### 11.2.2 Kok-Ing Diversion Canal

#### (1) Design concept and Criteria

(a) Hydraulic condition

Basic hydraulic design dimensions and formula are follows.

*Basic design dimension*

| | |
|---|---|
| Maximum design discharge Kok-Ing diversion canal | 140 cu.m/s |
| Kok intake water level | NWL388.00 m M.S.L |
| Outlet water level of Ing river | NWL 363.500 m M.S.L |

*Hydraulic formula*

Manning's formula is applied in canals

Flow conditionUniform flow

Manning's formula$Q=A \times V V=R^{2/3} \times S^{1/2} / n$

WhereQ; Discharge (cu.m/s)

V; Velocity (m/s)

A; Flow area (sq.m.)

R; Hydraulic Radius R=A/P (m)

S; Gradient of canal bed

n; Coefficient of roughness in open canal of concrete canal lining n=0.016

culvert, siphon and tunnel n=0.015

Siphon loss

Siphon loss consists of friction loss, inlet transition loss, outlet transition loss and trash rack loss.

$h_l = ( nV / R^{2/3})^2 \times L + ( fi+fo+ft ) \times V^2 / 2g$

Maximum flow velocity

| | |
|---|---|
| Earth lining canal(in case of clay) | $V_{max}$=1.00 m/s |
| Concrete lining canal ( t<10cm) | $V_{max}$=1.80 m/s (USBR standard) |
| ( t>18cm) | $V_{max}$=3.00 m/s |
| R.C canal & R.C pipe | $V_{max}$=3.00 m/s |
| Froude number | Fd < 0.7 |

Free board

| | |
|---|---|
| Concrete lining canal | Fb >0.05d +$h_v$+ (0.05----0.15) m |
| Culvert, tunnel | d / r = 1.60 (Circular and horse shoe type) |
| | d : Water depth (m) |

*Mean Hydraulic Gradient*

As hydraulic mean gradients of Kok-Ing diversion canal are supposed as follows.

Hydraulic heads is appropriately enough for canal design.

Kok diversion canal Head = 388.00-363.50-(Intake loss + 4 siphon losses) =20 m

Gradient slope =20 / 54,500 = 1 / 2,700

Composition of bed gradient

Kok-Ing diversion canal consists of about 39 km open canal, 7 km culvert and 8.5 km tunnel. Mean gradient of Kok-Ing diversion canal would be designed less than 1/2,700. Hydraulic gradient and water head in each case is shown in Table 11.2.2(1)-3. Hydraulic energy in following cases is enough. Gradient would be decided topographic condition, velocity and cost into conditions.

**Table 11.2.2 (1)-3 Hydraulic Gradient and Water Head in each Cases**

| Canal | Length (m) | Case-1 | | Case-2 | | Case-3 | |
|---|---|---|---|---|---|---|---|
| | | Gradient | Head(m) | Gradient | Head(m) | Gradient | Head(m) |
| Open canal | 39,000 | 1/3,000 | 13.00 | 1/5,000 | 7.80 | 1/10,000 | 3.90 |
| Culvert | 7,000 | 1/3,000 | 2.30 | 1/2,500 | 2.80 | 1/ 2,000 | 3.50 |
| Tunnel | 8,500 | 1/3,000 | 2.85 | 1/2,500 | 3.40 | 1/ 2,000 | 4.25 |
| Total | 54,500 | | 18.15 | | 14.20 | | 11.65 |

(b) Open Canal

*Canal Type and Lining*

The purpose of Diversion canal is to be safely and speedily to convey the diverted water to Ing river. Canal velocity is requested more than 1.0 m/s based on the hydraulic energy and lining is also requested to protect the canal erosion and to maintenance of canal. Open canal type would be applied for trapezoid concrete lining type by the reason of widespread in Thailand, with technical, economical and constructional experience.

Lined open canals are classified into three types with, which is shown in Table 11.2.2 (1)-2. Though trapezoid concrete lining type requires much spoils bank volume and land acquisition area, construction cost is low.

**Table 11.2.2 (1)-4 Land Acquisition Width and Excavation Volume in Open Canal Types**

(In case of Q=140 cu.m/s, S=1/5,000, Water depth D=3.85m and excavation depth H=9.55m)

| Canal type | Lining | Side slope | Width sq.m/m | Excavation Volume cu./m | Cost |
|---|---|---|---|---|---|
| Trapezoid type | Placing thin concrete | 1:1.5 (2.0) | 70 | 315 | Low |
| Trapezoid type | Pre-cast concrete block | 1:0.5 (1.0) | 65 | 290 | Medium |
| Rectangular type | Reinforced concrete | 1:0.0 | 65 | 310 | More |

*Longitudinal gradient of canal slope*

Relating with canal velocity and cross section, canal section with steep slope shows high velocity in small section and increases the excavation depth. Canal longitudinal slope would be generally decided taking followings into consideration.

- Purpose of canal and lining condition

- Required water level at turn out
- Total energy and arrangement of canal type
- Topographical condition
- Balance of earthwork volume (Excavation and filling volume)
- Hydraulic most effective cross section, Allowable velocity

This diversion canal is excavated type under the ground, and has no turnouts except for associated project. Longitudinal slope is decided as S=1/5,000 in open canal and S=1/2,500 in culvert and tunnel taking hydraulic conditions including total energy from kok to Ing river into consideration. The canal dimensions are shown in Table 11.2.2 (1)-4.1

Longitudinal gradients and velocity in open canal is shown in Table11.2.2 (1)-5 and derail is shown in 11.2.2 (1)-8.

**Table 11.2.2 (1)-5 Longitudinal Gradients and Velocity in Open Canal**

| Gradient | d =3.00m | | d=3.50m | | d=3.85m | | Remarks |
|---|---|---|---|---|---|---|---|
| | W(m) | V(m/s) | W(m) | V(m/s) | W(m) | V(m/s) | |
| I/ 3,000 | 18.60 | 2.02 | 13.70 | 2.11 | 11.10 | 2.16 | |
| 1/ 5,000 | 24.50 | 1.61 | 18.40 | 1.70 | 15.00 | 1.74 | $V_{max}$<1.8 |
| I/ 7,000 | 29.30 | 1.39 | 22.00 | 1.47 | 18.40 | 1.51 | |
| 1/10,000 | 35.20 | 1.18 | 26.70 | 1.25 | 23.30 | 1.30 | H<23 m |

Whered: Water depth (m)W: Bottom widthV: Velocity (m/s)

*Free board*

Free board (Fb) and lining height (Hc) of canal would be employed 0.70m and 4.50 m, respectively. In case of flood or miss operation of gates, discharge of 189 cu.m/s, which is 1.35 times of design capacity, can flow with in free board.

(c) Culvert

*Culvert Section*

The culvert covered by backfill is used for deep excavation portion, which excavation depth is over 15 meter. Culver canal type would be applied for concrete horseshoe type reinforced by steel bar taking earth/hydraulic pressure and economical conditions into consideration. Culver canal is generally classified as Table 11.2.2 (1)-6.

**Table 11.2.2 (1)-6 Land Acquisition Width and Excavation Volume in Culvert Types**

In case of Q=140 cu.m/s, S=1/2,500 and water surface 15m under ground level

| Canal type (Reinforced concrete) | Water Depth | Size H*B*rows | Excavation Width | Excavation Volume | Cost |
|---|---|---|---|---|---|
| Rectangular type | 3.85 m | 4.55*3.85*6 | 72 m | 790 cu.m | High |
| Circular type | 7.20 m | D=9.00 m | 57 m | 640 cu.m | Medium |
| Horse shoe type | 7.00 m | D=8.70 m | 56 m | 620 cu.m | Medium |

*Longitudinal gradient of culvert canal*

Longitudinal gradient of culvert is designed with more rapidly velocity than open canal to reduce cross section. Longitudinal slope of culvert is decided as S=1/2,500 taking hydraulic conditions including total energy from kok to Ing river into consideration.

Longitudinal Gradients and Velocity in culvert is shown in Table11.2.2 (1)-7 and detail calculations are shown in Table 11.2.2 (1)-9 and10.

