

ANNEX 15
NETWORK ANALYSIS FOR
ALTERNATIVE STUDY

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1 General

Network analysis for the alternative study has been conducted by using WaterCAD which runs under AutoCAD environment the same as the network analysis on the existing distribution network system mentioned in Annex 11. The network model for the alternative study was modified from the model for the existing network based on the investigation of the existing transmission and distribution network of which diameter is more than 100mm.

2 Conditions for Network Analysis

Pipe network models for each stage, 1st Stage in 2007 and 2nd Stage in 2015, and for each alternative were developed and hydraulic analyses were conducted based on the following conditions:

- Formula for friction loss calculation : Hazen-Williams Formula
- C value for all pipes: 110
- Velocity Range: 1.0 m/s – 1.5 m/s
- Minimum Residual Pressure at junction: 1.5 kg/cm² (15 m)
- Hourly peak factor for domestic demand is estimated at 1.4 as shown on Figure 1. Half of non-domestic demand is assumed to be the same hourly peak factor as domestic. For the remaining non-domestic demand, hourly peak factor is not applied since they have own reservoir. Overall hourly peak factor, average of domestic and non-domestic is calculated as 1.3.

3 Demand Allocation to the Junctions

Domestic water demand is allocated to each junction based on location of villages nearby the junction. Population, service ratio, served population and water demand for each village is calculated as described in the previous section.

Non-domestic water demand is allocated to junctions in three different ways. First of all, major large 50 consumers which consume water more than 2,000 m³/month were identified and plotted on the map. From the map, water consumption of these large consumers was allocated to junctions nearby. As a second step, 20 % of remaining non-domestic water demand is allocated to the

junction which were located in the future industrial area. In the third step, remaining non-domestic water demand allocated to all junctions correlated to the population covered by each junction.

4 Results of the Network Analysis

Results of the network analysis for five alternatives are attached below and the basic features of alternatives are as follows:

Alternative C-1: Expansion of Chinaimo WTP in the 1st Stage and newly construction of Thangone WTP in the 2nd Stage

Alternative C-2: Expansion of Chinaimo WTP in the 1st Stage and expansion of Kaolieo WTP in the 2nd Stage

Alternative K-1: Expansion of Kaolieo WTP in the 1st Stage and newly construction of Thangone WTP in the 2nd Stage

Alternative T-2: Newly construction of Thangone WTP in the 1st Stage and expansion of Kaolieo WTP in the 2nd Stage

Alternative T-3: Newly construction of Thangone WTP in the 1st Stage and expansion of Chinaimo WTP in the 2nd Stage

Figure 1 Peak Hour Factor for Domestic Demand

| Time | Hourly Factor |
|------|---------------|
| 1 | 1.17 |
| 2 | 1.17 |
| 3 | 0.49 |
| 4 | 0.50 |
| 5 | 0.52 |
| 6 | 1.40 |
| 7 | 1.31 |
| 8 | 1.19 |
| 9 | 1.19 |
| 10 | 1.16 |
| 11 | 1.15 |
| 12 | 1.08 |
| 13 | 0.75 |
| 14 | 0.73 |
| 15 | 0.79 |
| 16 | 0.78 |
| 17 | 0.70 |
| 18 | 0.70 |
| 19 | 1.35 |
| 20 | 1.20 |
| 21 | 1.22 |
| 22 | 1.07 |
| 23 | 1.20 |
| 24 | 1.18 |

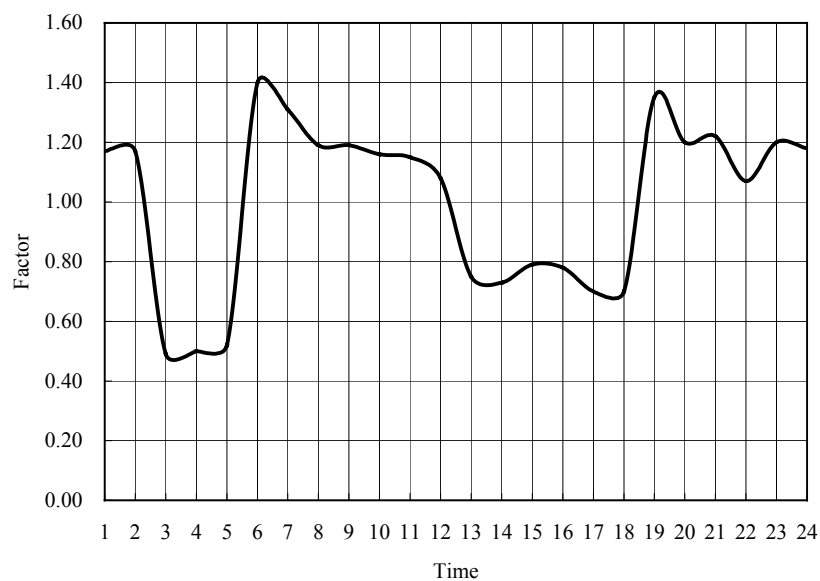


Figure 2 Clear Water Transmission and Distribution Trunk Mains Required for Alternative C-1

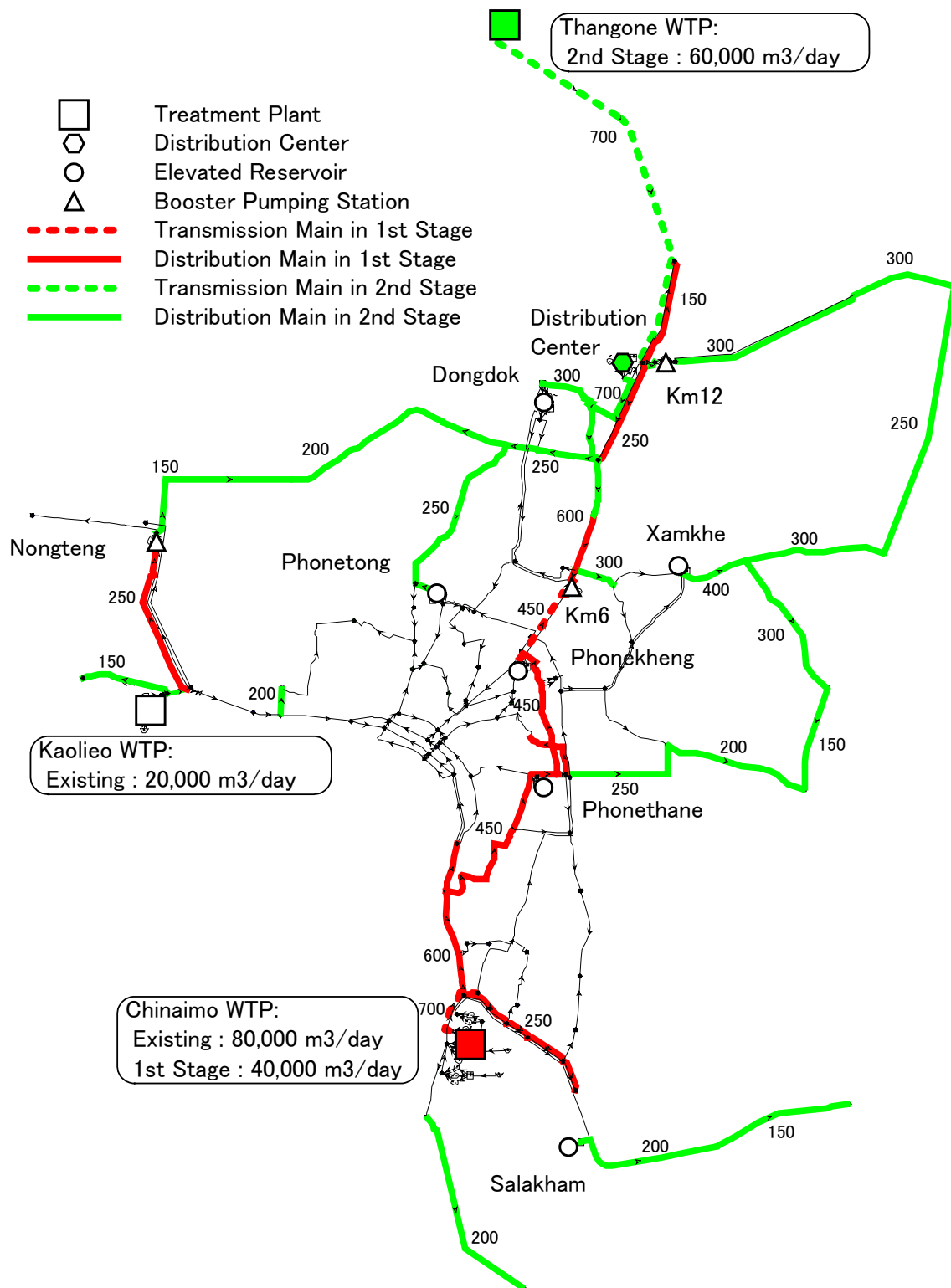


Figure 3 Residual Water Pressure Contour at 06:00 for 1st Stage of Alternative C-1

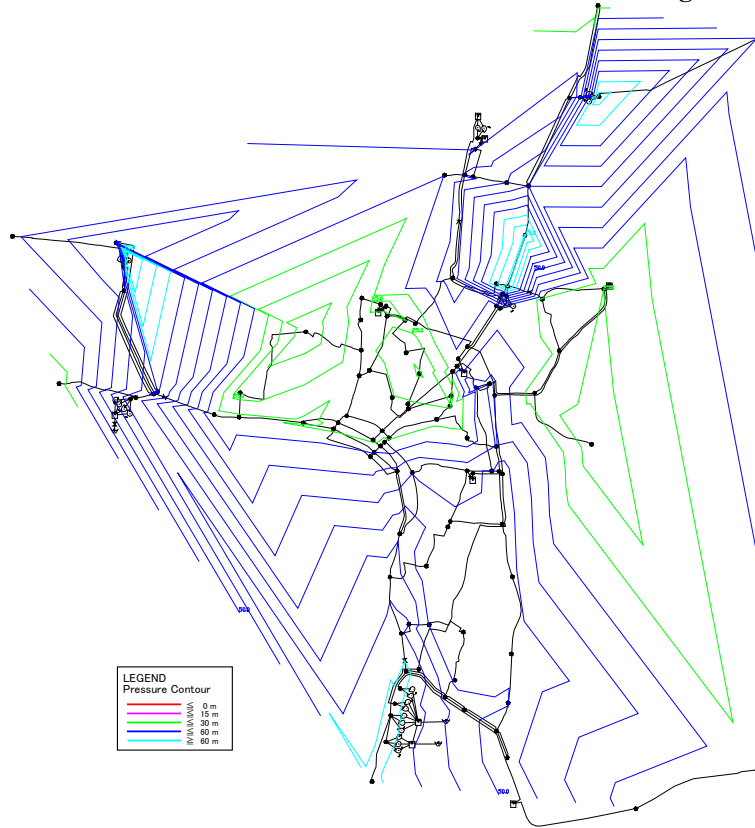


Figure 4 Residual Water Pressure Contour at 12:00 for 1st Stage of Alternative C-1

