3.5km 25,168.65(US$/km)x3.5(km) =88,089 MV switchgear for 11kV 891,000	Transformers <11kV/0.4kV> 500kVA : 2 315kVA : 1 200kVA : 3 100kVA : 5 50kVA: 2 25kVA : 1 9,623(US$)	2,381,817
<Plan 2> To improve the voltage drop of existing feeder “Asamankese”, a new 33kV feeder is to be constructed from Akwatia substation to the middle point of existing 11kV Asamankese feeder. The conductor size of it is 240mm^2. The existing part of Asamankese feeder will be split on this point and be separated to 2 parts. The part from “Akwatia substation" to this point will be left as it is, and the other part will be a new substation that will be constructed in “the Middle part of this existing feeder” and transform 33kV from the new feeder into 11kV.	240 mm^2 AAC (with pole construction) 34km 80,500(US$/km) x 34(km) = 2,737,000 (US$) 33kV/11kV Substation (5MVA) 1,000,000(US$) 120mm^2 AAC (with pole construction), 3.5km 25,168.65(US$/km)x3.5(km) =88,089 MV switchgear for 11kV 891,000		4,716,089

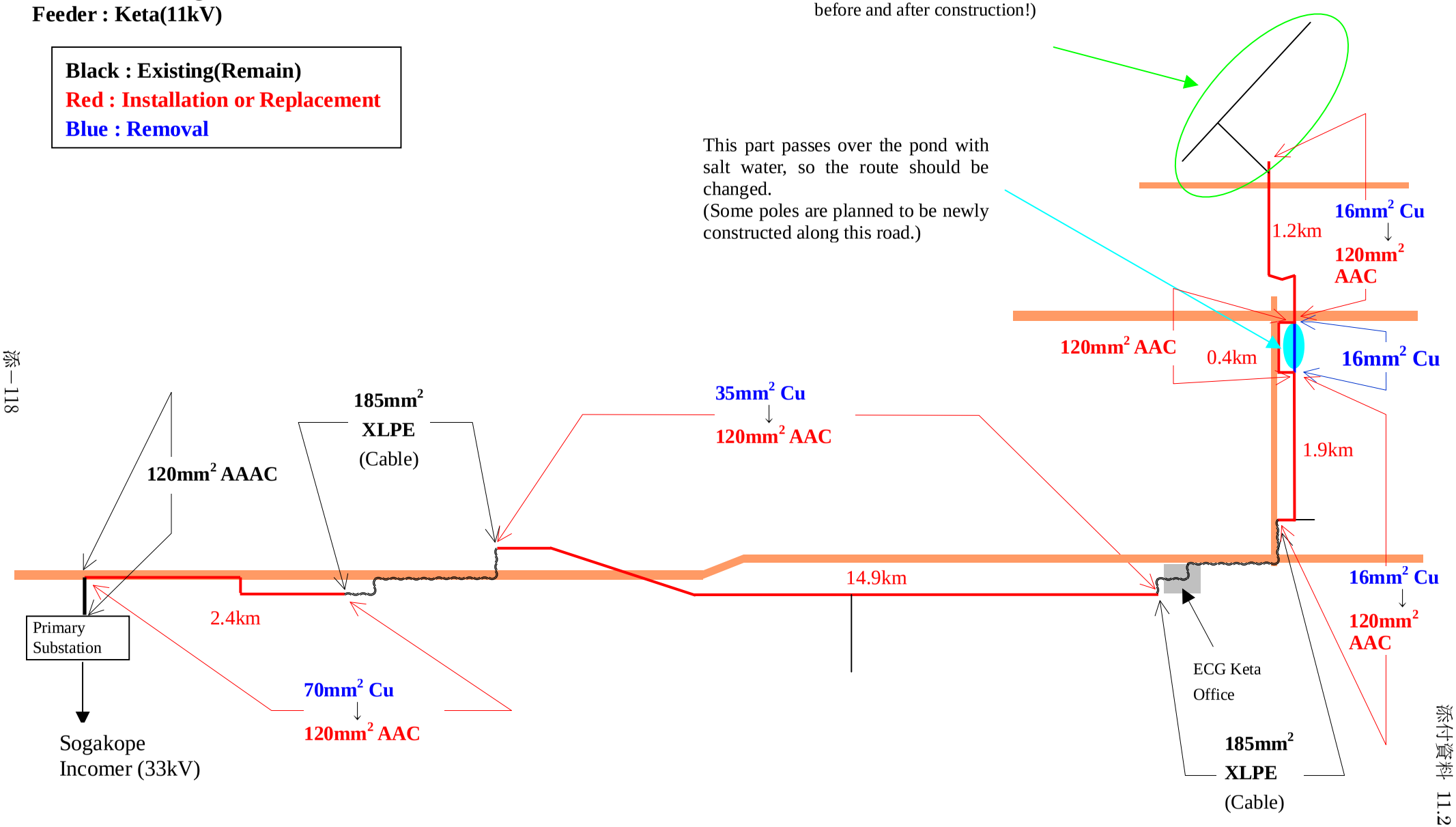
【Example of drawing(Case Study at Keta(Volta Region)】

Substation : Anloga
Feeder : Keta(11kV)

Black : Existing(Remain)
Red : Installation or Replacement
Blue : Removal

New line constructed by MOE
as rural electrification
(Voltage drop was not considered
before and after construction!)

This part passes over the pond with salt water, so the route should be changed.
(Some poles are planned to be newly constructed along this road.)