**Table 11.2.2 (1)-7 Longitudinal Gradients and Velocity in Culvert**

| Gradient | Rectangular | | Circular | | Horse shoe | | Remarks |
|---|---|---|---|---|---|---|---|
| | W(m) | V(m/s) | D(m) | V(m/s) | D(m) | V(m/s) | |
| I/ 2,000 | 21.40 | 1.70 | 8.60 | 2.83 | 8.40 | 2.80 | |
| 1/ 2,500 | 23.10 | 1.57 | 9.00 | 2.61 | 8.70 | 2.57 | |
| I/ 5,000 | 32.10 | 1.13 | 10.20 | 2.01 | 10.00 | 1.99 | |

WhereD: Diameter (m)W: Bottom width V: Velocity (m/s)Culvert cross section

Culvert section with diameter 8.70 m and water depth of 7.00 m is selected taking water velocity into consideration. The dimensions of canal section are as follows.

| Discharge Q(cu.m/s) | Diameter (m) | Water depth d(m) | Flow area A(sq.m) | Coefficient Roughness n | Longitu .Slope | Velocity V(m) | Remarks |
|---|---|---|---|---|---|---|---|
| 140.00 | 8.70 | 7.00 | 54.56 | 0.015 | 1/2,500 | 2.57 | |

## Table 11.2.2(1)-8 Hydraulic Dimension in Open Cnal (Gradient & Section)

| Lining | L/S | b m | d m | z | A sqm | P m | R m | n | S | V m/s | Q cum/s | Hc m | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KOK-ING | Q=140 cum/s | | | | | | | | | | | | |
| Conc.Lining | 1/5000 | 15.00 | 3.850 | 1.50 | 79.98 | 28.88 | 2.77 | 0.016 | 0.00020 | 1.743 | 140.0 | 4.55 | |
| Culvert | 1/2500 | 8.70 (2r) | 7.000 | - | 54.30 | 41.59 | 1.31 | 0.015 | 0.00040 | 2.564 | 140.0 | 8.70 | |
| ING-YOT | Q=175 cum/s | | | | | | | | | | | | |
| Conc.Lining | 1/5000 | 20.00 | 3.795 | 1.50 | 97.50 | 33.68 | 2.89 | 0.016 | 0.00020 | 1.80 | 175.0 | 4.55 | |
| Culvert | 1/2500 | 9.50 | 7.500 | - | 63.99 | 21.98 | 2.91 | 0.015 | 0.00040 | 2.72 | 173.9 | 9.50 | |

| Lining | L/S | b m | d m | z | A sqm | P m | R m | n | S | V m/s | Q cum/s | Hc m | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KOK-ING | Q=140m3/s | | | | | | | | | | | | |
| Conc.Lining | 1/3000 | 11.10 | 3.85 | 1.50 | 64.97 | 24.98 | 2.60 | 0.016 | 0.00033 | 2.16 | 140.20 | | |
| | 1/5000 | 15.00 | 3.85 | 1.50 | 79.98 | 28.88 | 2.77 | 0.016 | 0.00020 | 1.74 | 139.42 | | Employed |
| | 1/7000 | 18.40 | 3.85 | 1.50 | 93.07 | 32.28 | 2.88 | 0.016 | 0.00014 | 1.51 | 140.85 | | |
| | 1/10000 | 22.30 | 3.85 | 1.50 | 108.09 | 36.18 | 2.99 | 0.016 | 0.00010 | 1.30 | 140.13 | | |
| | 1/3000 | 13.70 | 3.50 | 1.50 | 66.33 | 26.32 | 2.52 | 0.016 | 0.00033 | 2.11 | 140.15 | | |
| | 1/5000 | 18.40 | 3.50 | 1.50 | 82.78 | 31.02 | 2.67 | 0.016 | 0.00020 | 1.70 | 140.76 | | |
| | 1/7000 | 22.00 | 3.50 | 1.50 | 95.38 | 34.62 | 2.75 | 0.016 | 0.00014 | 1.47 | 140.02 | | |
| | 1/10000 | 26.70 | 3.50 | 1.50 | 111.83 | 39.32 | 2.84 | 0.016 | 0.00010 | 1.25 | 140.29 | | |
| | 1/3000 | 18.00 | 3.00 | 1.50 | 67.50 | 28.82 | 2.34 | 0.016 | 0.00033 | 2.01 | 135.85 | | |
| | 1/5000 | 24.50 | 3.00 | 1.50 | 87.00 | 35.32 | 2.46 | 0.016 | 0.00020 | 1.61 | 140.26 | | |
| | 1/7000 | 29.30 | 3.00 | 1.50 | 101.40 | 40.12 | 2.53 | 0.016 | 0.00014 | 1.39 | 140.55 | | |
| | 1/10000 | 35.20 | 3.00 | 1.50 | 119.10 | 46.02 | 2.59 | 0.016 | 0.00010 | 1.18 | 140.32 | | |

| Lining | L/S | b m | d m | z | A sqm | P m | R m | n | S | V m/s | Q cum/s | Hc m | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ING-YOT | Q=175m3/s | | | | | | | | | | | | |
| Conc.Lining | 1/3000 | 15.00 | 3.795 | 1.50 | 78.53 | 28.68 | 2.74 | 0.016 | 0.00033 | 2.23 | 175.37 | | |
| | 1/5000 | 20.00 | 3.795 | 1.50 | 97.50 | 33.68 | 2.89 | 0.016 | 0.00020 | 1.80 | 175.05 | | Employed |
| | 1/7000 | 24.10 | 3.795 | 1.50 | 113.06 | 37.78 | 2.99 | 0.016 | 0.00014 | 1.55 | 175.39 | | |
| | 1/10000 | 29.20 | 3.795 | 1.50 | 132.42 | 42.88 | 3.09 | 0.016 | 0.00010 | 1.33 | 175.49 | | |
| | 1/3000 | 17.70 | 3.50 | 1.50 | 80.33 | 30.32 | 2.65 | 0.016 | 0.00033 | 2.18 | 175.49 | | |
| | 1/5000 | 23.40 | 3.50 | 1.50 | 100.28 | 36.02 | 2.78 | 0.016 | 0.00020 | 1.75 | 175.40 | | |
| | 1/7000 | 28.00 | 3.50 | 1.50 | 116.38 | 40.62 | 2.87 | 0.016 | 0.00014 | 1.51 | 175.36 | | |
| | 1/10000 | 33.88 | 3.50 | 1.50 | 136.96 | 46.50 | 2.95 | 0.016 | 0.00010 | 1.28 | 175.88 | | |
| | 1/3000 | 23.70 | 3.00 | 1.50 | 84.60 | 34.52 | 2.45 | 0.016 | 0.00033 | 2.07 | 175.49 | | |
| | 1/5000 | 31.00 | 3.00 | 1.50 | 106.50 | 41.82 | 2.55 | 0.016 | 0.00020 | 1.65 | 175.55 | | |
| | 1/7000 | 36.80 | 3.00 | 1.50 | 123.90 | 47.62 | 2.60 | 0.016 | 0.00014 | 1.41 | 175.10 | | |
| | 1/10000 | 44.20 | 3.00 | 1.50 | 146.10 | 55.02 | 2.66 | 0.016 | 0.00010 | 1.20 | 175.11 | | |