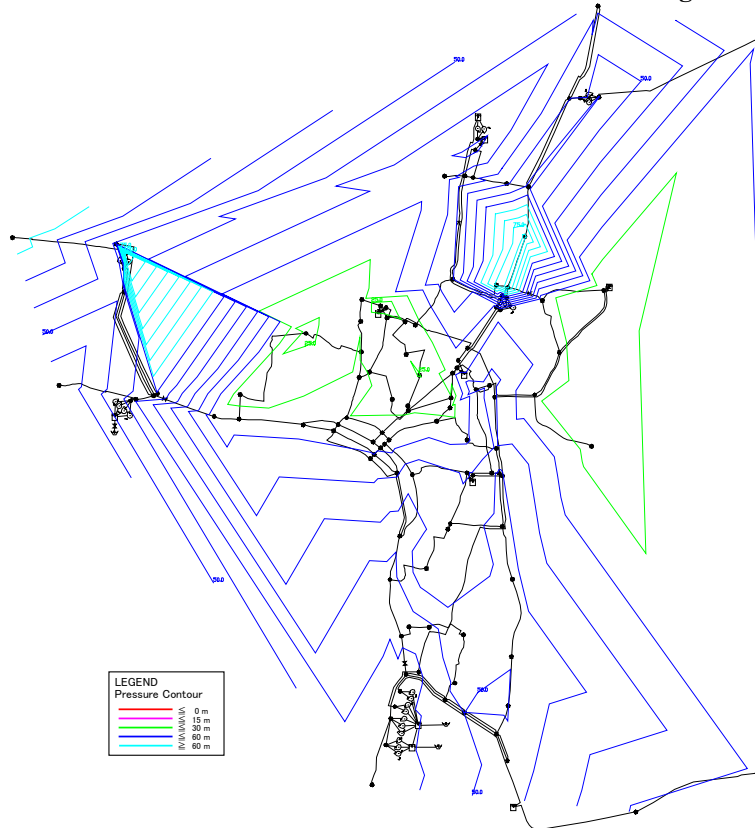


Figure 5 Residual Water Pressure Contour at 18:00 for 1st Stage of Alternative C-1

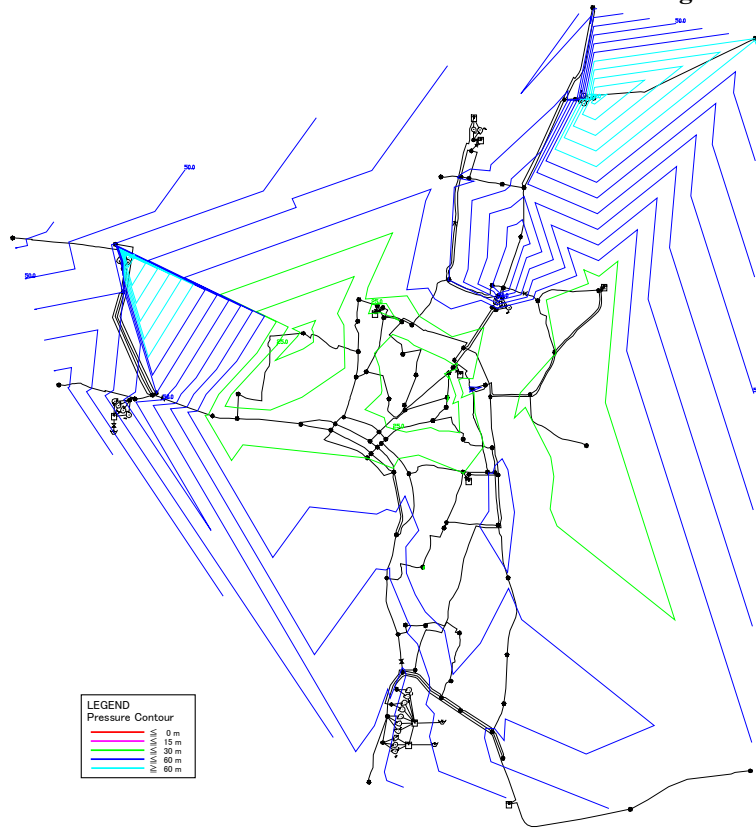


Figure 6 Water Level Fluctuations of Tanks for 1st Stage of Alternative C-1

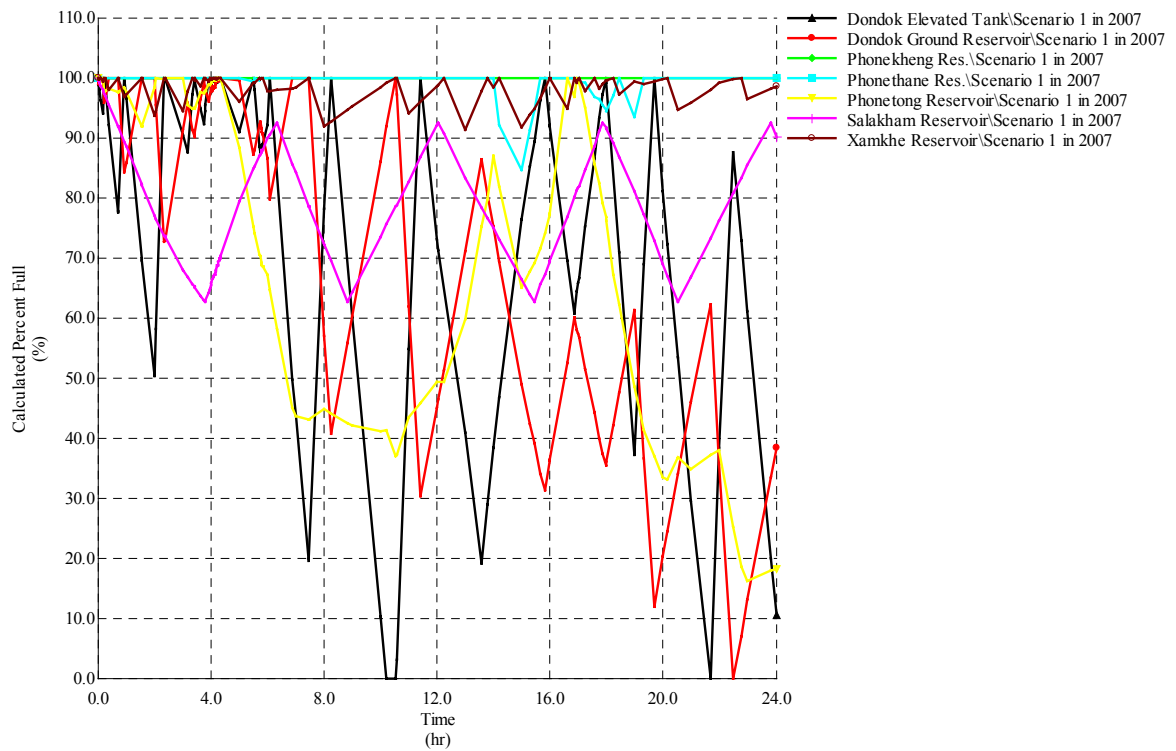


Figure 7 Residual Water Pressure Contour at 06:00 for 2nd Stage of Alternative C-1

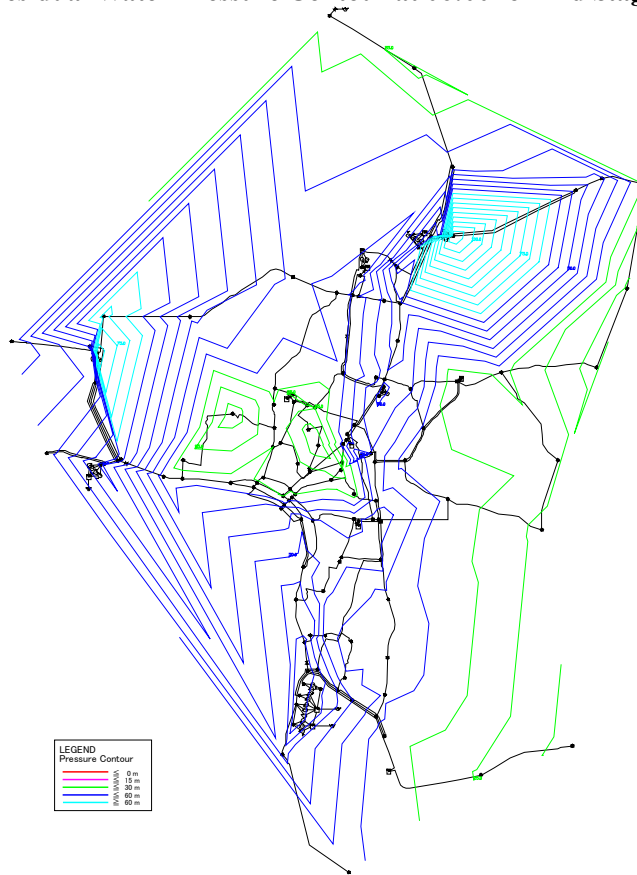


Figure 8 Residual Water Pressure Contour at 12:00 for 2nd Stage of Alternative C-1

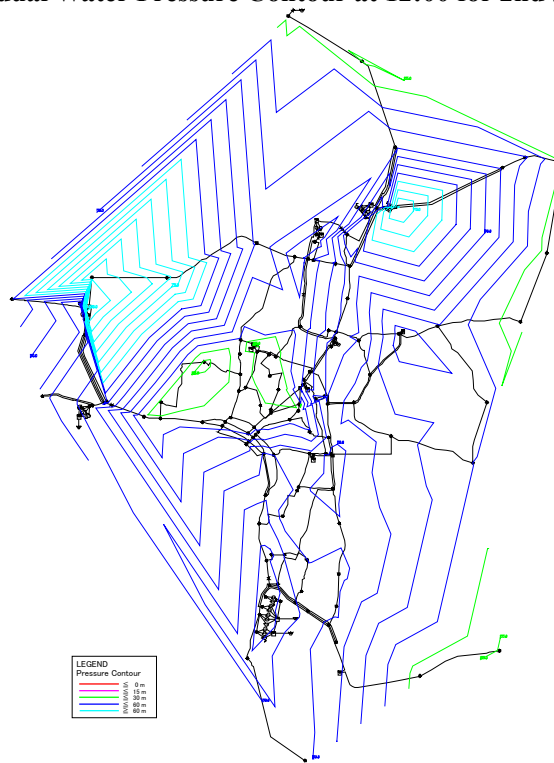


Figure 9 **Residual Water Pressure Contour at 18:00 for 2nd Stage of Alternative C-1**