<Cost Estimation>

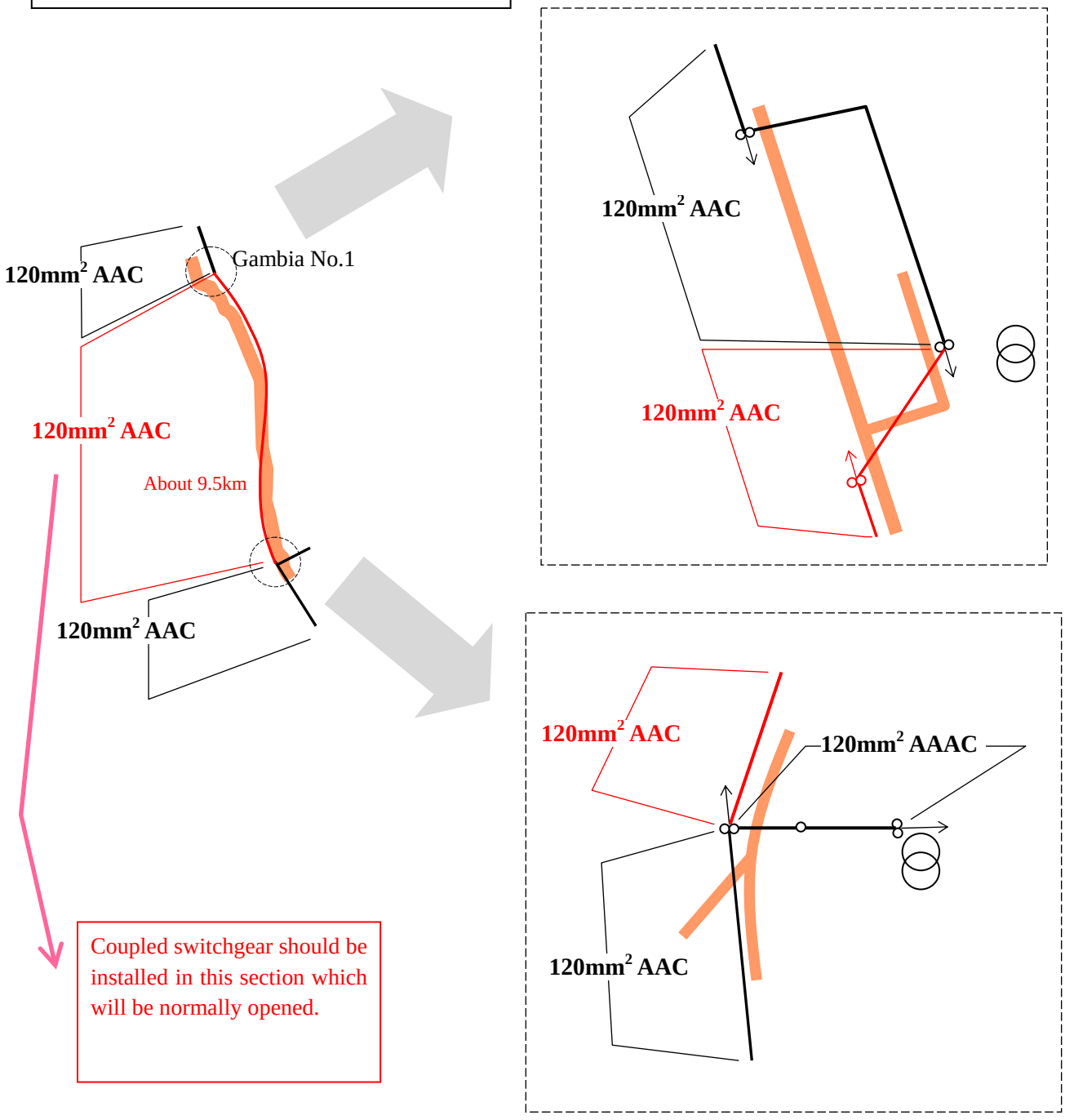
Site	Installation of Facilities	Removal of Facilities	Total Cost (US$)
<Site 1> Substation : Techiman Feeder : 26F1B(11kV)	120mm^2 AAC (without pole construction) 20.4km 120mm^2 AAC (with pole construction) 0.5km 5,106.24(US$/km) x 20.4(km) +25,168.28(US$/km) x 0.5(km) =104,167.3(US$)	70mm^2 Cu (without pole construction) 2.4km 35mm^2 Cu (without pole construction) 14.9km 16mm^2 Cu (without pole construction) 3.5km 1,117.87(US$/km) x 2.4(km) 1,075.11(US$/km) x 14.9(km) 1,075.11(US$/km) x 3.5(km) =22,464.3(US$)	116,752

【Example of drawing(Case Study at Sunyani Office Area (VRA-NED)】

Substation : Sunyani Substation
Feeder : Mim/Goaso/Hwidie (34.5kV)