## Table 11.2.2 (1)-9 Hydraulic Dimensions in Culvert (Gradient & Section)

1) Hydraulic Section d/2r=1.60--1.6 d/r=0.80--0.84 V<3.00m/s

| d/2r | α=A/r^2 | P/r | β=R/r | β^(1/2) | β^(2/3) | α β^(2/3 | Q m3/s | n | I (slope) | | Qn/(I^0.5*r^(8/3) | r m | A sqm | R m | V1 m/s | Q m3/s | d m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Q=100m3/s | | | | | | | | | | | | | | | | | |
| 0.80 | 2.8696 | 4.6785 | 0.6134 | 0.7832 | 0.7219 | 2.0716 | 100.00 | 0.015 | 1/2700 | 0.000370 | 3.90 | 3.90 | 43.647 | 2.392 | 2.295 | 100.17 | 6.24 |
| 0.82 | 2.9324 | 4.7805 | 0.6134 | 0.7832 | 0.7219 | 2.1170 | 100.00 | 0.015 | 1/2800 | 0.000357 | 3.89 | 3.90 | 44.602 | 2.392 | 2.254 | 100.51 | 6.40 |
| 0.84 | 2.9924 | 4.8871 | 0.6123 | 0.7825 | 0.7211 | 2.1578 | 100.00 | 0.015 | 1/2900 | 0.000345 | 3.89 | 3.90 | 45.514 | 2.388 | 2.212 | 100.66 | 6.55 |
| Q=125m3/s | | | | | | | | | | | | | | | | | |
| 0.80 | 2.8696 | 4.6785 | 0.6134 | 0.7832 | 0.7219 | 2.0716 | 125.00 | 0.015 | 1/2900 | 0.000345 | 4.29 | 4.30 | 53.059 | 2.638 | 2.363 | 125.39 | 6.88 |
| 0.82 | 2.9924 | 4.8871 | 0.6123 | 0.7825 | 0.7211 | 2.1578 | 125.00 | 0.015 | 1/3100 | 0.000323 | 4.28 | 4.30 | 55.329 | 2.633 | 2.283 | 126.32 | 7.05 |
| 0.84 | 3.0524 | 4.9937 | 0.6112 | 0.7818 | 0.7203 | 2.1986 | 125.00 | 0.015 | 1/3200 | 0.000313 | 4.28 | 4.30 | 56.439 | 2.628 | 2.244 | 126.67 | 7.22 |
| Q=140m3/s | | | | | | | | | | | | | | | | | |
| 0.80 | 2.8696 | 4.6785 | 0.6134 | 0.7832 | 0.7219 | 2.0716 | 140.00 | 0.015 | 1/2000 | 0.000500 | 4.18 | 4.20 | 50.620 | 2.576 | 2.801 | 141.81 | 6.72 |
| 0.82 | 2.9324 | 4.7805 | 0.6134 | 0.7832 | 0.7219 | 2.1170 | 140.00 | 0.015 | 1/2100 | 0.000476 | 4.18 | 4.20 | 51.728 | 2.576 | 2.734 | 141.42 | 6.72 |
| 0.84 | 2.9924 | 4.8871 | 0.6123 | 0.7825 | 0.7211 | 2.1578 | 140.00 | 0.015 | 1/2200 | 0.000455 | 4.19 | 4.20 | 52.786 | 2.572 | 2.668 | 140.83 | 7.06 |
| * 0.80 | 2.8696 | 4.6785 | 0.6134 | 0.7832 | 0.7219 | 2.0716 | 140.00 | 0.015 | 1/2500 | 0.000400 | 4.36 | 4.35 | 54.300 | 2.668 | 2.565 | 139.28 | 6.96 |
| 0.82 | 2.9324 | 4.7805 | 0.6134 | 0.7832 | 0.7219 | 2.1170 | 140.00 | 0.015 | 1/2600 | 0.000385 | 4.36 | 4.40 | 56.771 | 2.699 | 2.534 | 143.88 | 7.04 |
| Q=160m3/s | | | | | | | | | | | | | | | | | |
| 0.80 | 2.8696 | 4.6785 | 0.6134 | 0.7832 | 0.7219 | 2.0716 | 160.00 | 0.015 | 1/2000 | 0.000526 | 4.35 | 4.40 | 55.555 | 2.699 | 2.965 | 164.71 | 7.04 |
| 0.82 | 2.9324 | 4.7805 | 0.6134 | 0.7832 | 0.7219 | 2.1170 | 160.00 | 0.015 | 1/2000 | 0.000500 | 4.36 | 4.40 | 56.771 | 2.699 | 2.890 | 164.05 | 7.04 |
| 0.84 | 2.9924 | 4.8871 | 0.6123 | 0.7825 | 0.7211 | 2.1578 | 160.00 | 0.015 | 1/2100 | 0.000476 | 4.37 | 4.40 | 57.933 | 2.694 | 2.817 | 163.18 | 7.39 |
| Q=175m3/s | | | | | | | | | | | | | | | | | |
| 0.80 | 2.8696 | 4.6785 | 0.6134 | 0.7832 | 0.7219 | 2.0716 | 175.00 | 0.015 | 1/2600 | 0.000385 | 4.77 | 4.80 | 66.116 | 2.944 | 2.686 | 177.58 | 7.68 |
| 0.82 | 2.9324 | 4.7805 | 0.6134 | 0.7832 | 0.7219 | 2.1170 | 175.00 | 0.015 | 1/2700 | 0.000370 | 4.77 | 4.80 | 67.562 | 2.944 | 2.636 | 178.07 | 7.68 |
| 0.84 | 2.9924 | 4.8871 | 0.6123 | 0.7825 | 0.7211 | 2.1578 | 175.00 | 0.015 | 1/2900 | 0.000345 | 4.80 | 4.80 | 68.945 | 2.939 | 2.540 | 175.13 | 8.06 |
| * 0.84 | 2.9924 | 4.8871 | 0.6123 | 0.7825 | 0.7211 | 2.1578 | 175.00 | 0.015 | 1/2500 | 0.000400 | 4.67 | 4.70 | 66.102 | 2.878 | 2.698 | 178.32 | 7.90 |

## Tabke 11.2.2 (1)-10 Hydraulic Dimensions in Kok-Ing Culvert

Q=140m3/s

Rectangular type

| d m | b m | Section | z | P m | n | I (slope) | | A sq. | R m | V m/s | Q cum/s |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.85 | 21.40 | H=4.55 B=3.60*6 | 0.00 | 67.60 | 0.015 | 1/2000 | 0.000500 | 82.39 | 1.22 | 1.70 | 140.14 |
| 3.85 | 23.10 | H=4.55 B=3.85*6 | 0.00 | 69.30 | 0.015 | 1/2500 | 0.000400 | 88.94 | 1.28 | 1.57 | 140.04 |
| 3.85 | 25.80 | H=4.55 B=3.70*7 | 0.00 | 79.70 | 0.015 | 1/3000 | 0.000333 | 99.33 | 1.25 | 1.41 | 140.02 |
| 3.85 | 32.10 | H=4.55 B=4.00*8 | 0.00 | 93.70 | 0.015 | 1/5000 | 0.000200 | 123.59 | 1.32 | 1.13 | 140.13 |

d/2r=1.60 d/r=0.80 V<3.00m/s Qn/(I^0.5*r^(8/3))

| d/2r | α=A/r^2 | P/r | β=R/r | β^(1/2) | β^(2/3) | α β^(2/3) | Q m3/s | n | I (slope) | | r m | | A sq. | R m | V1 m/s | Q m3/s | d m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Circular type | | | | | | | | | | | | | | | | | |
| 0.80 | 2.6943 | 4.4286 | 0.6084 | 0.78 | 0.718 | 1.9435 | 140.00 | 0.015 | 1/2000 | 0.000500 | 4.28 | 4.30 | 49.818 | 2.616 | 2.830 | 141.00 | 6.88 |
| 0.80 | 2.6943 | 4.4286 | 0.6084 | 0.78 | 0.718 | 1.9435 | 140.00 | 0.015 | 1/2500 | 0.000400 | 4.46 | 4.50 | 54.560 | 2.738 | 2.609 | 142.37 | 7.20 |
| 0.80 | 2.6943 | 4.4286 | 0.6084 | 0.78 | 0.718 | 1.9435 | 140.00 | 0.015 | 1/3000 | 0.000333 | 4.62 | 4.70 | 59.517 | 2.859 | 2.452 | 145.94 | 7.52 |
| 0.80 | 2.6943 | 4.4286 | 0.6084 | 0.78 | 0.718 | 1.9435 | 140.00 | 0.015 | 1/5000 | 0.000200 | 5.08 | 5.10 | 70.079 | 3.103 | 2.006 | 140.56 | 8.16 |
| Horse shoe | | | | | | | | | | | | | | | | | |
| 0.80 | 2.8696 | 4.6785 | 0.6134 | 0.7832 | 0.7219 | 2.0716 | 140.00 | 0.015 | 1/2000 | 0.000500 | 4.18 | 4.20 | 50.620 | 2.576 | 2.801 | 141.81 | 6.72 |
| 0.80 | 2.8696 | 4.6785 | 0.6134 | 0.7832 | 0.7219 | 2.0716 | 140.00 | 0.015 | 1/2500 | 0.000400 | 4.36 | 4.35 | 54.300 | 2.668 | 2.565 | 139.28 | 6.96 |
| 0.80 | 2.8696 | 4.6785 | 0.6134 | 0.7832 | 0.7219 | 2.0716 | 140.00 | 0.015 | 1/3000 | 0.000333 | 4.51 | 4.50 | 58.109 | 2.760 | 2.395 | 139.18 | 7.20 |
| 0.80 | 2.8696 | 4.6785 | 0.6134 | 0.7832 | 0.7219 | 2.0716 | 140.00 | 0.015 | 1/5000 | 0.000200 | 4.96 | 5.00 | 71.740 | 3.067 | 1.990 | 142.78 | 8.00 |

(3) **Design by JICA**

(a) Siphon

*Location and Length of Siphon*

Four siphons are placed at Kok basin diversion canal to cross under existing big river. Inverted siphons with covering of 1 or 1.5 m earth is buried under the riverbed. Proposed water level, riverbed level and length of siphons are shown in Table 11.2.2 (3)-5. In a case of Lao river with one existing weir at down stream, riverbed level is higher than water level of diversion canal.