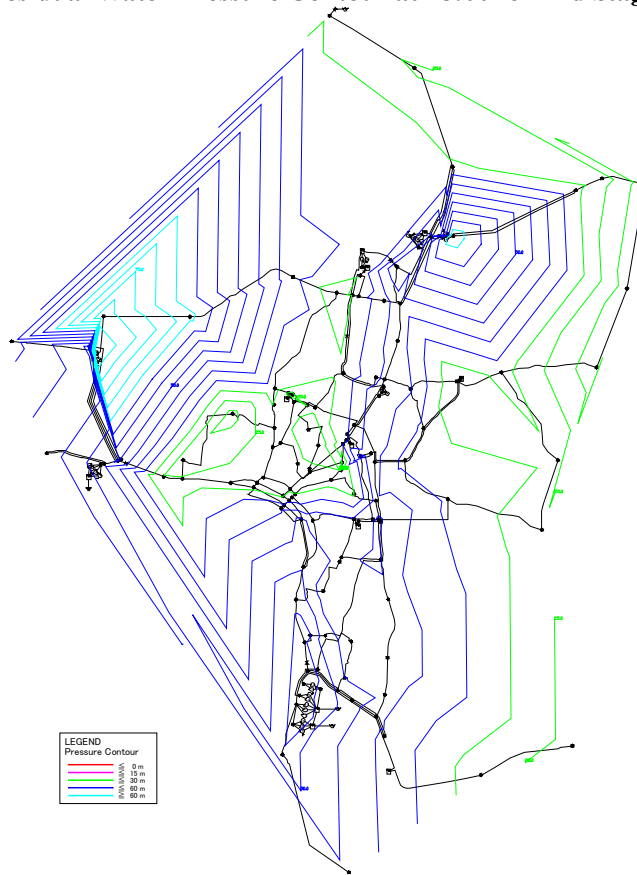


Figure 10 **Water Level Fluctuations of Tanks for 2nd Stage of Alternative C-1**

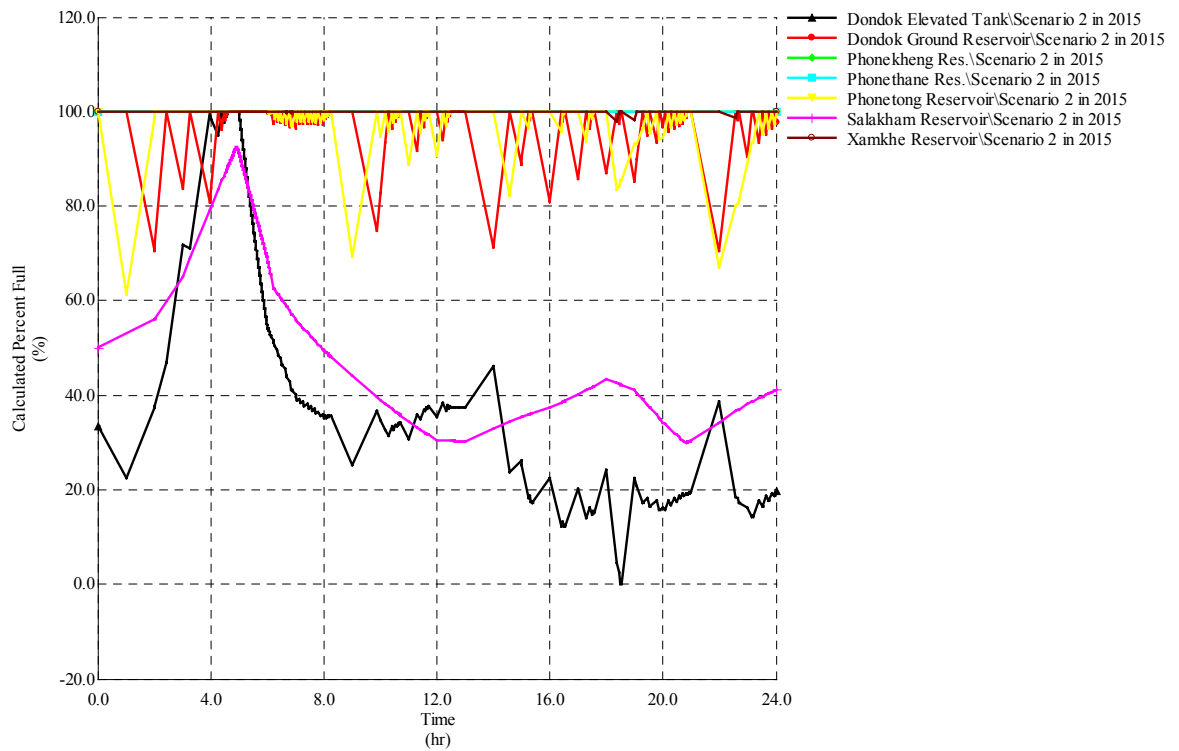


Figure 11 Clear Water Transmission and Distribution Trunk Mains Required for Alternative C-2

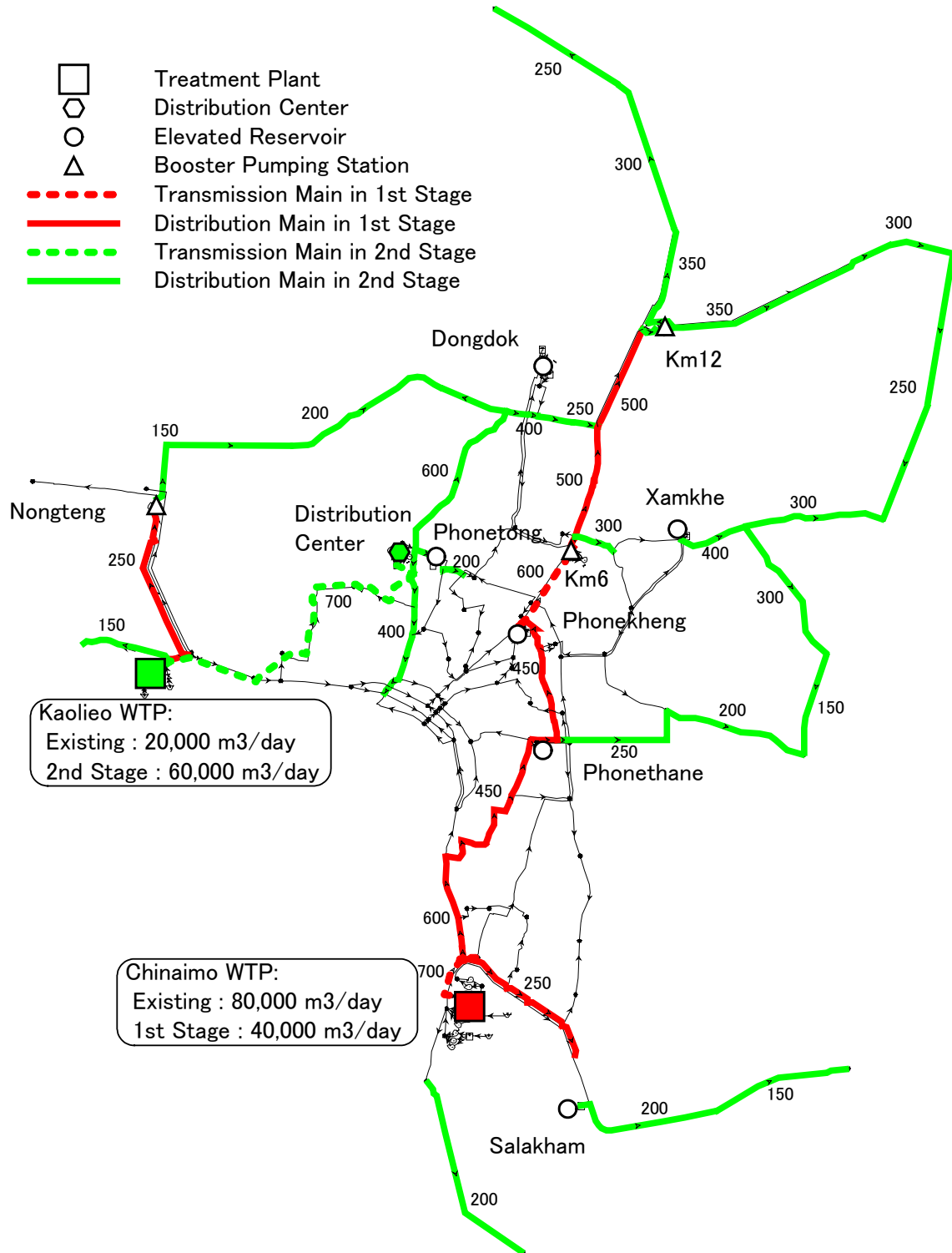


Figure 12 Residual Water Pressure Contour at 06:00 for 1st Stage of Alternative C-2

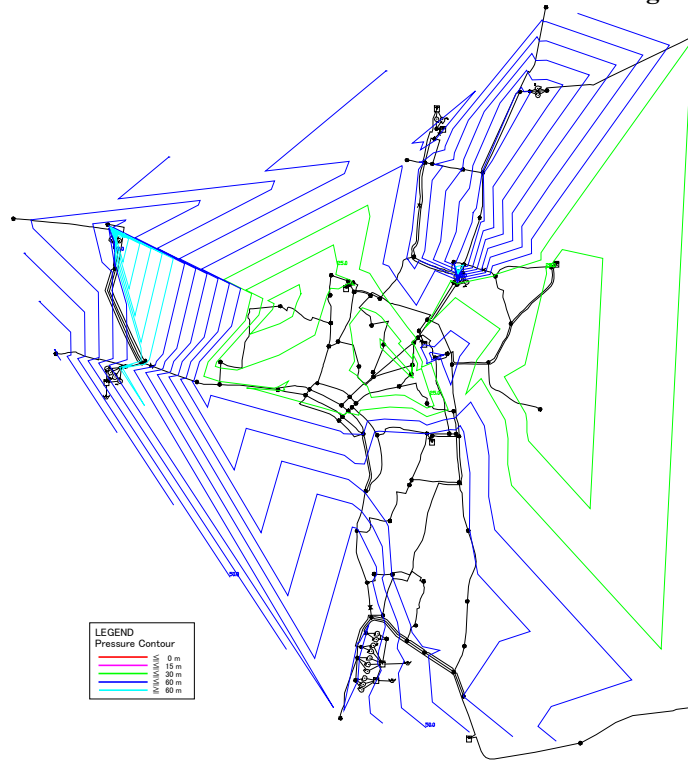


Figure 13 Residual Water Pressure Contour at 12:00 for 1st Stage of Alternative C-2

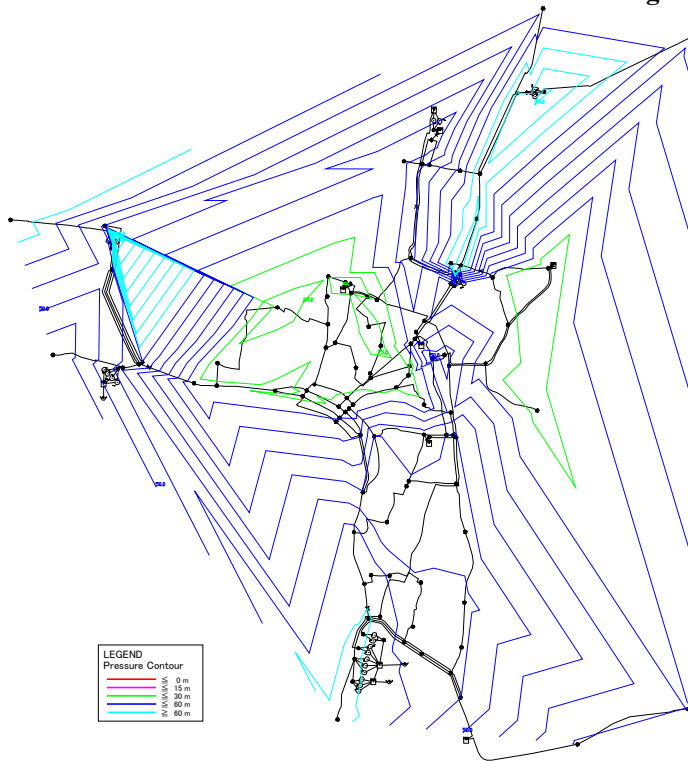


Figure 14 Residual Water Pressure Contour at 18:00 for 1st Stage of Alternative C-2