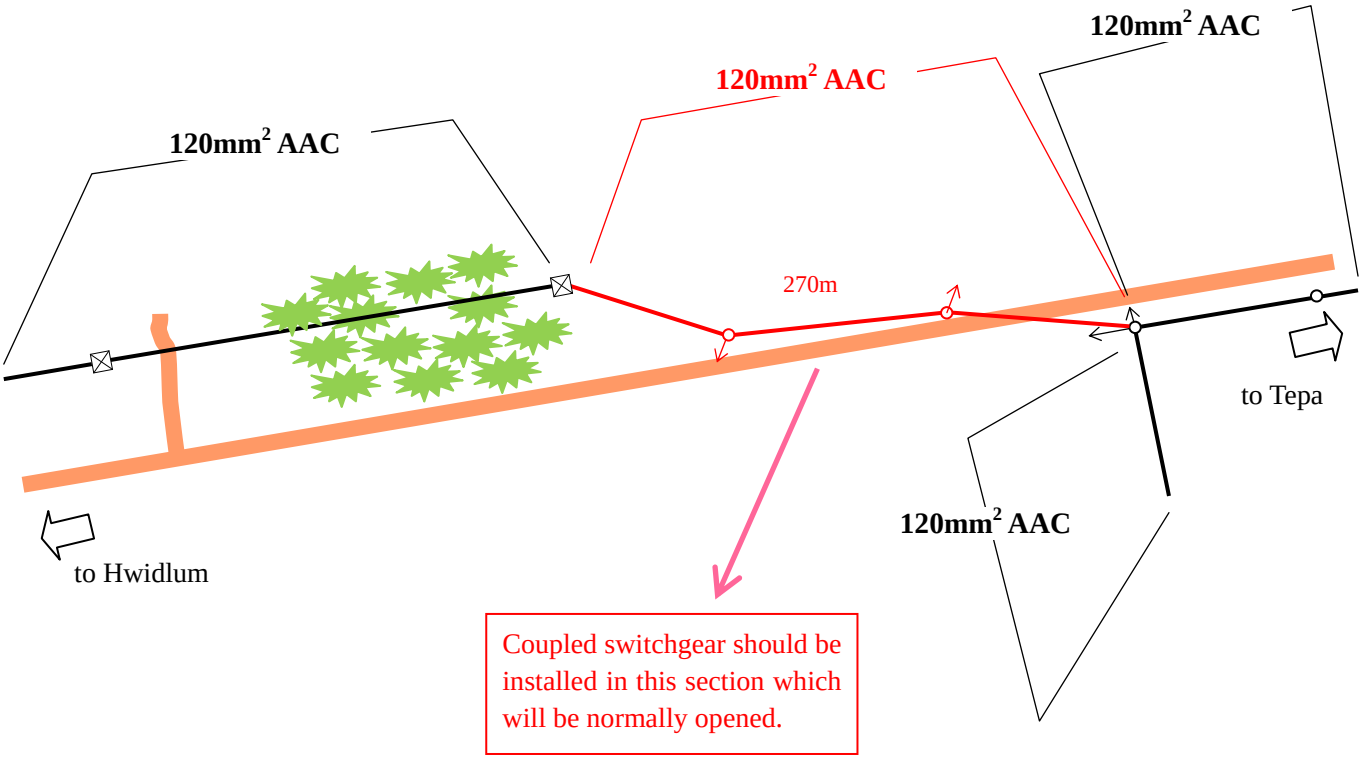
<Unconnected section -1>

Black : Existing(Remain)
Red : Installation or Replacement
Blue : Removal



<Unconnected section -2>

Black : Existing(Remain)
Red : Installation or Replacement
Blue : Removal



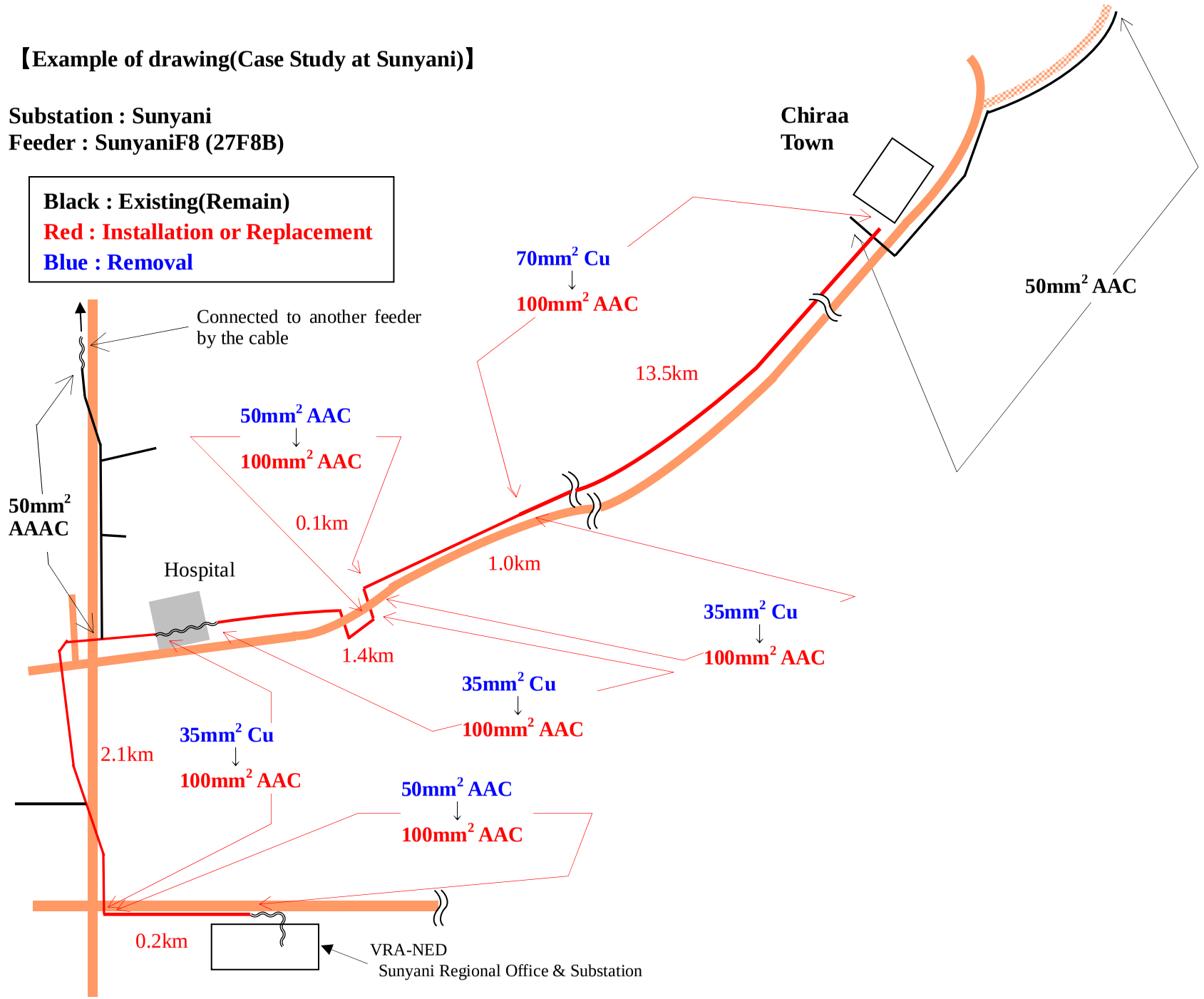
<Cost Estimation>

Site	Installation of Facilities	Removal of Facilities	Total Cost (US$)