**Table 11.2.2 (3)-5 Water level , River Bed Level and Length of Siphon**

| No. | Siphon name | Station | Water Level | River bed level | Length (m) | Remarks |
|---|---|---|---|---|---|---|
| S-1 | Nam Mea Kon | 1+160.475 | 387.54 | 386.7 | 140.50 | |
| S-2 | Nam Mea Lao | 3+619.675 | 386.30 | 387.3 | 218.00 | |
| S-3 | Huai Mae Hang | 9+ 8.475 | 384.37 | 382.1 | 168.00 | |
| S-4 | Nam Mae Sakoen | 11+685.405 | 383.03 | 382.4 | 198.00 | |
| | Total length | | | | 724.50 | |

*Cross section*

The section of siphon is usually applied with about 1.5 times velocity of open canal one's to reduce cross sectional area. Dimensions on siphon is shown in Table 11.2.2 (3)-6

**Table 11.2.2 (3)-6 Dimensions on Siphon**

| Discharge | Width (m) | Height (m) | Rows | Flow area | Coefficient Roughness | Velocity | Remarks |
|---|---|---|---|---|---|---|---|
| Q(cu.m/s) | W(m) | H(m) | 4 | A(sq.m) | n | V(m) | |
| 140.00 | 3.60 | 3.60 | 4 | 51.84 | 0.015 | 2.70 | |

*Foundation*

Foundation of siphon would be applied for direct foundation except Nam Mae Hang siphon based on drilling investigation.

- Nam Mae Kon N value at foundation N=18 to 20 Sandy Soil (SM) Direct foundation
- Nam Mae Lao N=28 to 32 Clay soil (CH) Direct foundation
- Nam Mae Hang N= 8 to 24 Clay soil (CH) Direct/Pile found.
- Nam Mae Sakoen N=15 to 45 Clay soil (CH) Direct foundation

(b) Detail hydraulic calculation

Detail hydraulic calculations are shown in Table 11.2.2 (3)-7 to17 and results of calculation is shown in Database Maps.

(c) List of structures

Structure lists are shown in Table 11.2.2 (3)-8 to 22.

(d) Quantity

Quantities are shown in Table in 11.2.2 (3)-23 to 26

(e) Spoil bank volume and area

Calculation of spoils bank volume and area are shown in Table 11.2.2 (3)-27 to 28 and location of spoil bank area is shown in Data Base Map.

## Table 11.2.2 (3)-7 Hydraulic Computation of Kok-Ing Diversion Canal (1/11)

| Station (KM) | Structure | $Q_{req.}$ ($m^3/s$) | $Q_{des.}$ ($m^3/s$) | b (m) | d (m) | $H_c$ (m) | H (m) | L.S. | S.S. | n | A ($m^2$) | R (m) | V (m/s) | $h_v$ (m) | Distance, $\Delta L$ (m) | Head Losses (m) $\Delta H$ Calc. | Head Losses (m) $\Delta H$ Provide | Height of E.G.L. | FSL. | BL. | Top Conc Lining El. | TBL. | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0+045 | Beginning of Approach Channel | 140.00 | 141.848 | 230.00 | 4.000 | - | vary | 1: 750,000 | 1: 2.0 | 0.019 | 952.000 | 3.840 | 0.149 | 0.001 | | | | 388.001 | 388.000 | 384.000 | - | 391.000 | |
| | | | | | | | | | | | | | | | 355.000 | 0.000 | 0.000 | | | | | | |
| 0+400 | End of Approach Channel | 140.00 | 141.848 | 230.00 | 4.000 | - | vary | 1: 750,000 | 1: 2.0 | 0.019 | 952.000 | 3.840 | 0.149 | 0.001 | | | | 388.001 | 388.000 | 384.000 | - - | 391.000 | |
| | | | 140.000 | Intake Structure | | 8-12.00x2.00 m. | | Fixed Wheel Gates | | | | | | | 325.000 | 0.400 | 0.246 | | | | | | ΔW.S.= 0.400 m. |
| 0+725 | Beginning of Concrete Lined Canal (Reach 1) | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 387.755 | 387.600 | 383.750 | 388.300 | 389.500 | |
| | | | | | | | | | | | | | | | 225.000 | 0.045 | 0.045 | | | | | | |
| 0+950 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 387.710 | 387.555 | 383.705 | 388.255 | 389.500 | |
| | | | | | | | | | | | | | | | 69.975 | 0.014 | 0.014 | | | | | | |
| 1+019.975 | Beginning of Nam Mae Kon Siphon | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 387.696 | 387.541 | 383.691 | 388.241 | 389.500 | |
| | | | 140.000 | Design Section of Siphon | | | 4-3.60x3.60 m. | | | 0.016 | 51.840 | 0.900 | 2.701 | 0.372 | 140.500 | 0.668 | 0.750 | | | | | | ΔW.S.= 0.750 m. |
| 1+160.475 | End of Nam Mae Kon Siphon | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 386.946 | 386.791 | 382.941 | 387.491 | 389.500 | |
| | | | | | | | | | | | | | | | 178.525 | 0.036 | 0.036 | | | | | | |
| 1+339 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 386.910 | 386.755 | 382.905 | 387.455 | 389.500 | |
| | | | | | | | | | | | | | | | 54.000 | 0.011 | 0.011 | | | | | | |
| 1+393 | Highway No.1232 Bridge, 11.00 m. Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 386.899 | 386.744 | 382.894 | 387.444 | 389.500 | |
| | | | | | | | | | | | | | | | 211.000 | 0.042 | 0.042 | | | | | | |
| 1+604 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 386.857 | 386.702 | 382.852 | 387.402 | 389.500 | |
| | | | | | | | | | | | | | | | 579.000 | 0.116 | 0.116 | | | | | | |
| 2+183 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 386.741 | 386.586 | 382.736 | 387.286 | 389.500 | |
| | | | | | | | | | | | | | | | 345.000 | 0.069 | 0.069 | | | | | | |
| 2+528 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 386.672 | 386.517 | 382.667 | 387.217 | 389.500 | |
| | | | | | | | | | | | | | | | 201.500 | 0.040 | 0.040 | | | | | | |
| 2+729.500 | Drain Culvert 3-2.00x2.00 m. (Nam Mae Hang) | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 386.632 | 386.477 | 382.627 | 387.177 | 389.500 | |
| | | | | | | | | | | | | | | | 270.500 | 0.054 | 0.054 | | | | | | |
| 3+000 | Station of Changing of TBL. El. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 386.578 | 386.423 | 382.573 | 387.123 | 389.500 | |
| | | | | | | | | | | | | | | | 70.000 | 0.014 | 0.014 | | | | | | |
| 3+070 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 386.564 | 386.409 | 382.559 | 387.109 | 389.782 | |
| | | | | | | | | | | | | | | | 35.000 | 0.007 | 0.007 | | | | | | |
| 3+105 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 386.557 | 386.402 | 382.552 | 387.102 | 389.923 | |
| | | | | | | | | | | | | | | | 146.000 | 0.029 | 0.029 | | | | | | |
| 3+251 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 386.528 | 386.373 | 382.523 | 387.073 | 390.512 | |
| | | | | | | | | | | | | | | | 249.000 | 0.050 | 0.050 | | | | | | |
| 3+500 | End of Sheet 1 & Beginning of Sheet 2 | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 386.478 | 386.323 | 382.473 | 387.023 | 391.517 | |