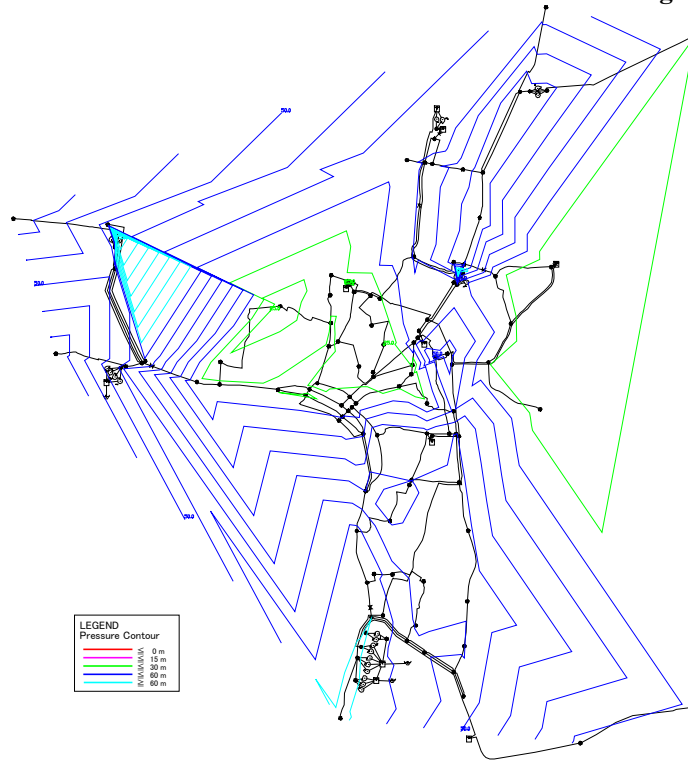


Figure 15 Water Level Fluctuations of Tanks for 1st Stage of Alternative C-2

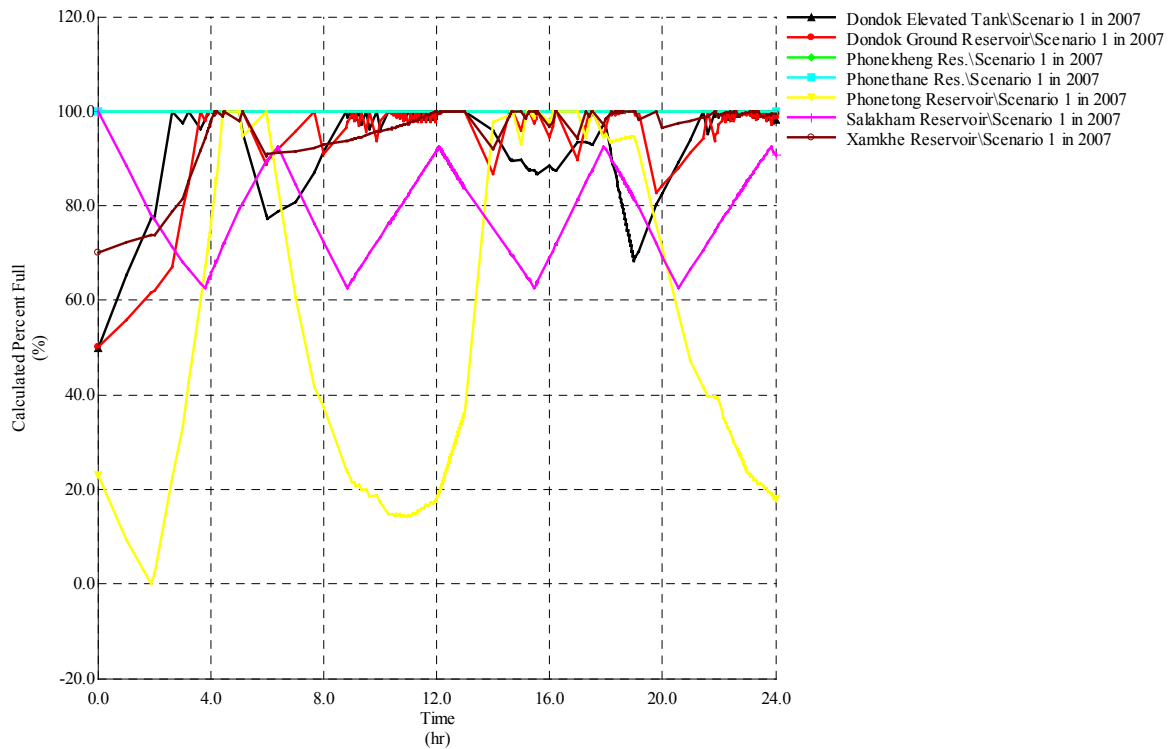


Figure 16 **Residual Water Pressure Contour at 06:00 for 2nd Stage of Alternative C-2**

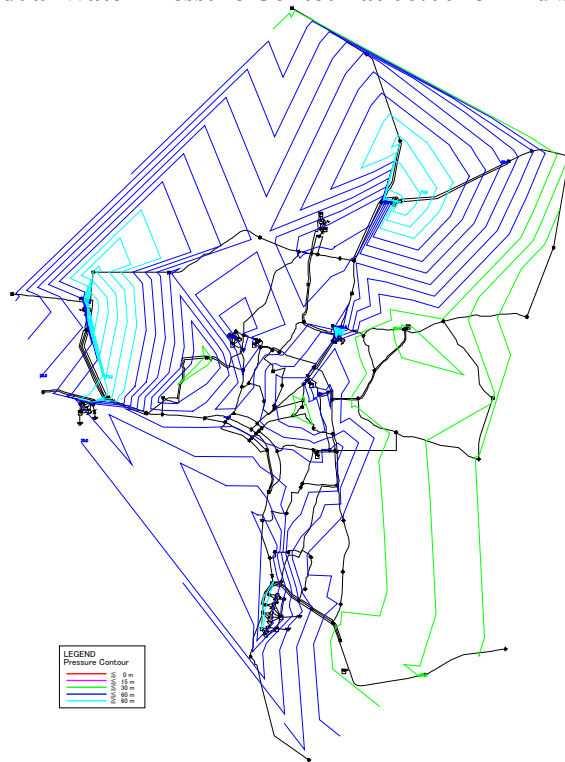


Figure 17 **Residual Water Pressure Contour at 12:00 for 2nd Stage of Alternative C-2**

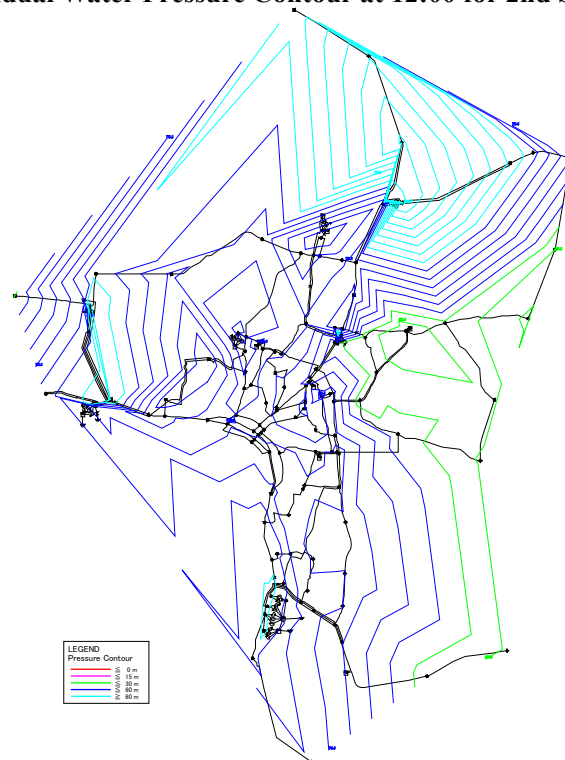


Figure 18 **Residual Water Pressure Contour at 18:00 for 2nd Stage of Alternative C-2**

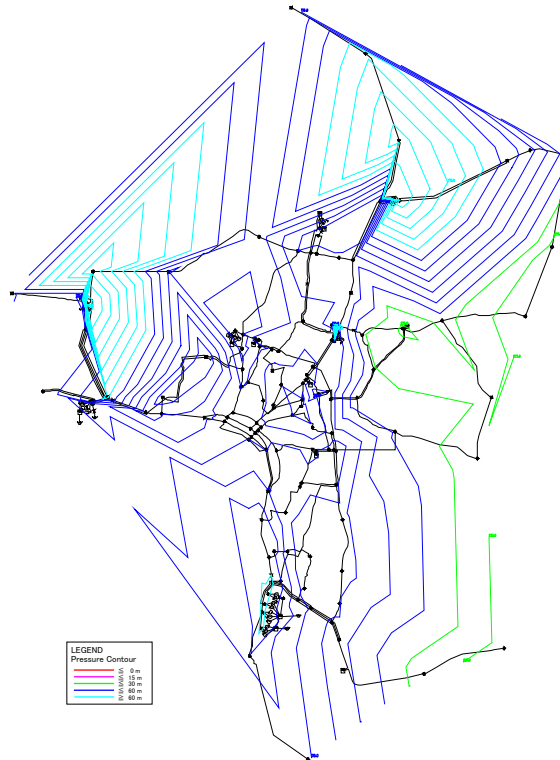


Figure 19 **Water Level Fluctuations of Tanks for 2nd Stage of Alternative C-2**

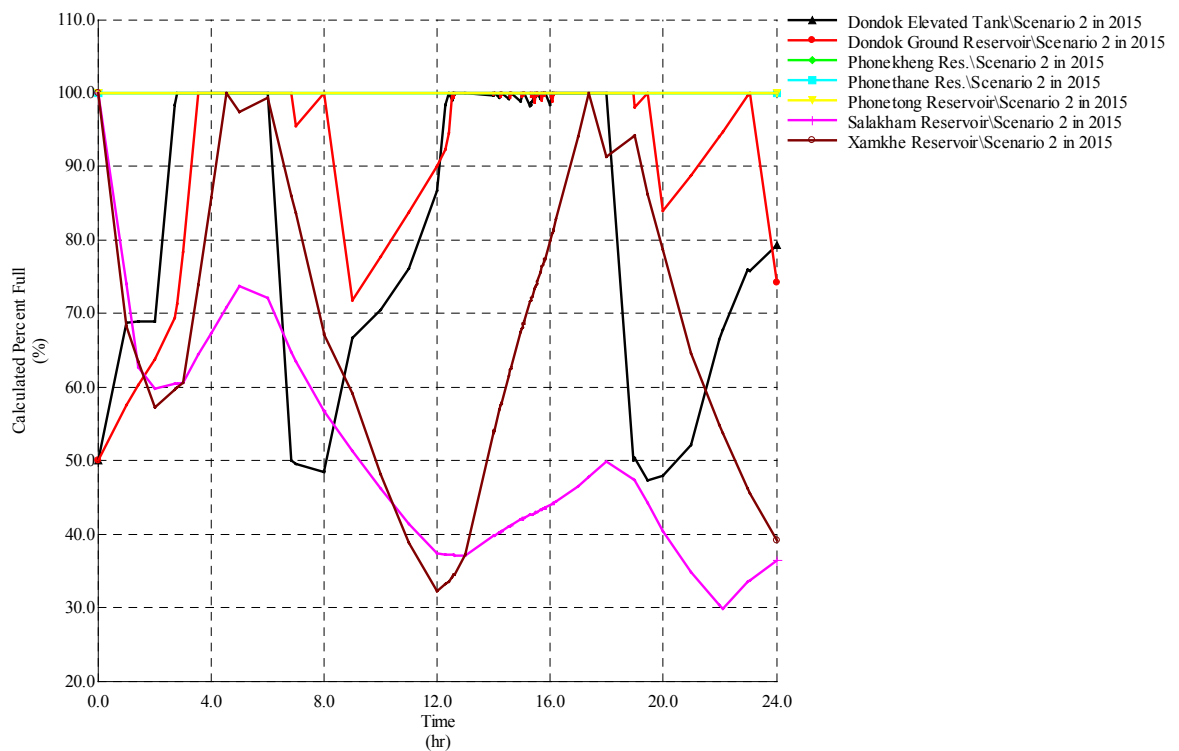


Figure 21 Residual Water Pressure Contour at 06:00 for 1st Stage of Alternative K-1