Substation : Sunyani Substation Feeder : Mim/Goaso/Hwidie (34.5kV)	120mm^2 AAC (with pole construction) 9.8km 25,168.65(US$/km) x 9.8(km) =246,652.8(US$)		246,653

【Example of drawing(Case Study at Sunyani)】

Substation : Sunyani
Feeder : SunyaniF8 (27F8B)

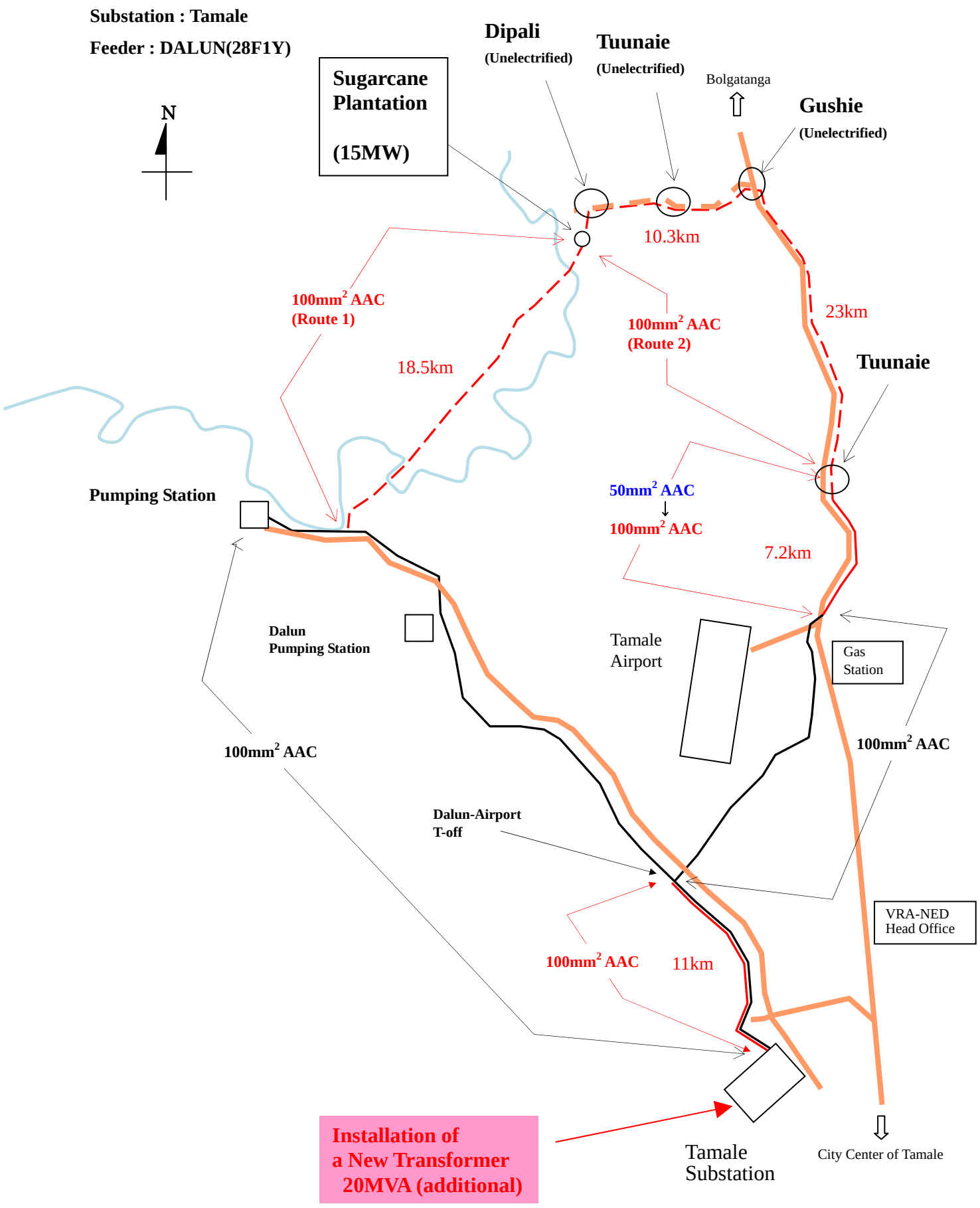
Black : Existing(Remain)
Red : Installation or Replacement
Blue : Removal