## Table 11.2.2 (3)-8 Hydraulic Computation of Kok-Ing Diversion Canal (2/11)

| Station (KM) | Structure | $Q_{re}$ ($m^3/s$) | $Q_{des}$ ($m^3/s$) | b (m) | d (m) | $H_c$ (m) | H (m) | L.S. | S.S. | n | A ($m^2$) | R (m) | V (m/s) | $h_v$ (m) | Distance, ΔL (m) | Head Losses (m) ΔH Calc. | Head Losses (m) ΔH Provide | Height of E.G.L. | FSL. | BL. | Top Conc Lining El. | TBL. | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | 119.675 | 0.024 | 0.024 | | | | | | |
| 3+619.675 | Beginning of Nam Mae Lao Siphon | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 386.454 | 386.299 | 382.449 | 386.999 | 392.000 | |
| | | | 140.000 | Design Section of Siphon | | | 4-3.60x3.60 m. | | | 0.016 | 51.840 | 0.900 | 2.701 | 0.372 | 218.000 | 0.851 | 0.900 | | | | | | ΔW.S.= 0.900 m. |
| 3+837.675 | End of Nam Mae Lao Siphon | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 385.554 | 385.399 | 381.549 | 386.099 | 392.000 | |
| | | | | | | | | | | | | | | | 162.325 | 0.032 | 0.032 | | | | | | |
| 4+000 | Station of Changing of TBL. El. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 385.522 | 385.367 | 381.517 | 386.067 | 391.000 | |
| | | | | | | | | | | | | | | | 52.000 | 0.010 | 0.010 | | | | | | |
| 4+052 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 385.512 | 385.357 | 381.507 | 386.057 | 390.956 | |
| | | | | | | | | | | | | | | | 85.500 | 0.017 | 0.017 | | | | | | |
| 4+137.500 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 385.495 | 385.340 | 381.490 | 386.040 | 390.884 | |
| | | | | | | | | | | | | | | | 302.500 | 0.061 | 0.061 | | | | | | |
| 4+440 | Roadway Bridge, 4.00 m. Roadway Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 385.434 | 385.279 | 381.429 | 385.979 | 390.629 | |
| | | | | | | | | | | | | | | | 152.000 | 0.030 | 0.030 | | | | | | |
| 4+592 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 385.404 | 385.249 | 381.399 | 385.949 | 390.501 | |
| | | | | | | | | | | | | | | | 5.500 | 0.001 | 0.001 | | | | | | |
| 4+597.500 | Roadway Bridge, 4.00 m. Roadway Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 385.403 | 385.248 | 381.398 | 385.948 | 390.496 | |
| | | | | | | | | | | | | | | | 213.500 | 0.043 | 0.043 | | | | | | |
| 4+811 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 385.360 | 385.205 | 381.355 | 385.905 | 390.316 | |
| | | | | | | | | | | | | | | | 89.000 | 0.018 | 0.018 | | | | | | |
| 4+900 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 385.342 | 385.187 | 381.337 | 385.887 | 390.241 | |
| | | | | | | | | | | | | | | | 137.000 | 0.027 | 0.027 | | | | | | |
| 5+037 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 385.315 | 385.160 | 381.310 | 385.860 | 390.125 | |
| | | | | | | | | | | | | | | | 627.000 | 0.125 | 0.125 | | | | | | |
| 5+664 | Roadway Bridge, 4.00 m. Roadway Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 385.190 | 385.035 | 381.185 | 385.735 | 389.596 | |
| | | | | | | | | | | | | | | | 10.000 | 0.002 | 0.002 | | | | | | |
| 5+674 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 385.188 | 385.033 | 381.183 | 385.733 | 389.588 | |
| | | | | | | | | | | | | | | | 459.000 | 0.092 | 0.092 | | | | | | |
| 6+133 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 385.096 | 384.941 | 381.091 | 385.641 | 389.201 | |
| | | | | | | | | | | | | | | | 387.000 | 0.077 | 0.077 | | | | | | |
| 6+520 | Station of Changing of TBL. El. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 385.019 | 384.864 | 381.014 | 385.564 | 389.200 | |
| | | | | | | | | | | | | | | | 20.000 | 0.004 | 0.004 | | | | | | |
| 6+540 | Station of Changing of TBL. El. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 385.015 | 384.860 | 381.010 | 385.560 | 389.850 | |
| | | | | | | | | | | | | | | | 92.000 | 0.018 | 0.018 | | | | | | |

## Table 11.2.2 (3)-9 Hydraulic Computation of Kok-Ing Diversion Canal (3/11)

| Station (KM) | Structure | $Q_{req.}$ ($m^3/s$) | $Q_{des.}$ ($m^3/s$) | b (m) | d (m) | $H_c$ (m) | H (m) | L.S. | S.S. | n | A ($m^2$) | R (m) | V (m/s) | $h_v$ (m) | Distance, ΔL (m) | Head Losses (m) ΔH Calc. | Head Losses (m) ΔH Provide | Height of E.G.L. | FSL. | BL. | Top Conc Lining El. | TBL. | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6+632 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.6 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 384.997 | 384.842 | 380.992 | 385.542 | 389.850 | |
| | | | | | | | | | | | | | | | 6.000 | 0.001 | 0.001 | | | | | | |
| 6+638 | Highway No.1232 Bridge, 11.00 m. Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 384.996 | 384.841 | 380.991 | 385.541 | 389.850 | |
| | | | | | | | | | | | | | | | 102.000 | 0.020 | 0.020 | | | | | | |
| 6+740 | Station of Changing of TBL. El. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 384.976 | 384.821 | 380.971 | 385.521 | 389.850 | |
| | | | | | | | | | | | | | | | 20.000 | 0.004 | 0.004 | | | | | | |
| 6+760 | Station of Changing of TBL. El. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 384.972 | 384.817 | 380.967 | 385.517 | 389.000 | |
| | | | | | | | | | | | | | | | 90.500 | 0.018 | 0.018 | | | | | | |
| 6+850.500 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 384.954 | 384.799 | 380.949 | 385.499 | 388.989 | |
| | | | | | | | | | | | | | | | 149.500 | 0.030 | 0.030 | | | | | | |
| 7+000 | End of Sheet 2 & Beginning of Sheet 3 | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 384.924 | 384.769 | 380.919 | 385.469 | 388.939 | |
| | | | | | | | | | | | | | | | 987.000 | 0.197 | 0.197 | | | | | | |
| 7+987 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 384.727 | 384.572 | 380.722 | 385.272 | 388.856 | |
| | | | | | | | | | | | | | | | 168.000 | 0.034 | 0.034 | | | | | | |
| 8+155 | Highway No.1173 Bridge, 11.00 m. Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 384.693 | 384.538 | 380.688 | 385.238 | 388.308 | |
| | | | | | | | | | | | | | | | 45.000 | 0.009 | 0.009 | | | | | | |
| 8+200 | Station of Changing of TBL. El. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 384.684 | 384.529 | 380.679 | 385.229 | 388.200 | |
| | | | | | | | | | | | | | | | 40.000 | 0.008 | 0.008 | | | | | | |
| 8+240 | Station of Changing of TBL. El. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 384.676 | 384.521 | 380.671 | 385.221 | 387.000 | |
| | | | | | | | | | | | | | | | 42.500 | 0.009 | 0.009 | | | | | | |
| 8+282.500 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 384.667 | 384.512 | 380.662 | 385.212 | 387.000 | |
| | | | | | | | | | | | | | | | 247.500 | 0.050 | 0.050 | | | | | | |
| 8+530 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 384.617 | 384.462 | 380.612 | 385.162 | 387.000 | |
| | | | | | | | | | | | | | | | 281.000 | 0.056 | 0.056 | | | | | | |
| 8+811 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 384.561 | 384.406 | 380.556 | 385.106 | 387.000 | |
| | | | | | | | | | | | | | | | 76.000 | 0.015 | 0.015 | | | | | | |
| 8+887 | Roadway Bridge, 4.00 m. Roadway Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 384.546 | 384.391 | 380.541 | 385.091 | 387.000 | |
| | | | | | | | | | | | | | | | 2.700 | 0.001 | 0.001 | | | | | | |
| 8+889.700 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 384.545 | 384.390 | 380.540 | 385.090 | 387.000 | |
| | | | | | | | | | | | | | | | 118.775 | 0.024 | 0.024 | | | | | | |
| 9+008.475 | Beginning of Huai Mae Hang Siphon | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 384.521 | 384.366 | 380.516 | 385.066 | 387.000 | |
| | | | 140.000 | Design Section of Siphon | | | 4-3.60x3.60 m. | | | 0.016 | 51.840 | 0.900 | 2.701 | 0.372 | 168.000 | 0.733 | 0.850 | | | | | | ΔW.S.= 0.850 m. |
| 9+176.475 | End of Huai Mae Hang Siphon | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 383.671 | 383.516 | 379.666 | 384.216 | 387.000 | |
| | | | | | | | | | | | | | | | 329.025 | 0.066 | 0.066 | | | | | | |