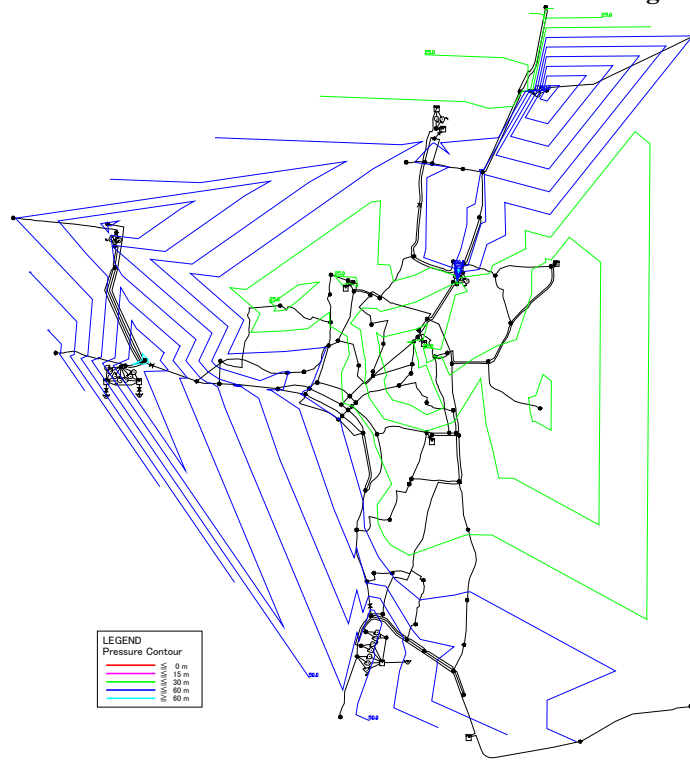


Figure 22 Residual Water Pressure Contour at 12:00 for 1st Stage of Alternative K-1

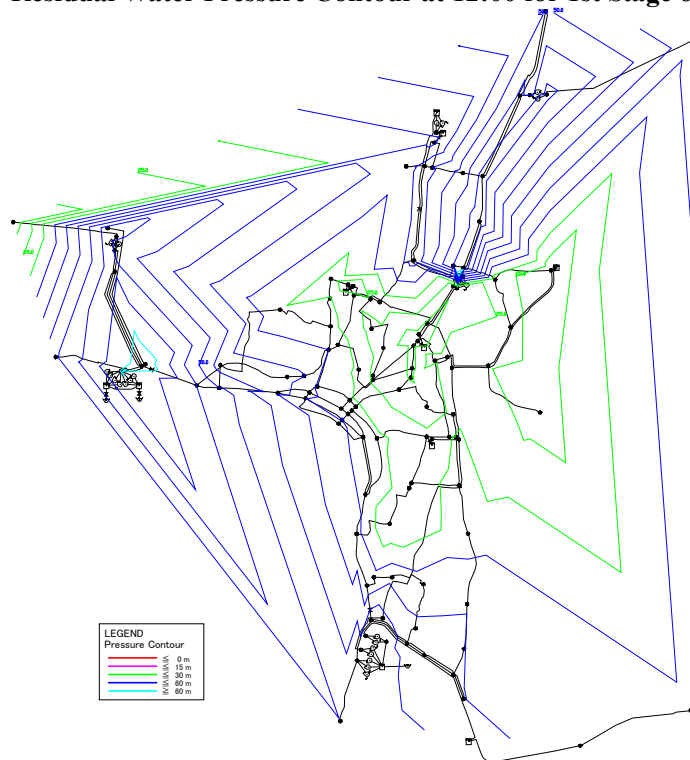


Figure 23 **Residual Water Pressure Contour at 18:00 for 1st Stage of Alternative K-1**

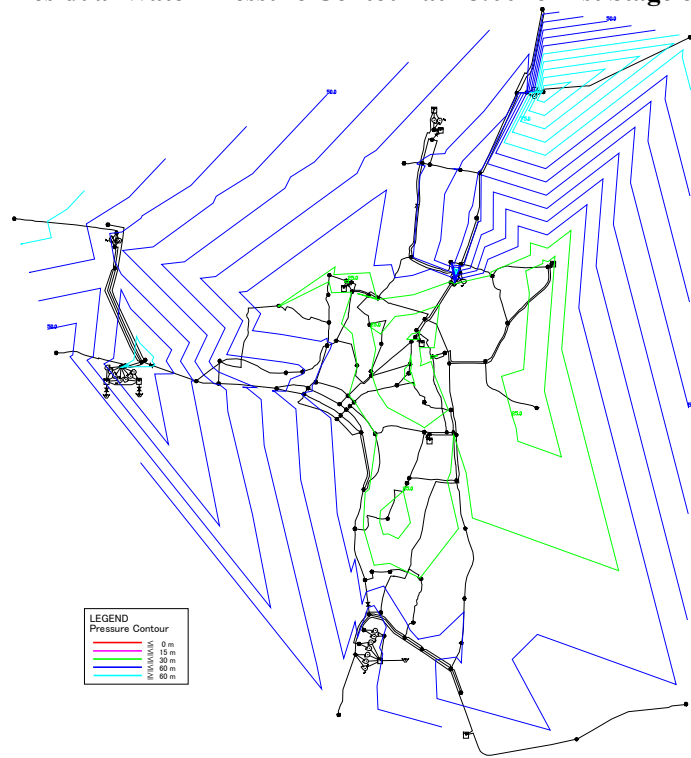


Figure 24 **Water Level Fluctuations of Tanks for 1st Stage of Alternative K-1**

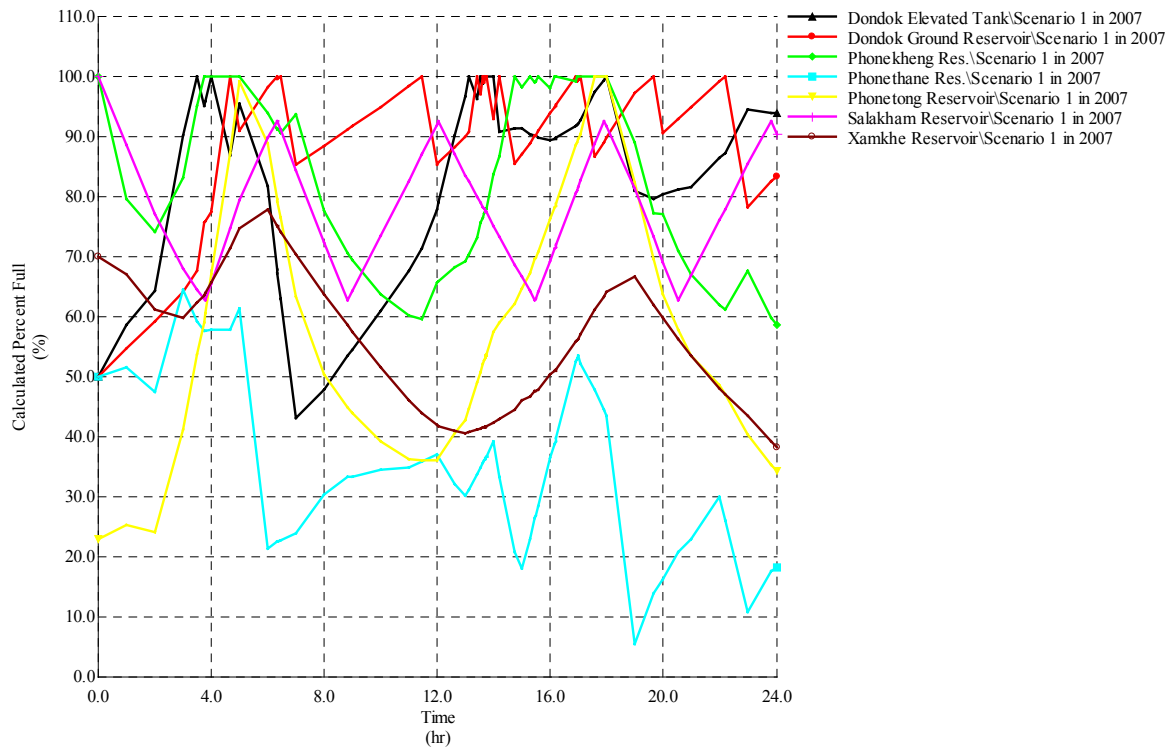


Figure 25 Residual Water Pressure Contour at 06:00 for 2nd Stage of Alternative K-1

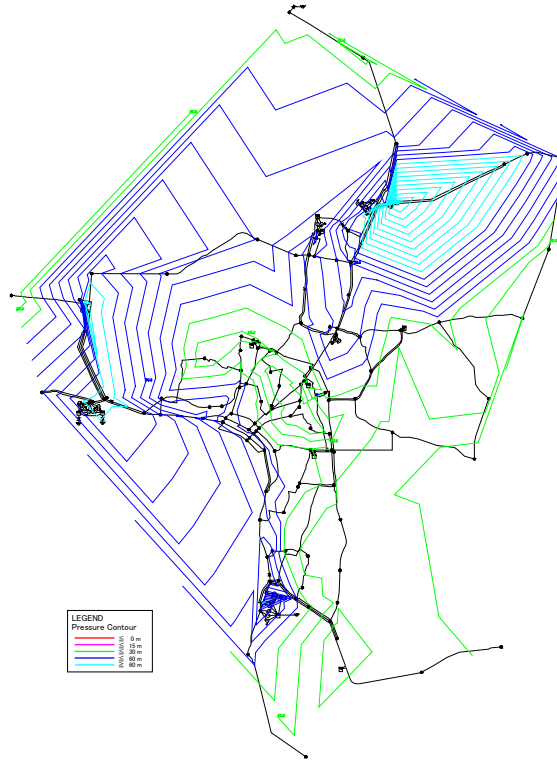


Figure 26 Residual Water Pressure Contour at 12:00 for 2nd Stage of Alternative K-1

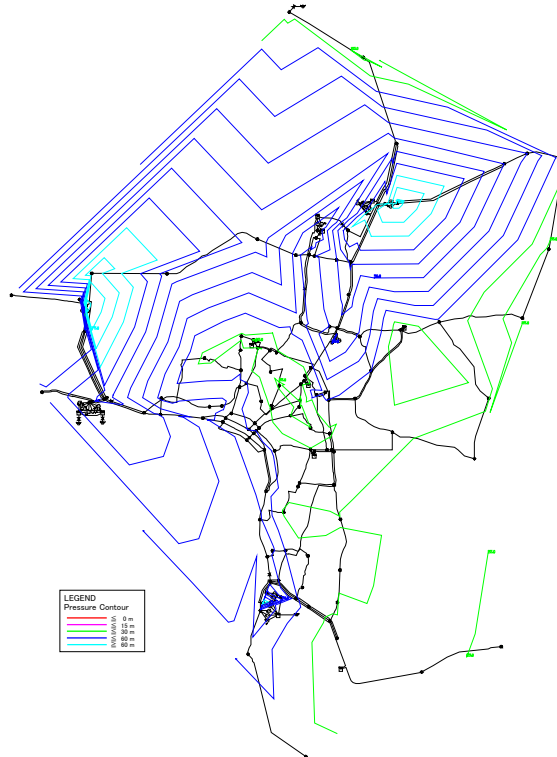


Figure 27 Residual Water Pressure Contour at 18:00 for 2nd Stage of Alternative K-1