<Cost Estimation>

Site	Installation of Facilities	Removal of Facilities	Total Cost (US$)
<Site 1> Substation : Main B Feeder : Circuit 5	100 mm^2 AAC (without pole construction) 18.3km 5,106.24(US$/km) x 18.3(km) =93,444.2(US$)	35 mm^2 AAC (without pole construction) 4.5km 50 mm^2 AAC (without pole construction) 0.3km 70 mm^2 AAC (without pole construction) 13.5km 1,075.11(US$/km) x 4.5(km) 1,075.11(US$/km) x 0.3(km) 1,075.11(US$/km) x 13.5(km) =19,674.5(US$)	113,119

【Example of drawing(Case Study at Tamale (Northern Region)】

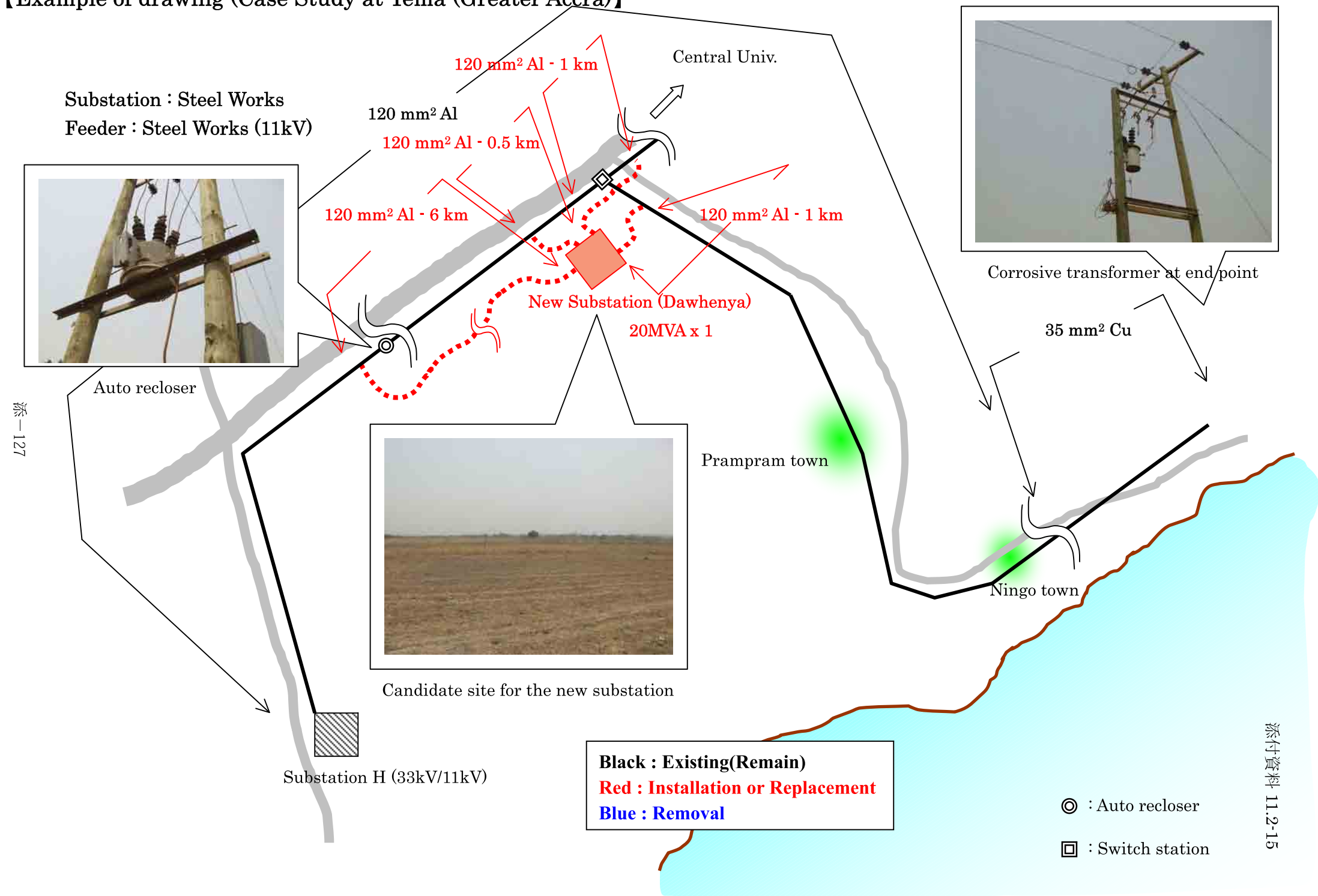


(*) 100mm^2 AAC line (34.5kV) will be newly constructed from Tamale Substation to "Dalun – Airport T-off" to reinforce the capability of sending power of this feeder. As a result, this section will have 2 circuits on the same supporting structures. (New line can be constructed on existing iron towers.)