## Table 11.2.2 (3)-10 Hydraulic Computation of Kok-Ing Diversion Canal (4/11)

| Station (KM) | Structure | $Q_{req.}$ ($m^3/s$) | $Q_{dev.}$ ($m^3/s$) | b (m) | d (m) | $H_c$ (m) | H (m) | L.S. | S.S. | n | A ($m^2$) | R (m) | V (m/s) | $h_v$ (m) | Distance, ΔL (m) | Head Losses (m) ΔH Calc. | Head Losses (m) ΔH Provide | Height of E.G.L. | FSL. | BL. | Top Conc Lining El. | TBL. | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9+505.500 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 383.605 | 383.450 | 379.600 | 384.150 | 387.000 | |
| | | | | | | | | | | | | | | | 133.500 | 0.027 | 0.027 | | | | | | |
| 9+639 | Roadway Bridge, 4.00 m. Roadway Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 383.578 | 383.423 | 379.573 | 384.123 | 387.000 | |
| | | | | | | | | | | | | | | | 285.000 | 0.057 | 0.057 | | | | | | |
| 9+924 | Roadway Bridge, 4.00 m. Roadway Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 383.521 | 383.366 | 379.516 | 384.066 | 387.000 | |
| | | | | | | | | | | | | | | | 3.000 | 0.001 | 0.001 | | | | | | |
| 9+927 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 383.520 | 383.365 | 379.515 | 384.065 | 387.000 | |
| | | | | | | | | | | | | | | | 167.000 | 0.033 | 0.033 | | | | | | |
| 10+094 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 383.487 | 383.332 | 379.482 | 384.032 | 387.000 | |
| | | | | | | | | | | | | | | | 400.500 | 0.080 | 0.080 | | | | | | |
| 10+494.500 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 383.407 | 383.252 | 379.402 | 383.952 | 387.000 | |
| | | | | | | | | | | | | | | | 5.500 | 0.001 | 0.001 | | | | | | |
| 10+500 | End of Sheet 3 & Beginning of Sheet 4 | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 383.406 | 383.251 | 379.401 | 383.951 | 387.000 | |
| | | | | | | | | | | | | | | | 499.500 | 0.100 | 0.100 | | | | | | |
| 10+999.500 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 383.306 | 383.151 | 379.301 | 383.851 | 387.000 | |
| | | | | | | | | | | | | | | | 8.500 | 0.002 | 0.002 | | | | | | |
| 11+008 | Roadway Bridge, 4.00 m. Roadway Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 383.304 | 383.149 | 379.299 | 383.849 | 387.000 | |
| | | | | | | | | | | | | | | | 172.000 | 0.034 | 0.034 | | | | | | |
| 11+180 | Station of Changing of TBL. El. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 383.270 | 383.115 | 379.265 | 383.815 | 387.000 | |
| | | | | | | | | | | | | | | | 20.000 | 0.004 | 0.004 | | | | | | |
| 11+200 | Station of Changing of TBL. El. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 383.266 | 383.111 | 379.261 | 383.811 | 386.000 | |
| | | | | | | | | | | | | | | | 342.302 | 0.068 | 0.068 | | | | | | |
| 11+542.302 | Equation - Back | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 383.198 | 383.043 | 379.193 | 383.743 | 386.000 | |
| 11+621.024 | Equation - Ahead | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 383.198 | 383.043 | 379.193 | 383.743 | 386.000 | |
| | | | | | | | | | | | | | | | 64.381 | 0.013 | 0.013 | | | | | | |
| 11+685.405 | Beginning of Nam Mae Sakoen Siphon | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 383.185 | 383.030 | 379.180 | 383.730 | 386.000 | |
| | | | 140.000 | Design Section of Siphon | | | 4-3.60x3.60 m. | | | 0.016 | 51.840 | 0.900 | 2.701 | 0.372 | 198.000 | 0.804 | 0.850 | | | | | | ΔW.S.= 0.850 m. |
| 11+883.405 | End of Nam Mae Sakoen Siphon | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 382.335 | 382.180 | 378.330 | 382.880 | 386.000 | |
| | | | | | | | | | | | | | | | 397.715 | 0.080 | 0.080 | | | | | | |
| 12+281.120 | End of Concrete Lined Canal (Reach 1) | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 382.255 | 382.100 | 378.250 | 382.800 | 392.000 | |
| | | | | | | | | | | | | | | | 29.000 | 0.083 | 0.083 | | | | | | ΔW.S.= 0.249 m. |
| 12+310.120 | Inlet of Tunnel No.1 | 140.00 | 140.006 | r=5.50 | 6.198 | H=7.50 | - | 1: 2,500 | - | 0.015 | 55.757 | 2.585 | 2.511 | 0.321 | | | | 382.172 | 381.851 | 375.653 | 383.153 | - | |
| | | | | | | | | | | | | | | | 1,689.880 | 0.676 | 0.676 | | | | | | |
| 14+000 | End of Sheet 4 & Beginning of Sheet 5 | 140.00 | 140.006 | r=5.50 | 6.198 | H=7.50 | - | 1: 2,500 | - | 0.015 | 55.757 | 2.585 | 2.511 | 0.321 | | | | 381.496 | 381.175 | 374.977 | 382.477 | - | |

## Table 11.2.2 (3)-11 Hydraulic Computation of Kok-Ing Diversion Canal (5/11)

| Station (KM) | Structure | $Q_{req.}$ ($m^3/s$) | $Q_{des.}$ ($m^3/s$) | b (m) | d (m) | $H_C$ (m) | H (m) | L.S. | S.S. | n | A ($m^2$) | R (m) | V (m/s) | $h_v$ (m) | Distance, $\Delta L$ (m) | Head Losses (m) $\Delta H$ Calc. | Head Losses (m) $\Delta H$ Provide | Height of E.G.L. | FSL. | BL. | Top Conc Lining El. | TBL. | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | 1,320.604 | 0.528 | 0.528 | | | | | | |
| 15+320.604 | Outlet of Tunnel No.1 | 140.00 | 140.006 | r=5.50 | 6.198 | H=7.50 | - | 1: 2,500 | - | 0.015 | 55.757 | 2.585 | 2.511 | 0.321 | | | | 380.968 | 380.647 | 374.449 | 381.949 | - | |
| | | | | | | | | | | | | | | | 25.000 | 0.014 | 0.014 | | | | | | ΔW.S.= 0.042 m. |
| 15+345.604 | Beginning of Cut & Cover Conduit | 140.00 | 141.023 | r=4.35 | 7.000 | H=8.70 | - | 1: 2,500 | - | 0.015 | 53.887 | 2.667 | 2.617 | 0.349 | | | | 380.954 | 380.605 | 373.605 | 382.305 | 395.000 | |
| | | | | | | | | | | | | | | | 1,220.396 | 0.488 | 0.488 | | | | | | |
| 16+566 | End of Cut & Cut Conduit | 140.00 | 141.023 | r=4.35 | 7.000 | H=8.70 | - | 1: 2,500 | - | 0.015 | 53.887 | 2.667 | 2.617 | 0.349 | | | | 380.466 | 380.117 | 373.117 | 381.817 | 389.000 | |
| | | | | | | | | | | | | | | | 34.000 | 0.161 | 0.161 | | | | | | ΔW.S.= -0.035 m. |
| 16+600 | Beginning of Concrete Lined Canal (Reach 2) | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 380.305 | 380.150 | 376.300 | 380.850 | 389.000 | |
| | | | | | | | | | | | | | | | 526.604 | 0.105 | 0.105 | | | | | | |
| 17+126.604 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 380.200 | 380.045 | 376.195 | 380.745 | 386.367 | |
| | | | | | | | | | | | | | | | 3.500 | 0.001 | 0.001 | | | | | | |
| 17+130.104 | Roadway Bridge, 4.00 m. Roadway Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 380.199 | 380.044 | 376.194 | 380.744 | 386.350 | |
| | | | | | | | | | | | | | | | 369.896 | 0.074 | 0.074 | | | | | | |
| 17+500 | End of Sheet 5 & Beginning of Sheet 6 | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 380.125 | 379.970 | 376.120 | 380.670 | 384.500 | |
| | | | | | | | | | | | | | | | 243.604 | 0.049 | 0.049 | | | | | | |
| 17+743.604 | Roadway Bridge, 7.00 m. Roadway Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 380.076 | 379.921 | 376.071 | 380.621 | 384.500 | |
| | | | | | | | | | | | | | | | 50.000 | 0.010 | 0.010 | | | | | | |
| 17+793.604 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 380.066 | 379.911 | 376.061 | 380.611 | 384.500 | |
| | | | | | | | | | | | | | | | 607.000 | 0.121 | 0.121 | | | | | | |
| 18+400.604 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 379.945 | 379.790 | 375.940 | 380.490 | 384.500 | |
| | | | | | | | | | | | | | | | 1,339.396 | 0.268 | 0.268 | | | | | | |
| 19+740 | Station of Changing of TBL. El. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 379.677 | 379.522 | 375.672 | 380.222 | 384.500 | |
| | | | | | | | | | | | | | | | 840.604 | 0.168 | 0.168 | | | | | | |
| 20+580.604 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 379.509 | 379.354 | 375.504 | 380.054 | 386.446 | |
| | | | | | | | | | | | | | | | 239.396 | 0.048 | 0.048 | | | | | | |
| 20+820 | Station of Changing of TBL. El. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 379.461 | 379.306 | 375.456 | 380.006 | 387.000 | |
| | | | | | | | | | | | | | | | 60.000 | 0.012 | 0.012 | | | | | | |
| 20+880 | Station of Changing of TBL. El. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 379.449 | 379.294 | 375.444 | 379.994 | 388.350 | |
| | | | | | | | | | | | | | | | 88.604 | 0.018 | 0.018 | | | | | | |
| 20+968.604 | Highway Bridge, 11.00 m. Roadway Width (Hig | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 379.431 | 379.276 | 375.426 | 379.976 | 388.350 | |
| | | | | | | | | | | | | | | | 31.396 | 0.006 | 0.006 | | | | | | |
| 21+000 | End of Sheet 6 & Beginning of Sheet 7 | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 379.425 | 379.270 | 375.420 | 379.970 | 388.350 | |
| | | | | | | | | | | | | | | | 240.000 | 0.048 | 0.048 | | | | | | |