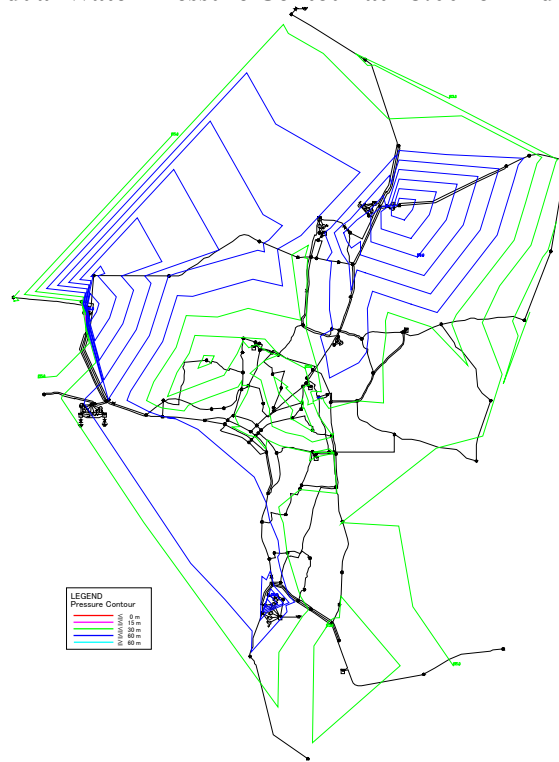


Figure 28 Water Level Fluctuations of Tanks for 2nd Stage of Alternative K-1

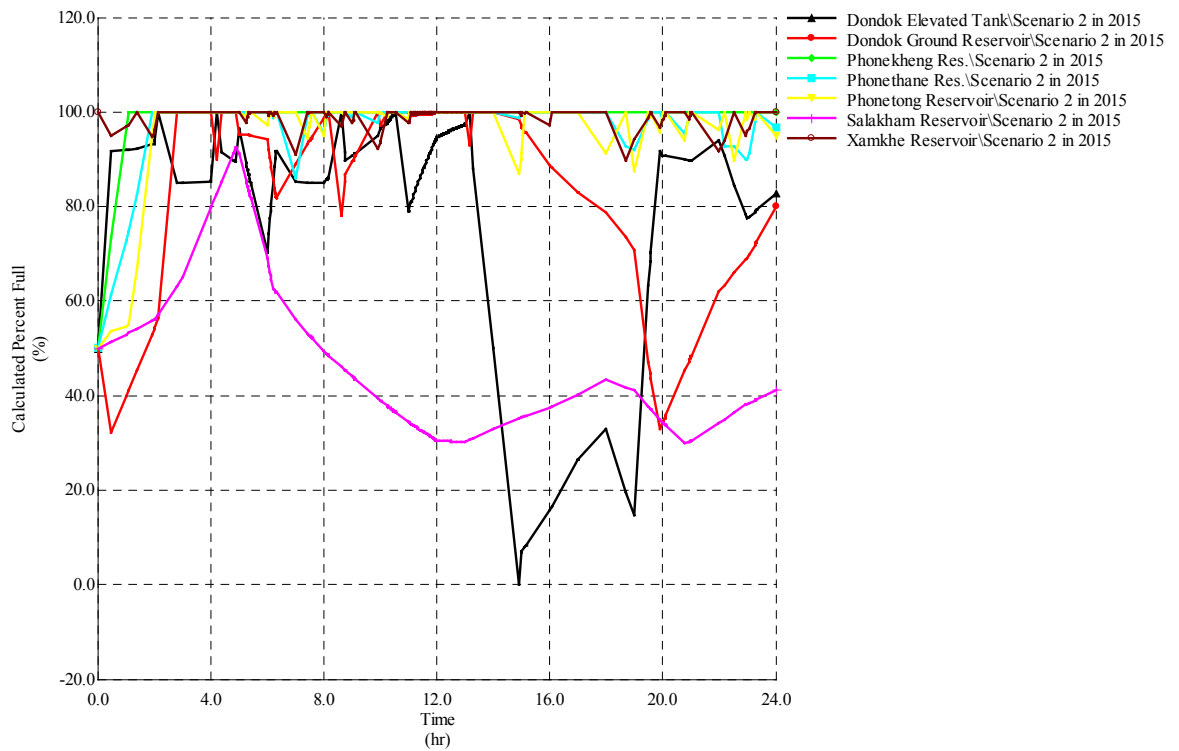


Figure 30 **Residual Water Pressure Contour at 06:00 for 1st Stage of Alternative T-2**

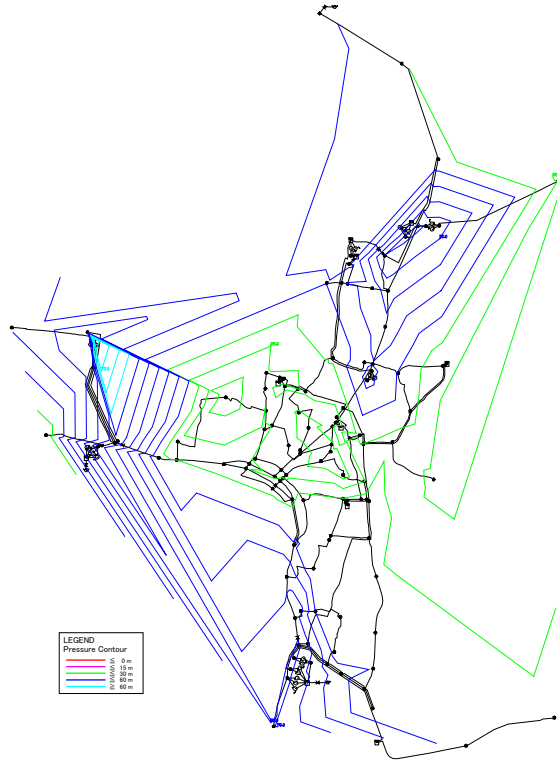


Figure 31 **Residual Water Pressure Contour at 12:00 for 1st Stage of Alternative T-2**

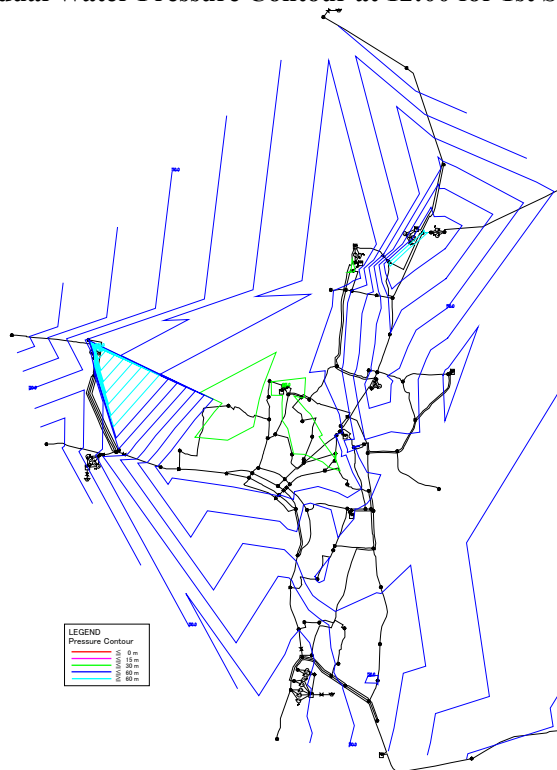


Figure 32 **Residual Water Pressure Contour at 18:00 for 1st Stage of Alternative T-2**

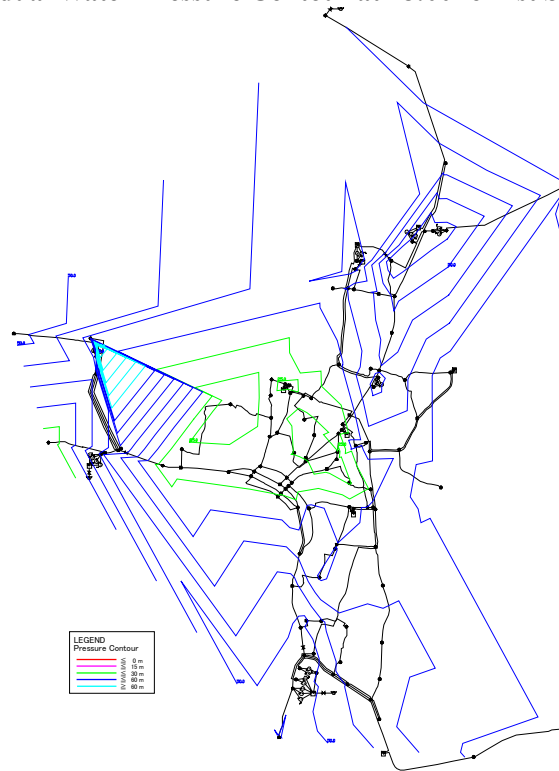


Figure 33 **Water Level Fluctuations of Tanks for 1st Stage of Alternative T-2**

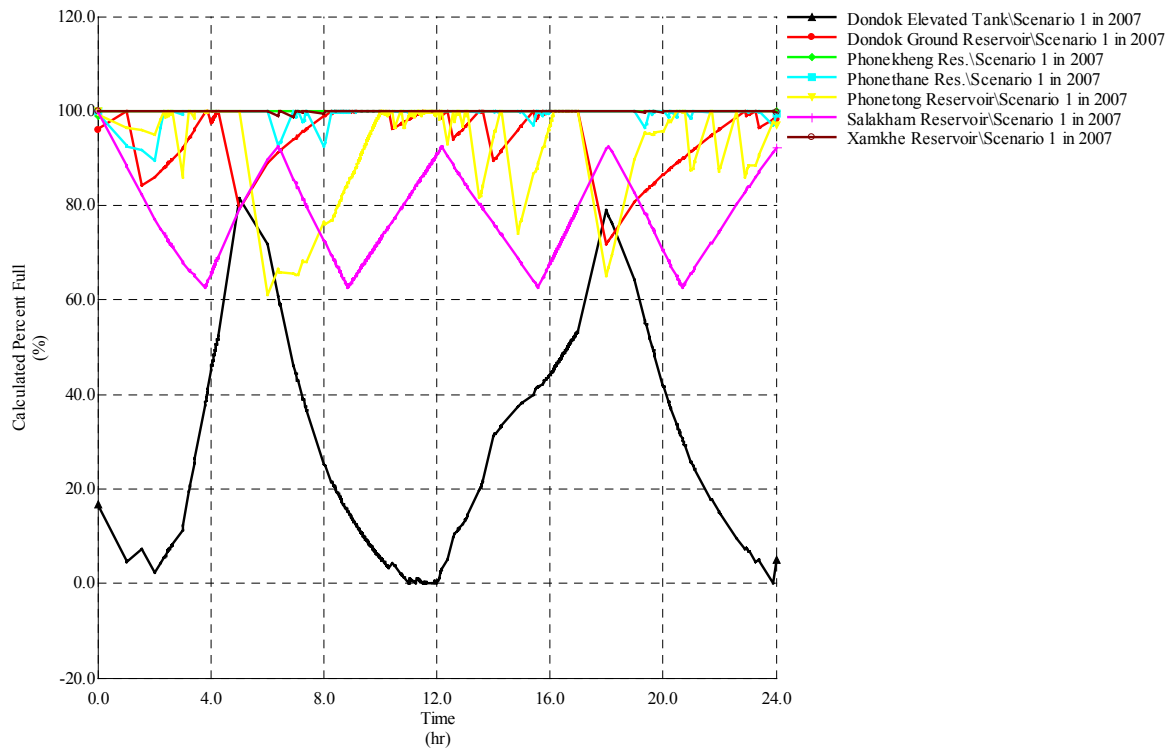


Figure 34 **Residual Water Pressure Contour at 06:00 for 2nd Stage of Alternative T-2**