<Cost Estimation>

Site	Installation of Facilities	Removal of Facilities	Total Cost (US$)
Substation : Tamale Feeder : DALUN (28F1Y) [34.5kV]			
<Route 1>	100mm^2 AAC (with pole construction) 18.5km 100mm^2 AAC (without pole construction) 11km 1,000kVA Transformer (34.5kV/0.4kV) : 15 (Estimated total demand is 15MVA, so it is assumed that 15 transformers (34.5kV/0.4kV) with 1,000kVA should be installed.) + Additionally, they need land leveling cost near the sugarcane. 25,168.65(US$/km) x 18.5(km) = 276,855(US$) 5,106.24(US$/km) x 11(km) = 91,912(US$) 61,261.1(US$/No.) x 15 = 918,917(US$)		1,287,684 + Land Leveling Cost
<Route 2>	100mm^2 AAC (with pole construction) 33.3km 100mm^2 AAC (without pole construction) 7.2km 1,000kVA Transformer (34.5kV/0.4kV) : 15 (Estimated total demand is 15MVA, so it is assumed that 15 transformers (34.5kV/0.4kV) with 1,000kVA should be installed.) 25,168.65(US$/km) x 33.3(km) = 838,116(US$) 5,106.24(US$/km) x 7.2(km) = 36,765(US$) 61,261.1(US$/No.) x 15 = 918,917(US$)	50mm^2 AAC (without pole construction) 7.2km 1,075.11(US$/km) x 7.2(km) =7,741 (US$)	1,801,538

【Example of drawing (Case Study at Tema (Greater Accra)】



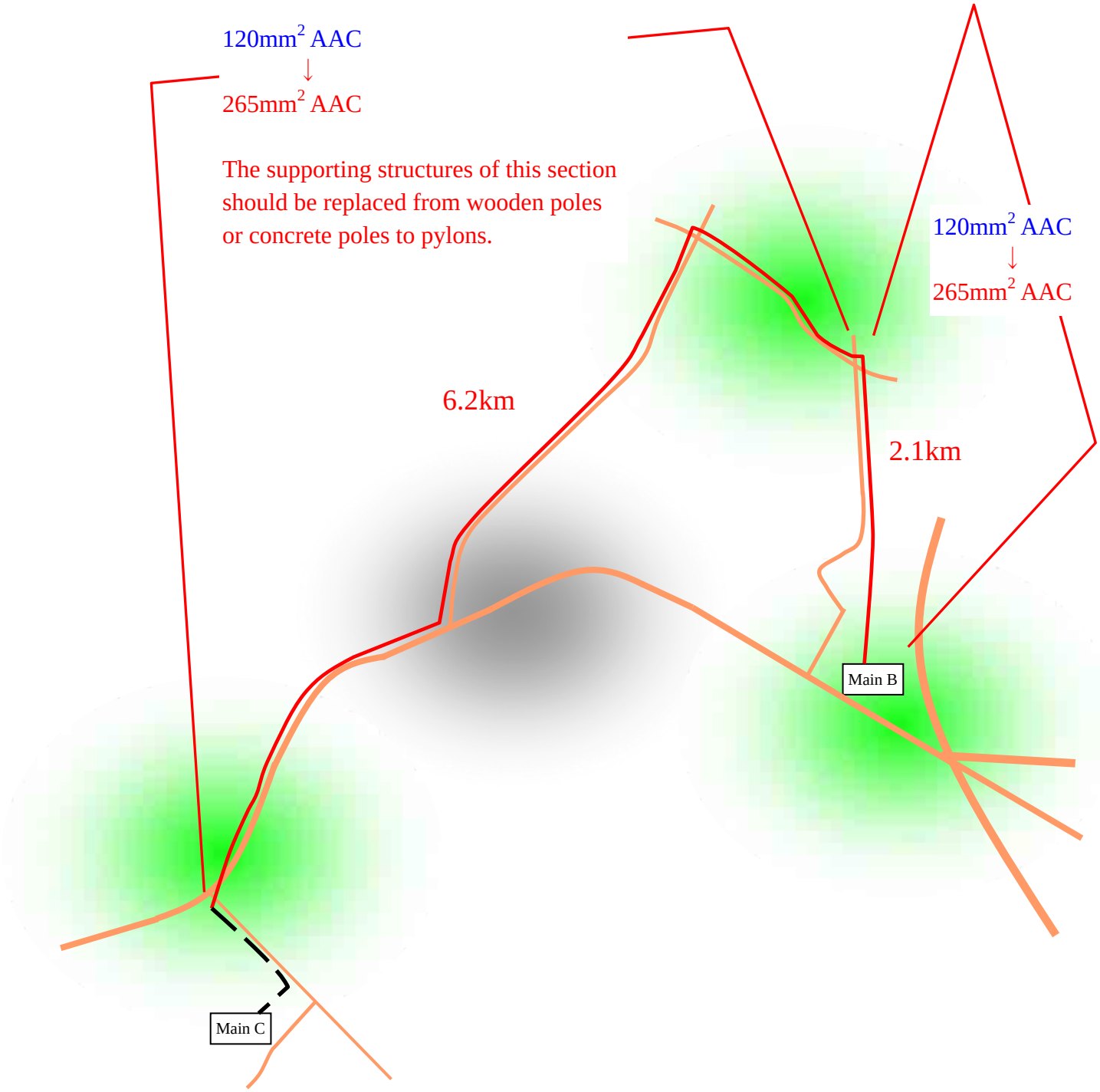
<Cost Estimation>

Site	Installation of Facilities	Removal of Facilities	Total Cost (US$)
<Site 1> Substation : Steel Works Feeder : Steel Works (11kV)	1x20MVA Substation (outdoor) 120mm^2 AAC (with pole construction) 8.5km 2,500.000(US$/km) x 1(place) +21,323.94(US$/km) x 8.5(km) =2,681,253(US$)	nothing	2,681,253