## Table 11.2.2 (3)-12 Hydraulic Computation of Kok-Ing Diversion Canal (6/11)

| Station (KM) | Structure | $Q_{req}$ ($m^3/s$) | $Q_{des}$ ($m^3/s$) | b (m) | d (m) | $H_c$ (m) | H (m) | L.S. | S.S. | n | A ($m^2$) | R (m) | V (m/s) | $h_v$ (m) | Distance, ΔL (m) | Head Losses (m) ΔH Calc. | Head Losses (m) ΔH Provide | Height of E.G.L. | FSL. | BL. | Top Conc Lining El. | TBL. | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21+240 | Station of Changing of TBL. El. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 379.377 | 379.222 | 375.372 | 379.922 | 388.350 | |
| | | | | | | | | | | | | | | | 697.604 | 0.140 | 0.140 | | | | | | |
| 21+937.604 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 379.237 | 379.082 | 375.232 | 379.782 | 391.402 | |
| | | | | | | | | | | | | | | | 22.396 | 0.004 | 0.004 | | | | | | |
| 21+960 | End of Concrete Lined Canal (Reach 2) | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 379.233 | 379.078 | 375.228 | 379.778 | 391.500 | |
| | | | | | | | | | | | | | | | 29.000 | 0.095 | 0.095 | | | | | | ΔW.S.= 0.289 m. |
| 21+989 | Beginning of Cut & Cover Conduit | 140.00 | 141.023 | r=4.35 | 7.000 | H=8.70 | - | 1: 2,500 | - | 0.015 | 53.887 | 2.667 | 2.617 | 0.349 | | | | 379.138 | 378.789 | 371.789 | 380.489 | - | |
| | | | | | | | | | | | | | | | 949.604 | 0.380 | 0.380 | | | | | | |
| 22+938.604 | Asphalt Road to Ban Doi Ngam | 140.00 | 141.023 | r=4.35 | 7.000 | H=8.70 | - | 1: 2,500 | - | 0.015 | 53.887 | 2.667 | 2.617 | 0.349 | | | | 378.758 | 378.409 | 371.409 | 380.109 | - | |
| | | | | | | | | | | | | | | | 253.000 | 0.101 | 0.101 | | | | | | |
| 23+191.604 | Nam Mae Tak | 140.00 | 141.023 | r=4.35 | 7.000 | H=8.70 | - | 1: 2,500 | - | 0.015 | 53.887 | 2.667 | 2.617 | 0.349 | | | | 378.657 | 378.308 | 371.308 | 380.008 | - | |
| | | | | | | | | | | | | | | | 1,308.396 | 0.523 | 0.523 | | | | | | |
| 24+500 | End of Sheet 7 & Beginning of Sheet 8 | 140.00 | 141.023 | r=4.35 | 7.000 | H=8.70 | - | 1: 2,500 | - | 0.015 | 53.887 | 2.667 | 2.617 | 0.349 | | | | 378.134 | 377.785 | 370.785 | 379.485 | - | |
| | | | | | | | | | | | | | | | 283.968 | 0.114 | 0.114 | | | | | | |
| 24+783.968 | Equation - Back | 140.00 | 141.023 | r=4.35 | 7.000 | H=8.70 | - | 1: 2,500 | - | 0.015 | 53.887 | 2.667 | 2.617 | 0.349 | | | | 378.020 | 377.671 | 370.671 | 379.371 | - | |
| 24+724.562 | Equation - Ahead | 140.00 | 141.023 | r=4.35 | 7.000 | H=8.70 | - | 1: 2,500 | - | 0.015 | 53.887 | 2.667 | 2.617 | 0.349 | | | | 378.020 | 377.671 | 370.671 | 379.371 | - | |
| | | | | | | | | | | | | | | | 1,415.215 | 0.566 | 0.566 | | | | | | |
| 26+139.777 | End of Cut & Cover Conduit | 140.00 | 141.023 | r=4.35 | 7.000 | H=8.70 | - | 1: 2,500 | - | 0.015 | 53.887 | 2.667 | 2.617 | 0.349 | | | | 377.454 | 377.105 | 370.105 | 378.805 | - | |
| | | | | | | | | | | | | | | | 25.000 | 0.017 | 0.017 | | | | | | ΔW.S.= -0.011 m. |
| 26+164.777 | Inlet of Tunnel No.2 | 140.00 | 140.006 | r=5.50 | 6.198 | H=7.50 | - | 1: 2,500 | - | 0.015 | 55.757 | 2.585 | 2.511 | 0.321 | | | | 377.437 | 377.116 | 370.918 | 378.418 | - | |
| | | | | | | | | | | | | | | | 1,835.223 | 0.734 | 0.734 | | | | | | |
| 28+000 | End of Sheet 8 & Beginning of Sheet 9 | 140.00 | 140.006 | r=5.50 | 6.198 | H=7.50 | - | 1: 2,500 | - | 0.015 | 55.757 | 2.585 | 2.511 | 0.321 | | | | 376.703 | 376.382 | 370.184 | 377.684 | - | |
| | | | | | | | | | | | | | | | 3,500.000 | 1.400 | 1.400 | | | | | | |
| 31+500 | End of Sheet 9 & Beginning of Sheet 10 | 140.00 | 140.006 | r=5.50 | 6.198 | H=7.50 | - | 1: 2,500 | - | 0.015 | 55.757 | 2.585 | 2.511 | 0.321 | | | | 375.303 | 374.982 | 368.784 | 376.284 | - | |
| | | | | | | | | | | | | | | | 23.254 | 0.009 | 0.009 | | | | | | |
| 31+523.254 | Outlet of Tunnel No.2 | 140.00 | 140.006 | r=5.50 | 6.198 | H=7.50 | - | 1: 2,500 | - | 0.015 | 55.757 | 2.585 | 2.511 | 0.321 | | | | 375.294 | 374.973 | 368.775 | 376.275 | - | |
| | | | | | | | | | | | | | | | 34.000 | 0.139 | 0.139 | | | | | | ΔW.S.= -0.027 m. |
| 31+557.254 | Beginning of Concrete Lined Canal (Reach 3) | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 375.155 | 375.000 | 371.150 | 375.700 | 388.000 | |
| | | | | | | | | | | | | | | | 529.000 | 0.106 | 0.106 | | | | | | |
| 32+086.254 | Roadway Bridge, 4.00 m. Roadway Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 375.049 | 374.894 | 371.044 | 375.594 | 380.500 | |
| | | | | | | | | | | | | | | | 223.000 | 0.045 | 0.045 | | | | | | |
| 32+309.254 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 375.004 | 374.849 | 370.999 | 375.549 | 377.338 | |
| | | | | | | | | | | | | | | | 70.746 | 0.014 | 0.014 | | | | | | |
| 32+380 | Station of Changing of TBL. El. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 374.990 | 374.835 | 370.985 | 375.535 | 376.335 | |