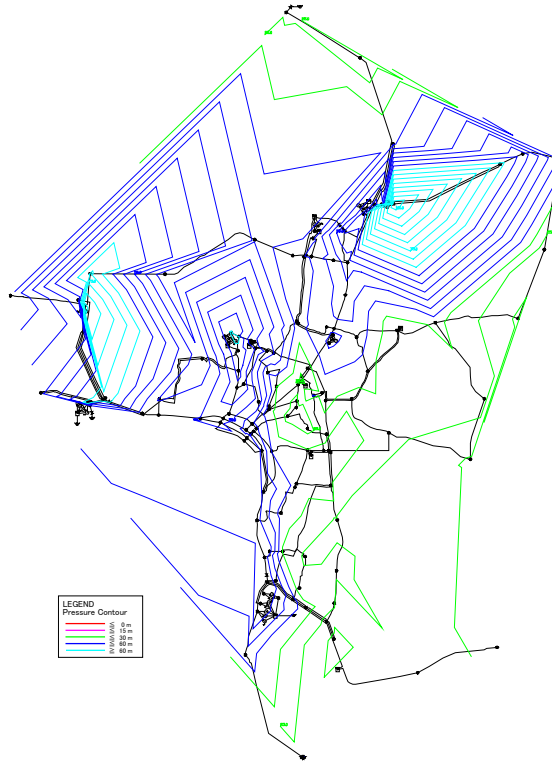


Figure 35 **Residual Water Pressure Contour at 12:00 for 2nd Stage of Alternative T-2**

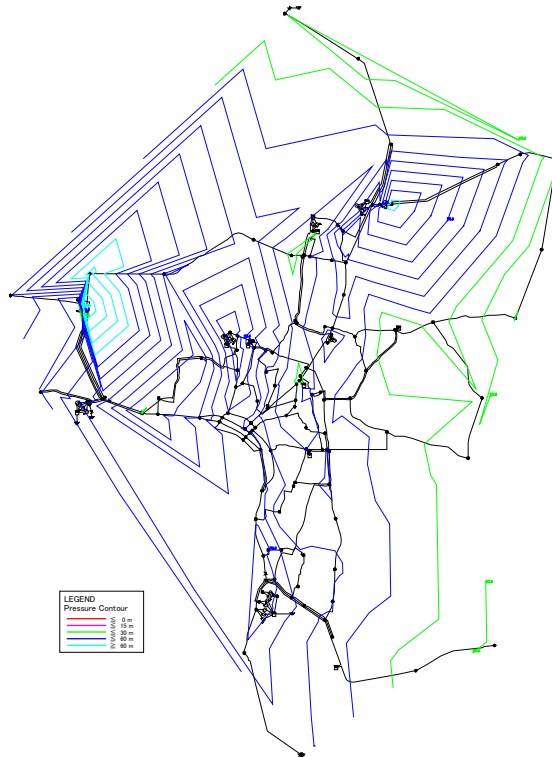


Figure 36 Residual Water Pressure Contour at 18:00 for 2nd Stage of Alternative T-2

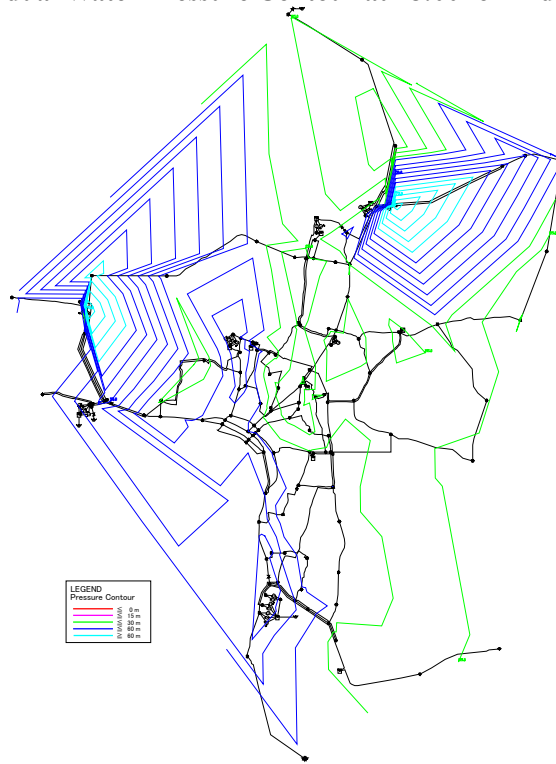


Figure 37 Water Level Fluctuations of Tanks for 2nd Stage of Alternative T-2

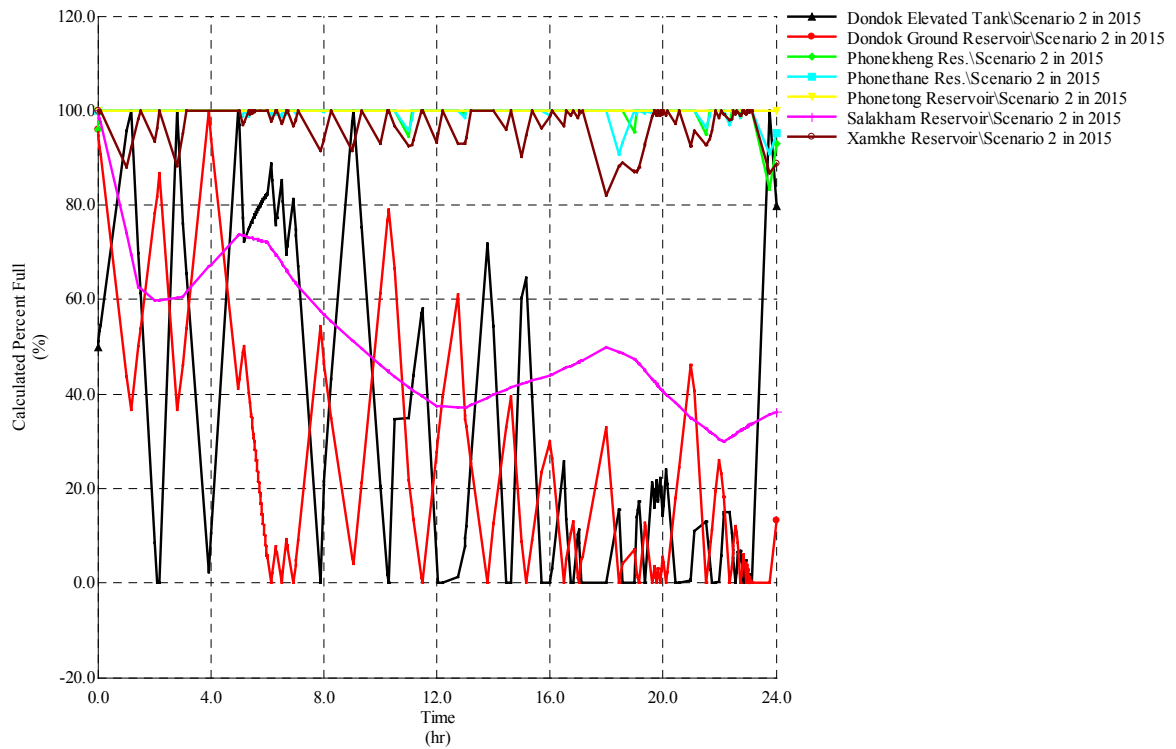


Figure 38 Clear Water Transmission and Distribution Trunk Mains Required for Alternative T-3

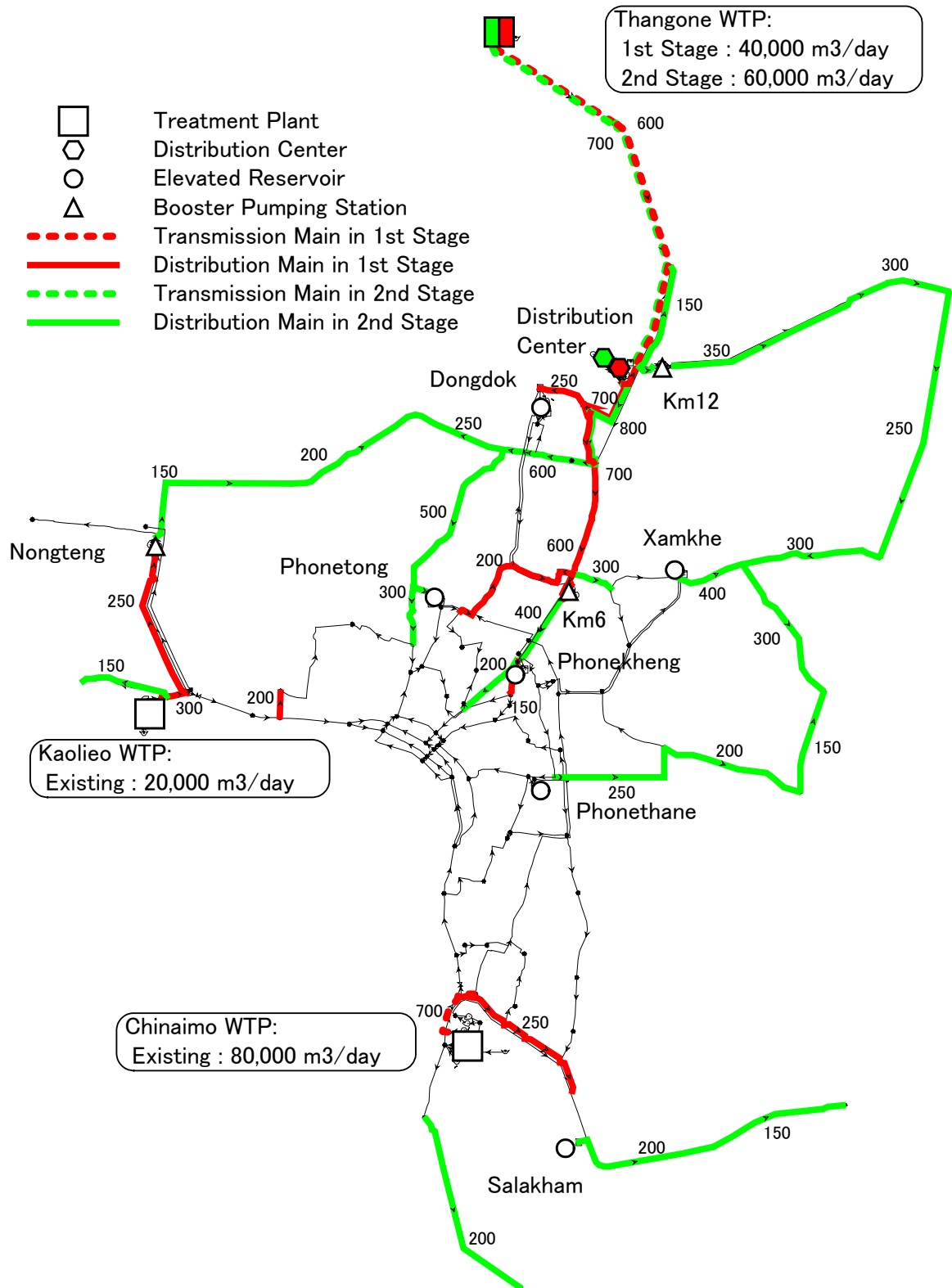


Figure 39 **Residual Water Pressure Contour at 06:00 for 1st Stage of Alternative T-3**