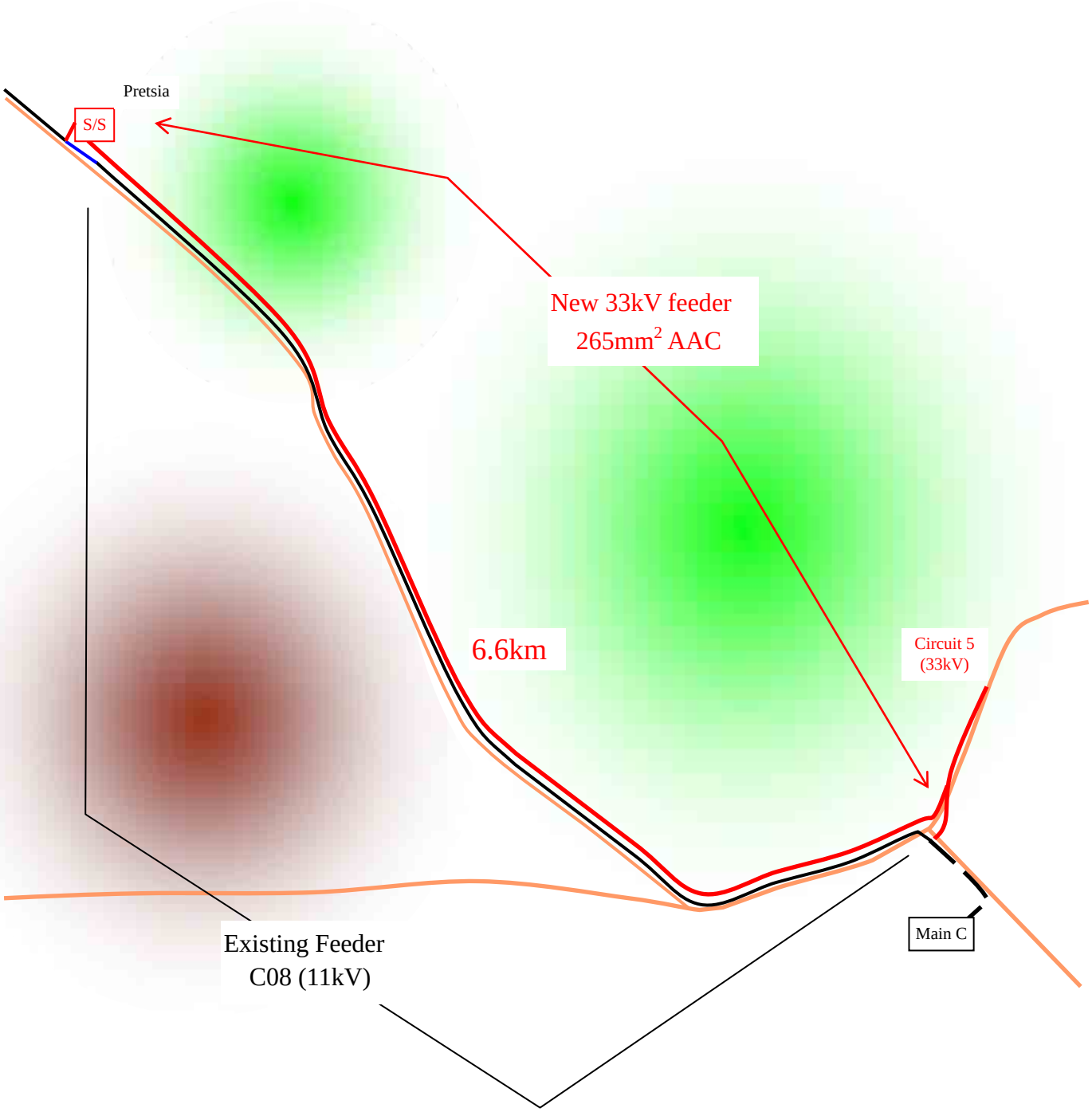
【Example of drawing(Case Study at Western Area (ECG Western Regional Office))】

<Site 1>
Substation : Main B
Feeder : Circuit 5

Black : Existing(Remain)
Red : Installation or Replacement
Blue : Removal



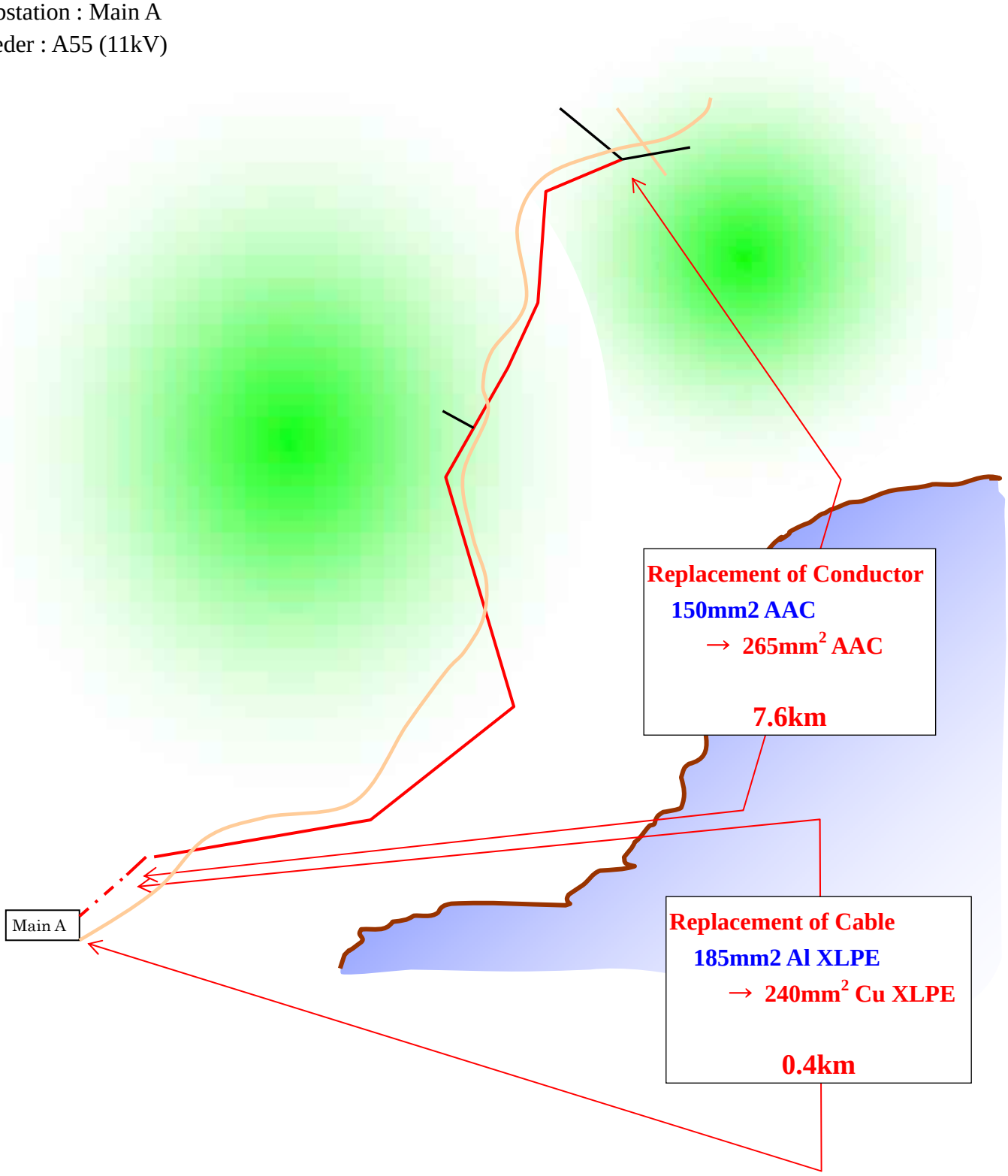
<Site 2>
Substation : Main C
Feeder : C08



To improve the voltage drop of existing feeder “C08”, a new 33kV feeder is to be constructed from the middle point of 33kV feeder “Circuit 5” to the city “Pretsia”. The conductor size of it is 265mm^2.

The existing part of “C08” will be split on “Pretsia” and be separated to 2 parts. The part from “Main C” to “Pretsia” will be left as it is, and the other part (from “Pretsia” to the end) will be connected to a new substation that will be constructed in “Pretsia” and transform 33kV from the new feeder into 11kV.

<Site 3>
Substation : Main A
Feeder : A55 (11kV)



To improve the overload current and the voltage drop of existing feeder “A55 (11kV)”, the existing cable (185mm^2 Al XLPE, 0.4km) should be replaced to 240mm^2 Cu ALPE, and the existing overhead line (150mm^2 AAC, 7.6km) should be replaced to 265mm^2 AAC. The supporting structures of the replaced section are all pylons that can endure the mechanical strengths of 265mm^2 AAC conductor, so it is not necessary to replace the supporting structure. Only conductors are to be replaced.

<Cost Estimation>

Site	Installation of Facilities	Removal of Facilities	Total Cost (US$)
<Site 1> Substation : Main B Feeder : Circuit 5	265 mm^2 AAC (with pole construction) 6.2km 265 mm^2 AAC (without pole construction) 2.1km 80,500(US$/km) x 6.2(km) +17,500(US$/km) x 2.1(km) = 535,850 (US$)	120 mm^2 AAC 8.3km 117.87(US$/km) x 8.3(km) = 978(US$)	536,828
<Site 2> Substation : Main C Feeder : C08	265 mm^2 AAC (with pole construction) 6.6km 33kV/11kV Substation (5MVA) 80,500(US$/km) x 6.6(km) +1,000,000 = 1,531,300 (US$)		1,531,300
<Site 3> Substation : Main A Feeder : A55	240mm^2 Cu Cable 0.4km 240mm^2 AAC 7.6km 64,181.33(US$/km) x 0.4(km) +7,111.97(US$/km) x 7.6(km) =79,724 (US$)	185mm^2 Al XLPE Cable 0.4km 150mm^2 AAC 7.6km 5,058.02(US$/km) x 0.4(km) +117.878(US$/km) x 7.6(km) =2,919(US$)	82,643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