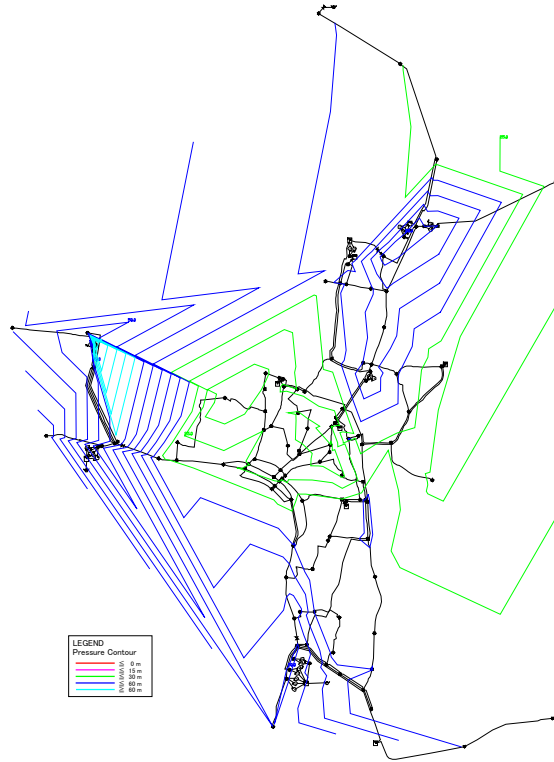


Figure 40 **Residual Water Pressure Contour at 12:00 for 1st Stage of Alternative T-3**

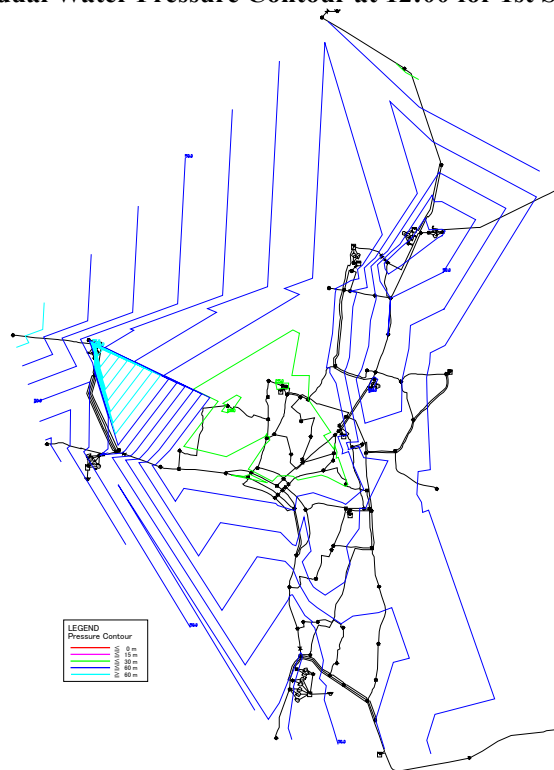


Figure 41 **Residual Water Pressure Contour at 18:00 for 1st Stage of Alternative T-3**

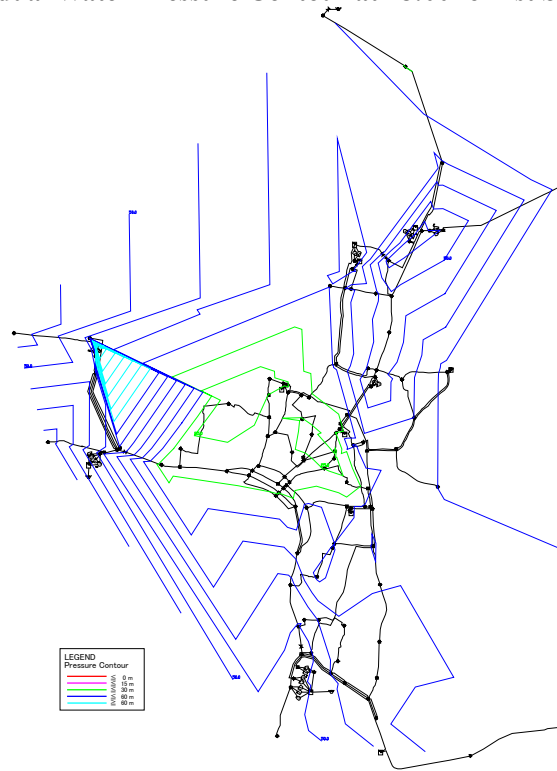


Figure 42 **Water Level Fluctuations of Tanks for 1st Stage of Alternative T-3**

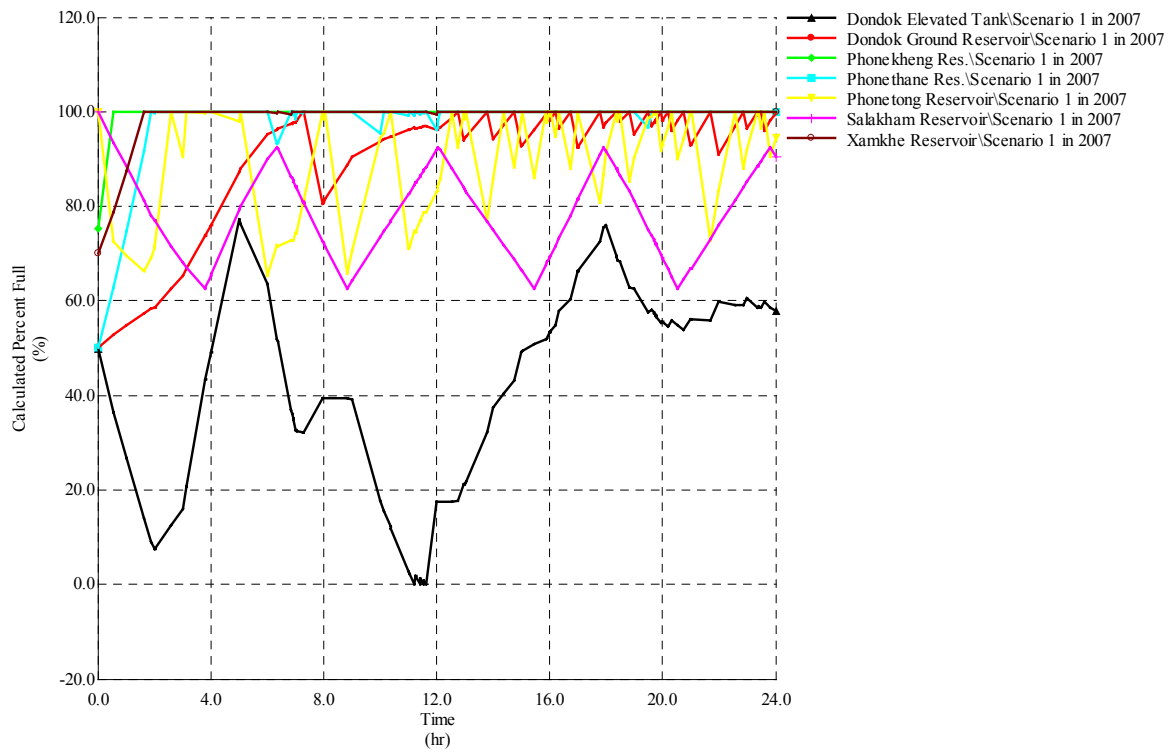


Figure 43 Residual Water Pressure Contour at 06:00 for 2nd Stage of Alternative T-3

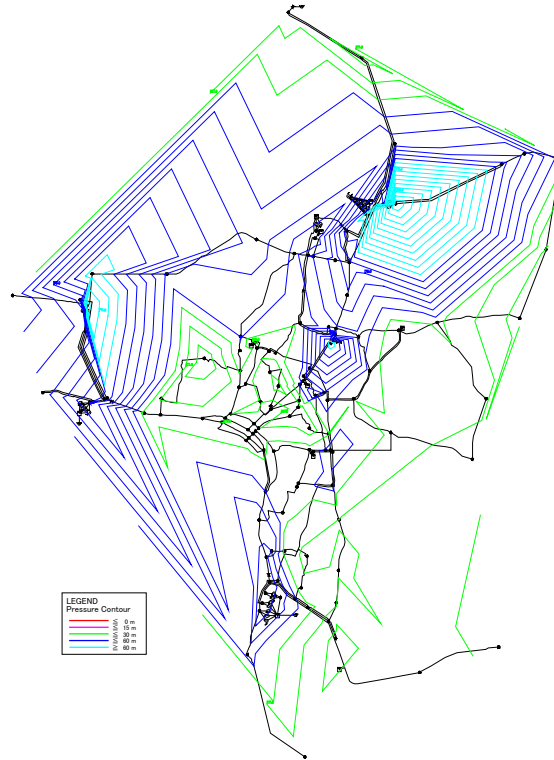


Figure 44 Residual Water Pressure Contour at 12:00 for 2nd Stage of Alternative T-3

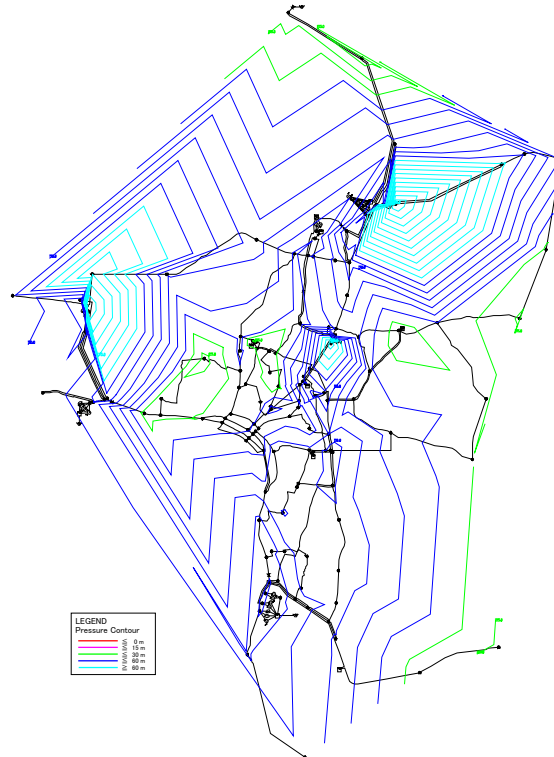


Figure 45 **Residual Water Pressure Contour at 18:00 for 2nd Stage of Alternative T-3**

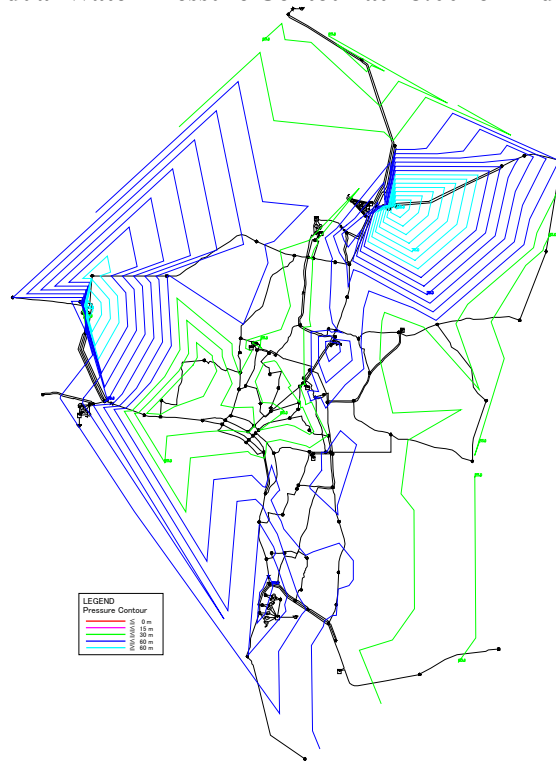


Figure 46 **Water Level Fluctuations of Tanks for 2nd Stage of Alternative T-3**