## Table 11.2.2 (3)-13 Hydraulic Computation of Kok-Ing Diversion Canal (7/11)

| Station (KM) | Structure | $Q_{req.}$ ($m^3/s$) | $Q_{des.}$ ($m^3/s$) | b (m) | d (m) | $H_c$ (m) | H (m) | L.S. | S.S. | n | A ($m^2$) | R (m) | V (m/s) | $h_v$ (m) | Distance, $\Delta L$ (m) | Head Losses (m) $\Delta H$ Calc. | Head Losses (m) $\Delta H$ Provide | Height of E.G.L. | FSL. | BL. | Top Conc Lining El. | TBL. | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | 487.254 | 0.097 | 0.097 | | | | | | |
| 32+867.254 | Drain Culvert 1-dia.1.00 m. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 374.893 | 374.738 | 370.888 | 375.438 | 376.238 | |
| | | | | | | | | | | | | | | | 92.746 | 0.019 | 0.019 | | | | | | |
| 32+960 | Inclined Drop (u/s) | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 374.874 | 374.719 | 370.869 | 375.419 | 376.219 | |
| | | | | | | | | | | | | | | | 0.000 | 0.000 | 4.194 | | | | | | ΔW.S.= 4.194 m. |
| 32+960 | Inclined Drop (d/s) | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 370.680 | 370.525 | 366.675 | 371.225 | 372.025 | |
| | | | | | | | | | | | | | | | 575.000 | 0.115 | 0.115 | | | | | | |
| 33+535 | Drain Culvert 2-dia.1.00 m. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 370.565 | 370.410 | 366.560 | 371.110 | 371.910 | |
| | | | | | | | | | | | | | | | 232.254 | 0.046 | 0.046 | | | | | | |
| 33+767.254 | Roadway Bridge, 4.00 m. Roadway Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 370.519 | 370.364 | 366.514 | 371.064 | 371.864 | |
| | | | | | | | | | | | | | | | 127.746 | 0.026 | 0.026 | | | | | | |
| 33+895 | Drain Culvert 2-dia.1.00 m. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 370.493 | 370.338 | 366.488 | 371.038 | 371.838 | |
| | | | | | | | | | | | | | | | 970.000 | 0.194 | 0.194 | | | | | | |
| 34+865 | Roadway Bridge, 4.00 m. Roadway Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 370.299 | 370.144 | 366.294 | 370.844 | 371.644 | |
| | | | | | | | | | | | | | | | 135.000 | 0.027 | 0.027 | | | | | | |
| 35+000 | End of Sheet 10 & Beginning of Sheet 11 | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 370.272 | 370.117 | 366.267 | 370.817 | 371.617 | |
| | | | | | | | | | | | | | | | 9.994 | 0.002 | 0.002 | | | | | | |
| 35+009.994 | Equation - Back | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 370.270 | 370.115 | 366.265 | 370.815 | 371.615 | |
| 35+021.074 | Equation - Ahead | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 370.270 | 370.115 | 366.265 | 370.815 | 371.615 | |
| | | | | | | | | | | | | | | | 290.954 | 0.058 | 0.058 | | | | | | |
| 35+312.028 | E.C. 27 (Beginning of Alternative Alignment) | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 370.212 | 370.057 | 366.207 | 370.757 | 371.557 | |
| | | | | | | | | | | | | | | | 212.972 | 0.043 | 0.043 | | | | | | |
| 35+525 | End of Concrete Lined Canal | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 370.169 | 370.014 | 366.164 | 370.714 | 378.500 | |
| | | | | | | | | | | | | | | | 29.000 | 0.095 | 0.095 | | | | | | ΔW.S.= 0.289 m. |
| 35+554 | Beginning of Cut & Cover Conduit | 140.00 | 141.023 | r=4.35 | 7.000 | H=8.70 | - | 1: 2,500 | - | 0.015 | 53.887 | 2.667 | 2.617 | 0.349 | | | | 370.074 | 369.725 | 362.725 | 371.425 | - | |
| | | | | | | | | | | | | | | | 870.038 | 0.348 | 0.348 | | | | | | |
| 36+424.038 | Equation - Back | 140.00 | 141.023 | r=4.35 | 7.000 | H=8.70 | - | 1: 2,500 | - | 0.015 | 53.887 | 2.667 | 2.617 | 0.349 | | | | 369.726 | 369.377 | 362.377 | 371.077 | - | |
| 36+554.347 | Equation - Ahead | 140.00 | 141.023 | r=4.35 | 7.000 | H=8.70 | - | 1: 2,500 | - | 0.015 | 53.887 | 2.667 | 2.617 | 0.349 | | | | 369.726 | 369.377 | 362.377 | 371.077 | - | |
| | | | | | | | | | | | | | | | 32.906 | 0.013 | 0.013 | | | | | | |
| 36+587.253 | Hua Kang | 140.00 | 141.023 | r=4.35 | 7.000 | H=8.70 | - | 1: 2,500 | - | 0.015 | 53.887 | 2.667 | 2.617 | 0.349 | | | | 369.713 | 369.364 | 362.364 | 371.064 | - | |
| | | | | | | | | | | | | | | | 378.747 | 0.151 | 0.151 | | | | | | |
| 36+966 | End of Cut & Cover Conduit | 140.00 | 141.023 | r=4.35 | 7.000 | H=8.70 | - | 1: 2,500 | - | 0.015 | 53.887 | 2.667 | 2.617 | 0.349 | | | | 369.562 | 369.213 | 362.213 | 370.913 | - | |
| | | | | | | | | | | | | | | | 34.000 | 0.161 | 0.161 | | | | | | ΔW.S.= -0.033 m. |
| 37+000 | Beginning of Concrete Lined Canal | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 369.401 | 369.246 | 365.396 | 369.946 | 377.500 | |

## Table 11.2.2 (3)-14 Hydraulic Computation of Kok-Ing Diversion Canal (8/11)

| Station (KM) | Structure | $Q_{req.}$ ($m^3/s$) | $Q_{des.}$ ($m^3/s$) | b (m) | d (m) | $H_c$ (m) | H (m) | L.S. | S.S. | n | A ($m^2$) | R (m) | V (m/s) | $h_v$ (m) | Distance, $\Delta L$ (m) | Head Losses (m) $\Delta H$ Calc. | Provide | Height of E.G.L. | FSL. | BL. | Top Conc Lining El. | TBL. | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | 114.253 | 0.023 | 0.023 | | | | | | |
| 37+114.253 | Overchute (Husi Pong) | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 369.378 | 369.223 | 365.373 | 369.923 | 377.107 | |
| | | | | | | | | | | | | | | | 19.000 | 0.004 | 0.004 | | | | | | |
| 37+133.253 | Roadway Bridge, 4.00 m. Roadway Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 369.374 | 369.219 | 365.369 | 369.919 | 377.042 | |
| | | | | | | | | | | | | | | | 1,174.000 | 0.235 | 0.235 | | | | | | |
| 38+307.253 | Highway No.1174 Bridge, 11.00 m. Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 369.139 | 368.984 | 365.134 | 369.684 | 375.000 | |
| | | | | | | | | | | | | | | | 17.747 | 0.004 | 0.004 | | | | | | |
| 38+325 | Station of Changing of TBL. El. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 369.135 | 368.980 | 365.130 | 369.680 | 370.480 | |
| | | | | | | | | | | | | | | | 175.000 | 0.035 | 0.035 | | | | | | |
| 38+500 | End of Sheet 11 & Beginning of Sheet 12 | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 369.100 | 368.945 | 365.095 | 369.645 | 370.445 | |
| | | | | | | | | | | | | | | | 1,633.253 | 0.327 | 0.327 | | | | | | |
| 40+133.253 | Roadway Bridge, 7.00 m. Roadway Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 368.773 | 368.618 | 364.768 | 369.318 | 370.118 | |
| | | | | | | | | | | | | | | | 76.747 | 0.015 | 0.015 | | | | | | |
| 40+210 | Drain Culvert 3-dia.1.00 m. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 368.758 | 368.603 | 364.753 | 369.303 | 370.103 | |
| | | | | | | | | | | | | | | | 14.253 | 0.003 | 0.003 | | | | | | |
| 40+224.253 | Roadway Bridge, 4.00 m. Roadway Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 368.755 | 368.600 | 364.750 | 369.300 | 370.100 | |
| | | | | | | | | | | | | | | | 4.000 | 0.001 | 0.001 | | | | | | |
| 40+228.253 | Drain Culvert 1-dia.1.00 m. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 368.754 | 368.599 | 364.749 | 369.299 | 370.099 | |
| | | | | | | | | | | | | | | | 46.747 | 0.009 | 0.009 | | | | | | |
| 40+275 | Drain Culvert 3-dia.1.00 m. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 368.745 | 368.590 | 364.740 | 369.290 | 370.090 | |
| | | | | | | | | | | | | | | | 289.253 | 0.058 | 0.058 | | | | | | |
| 40+564.253 | Roadway Bridge, 4.00 m. Roadway Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 368.687 | 368.532 | 364.682 | 369.232 | 370.032 | |
| | | | | | | | | | | | | | | | 383.000 | 0.077 | 0.077 | | | | | | |
| 40+947.253 | Roadway Bridge, 7.00 m. Roadway Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 368.610 | 368.455 | 364.605 | 369.155 | 369.955 | |
| | | | | | | | | | | | | | | | 555.000 | 0.111 | 0.111 | | | | | | |
| 41+502.253 | Drain Culvert 1-dia.1.00 m. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 368.499 | 368.344 | 364.494 | 369.044 | 369.844 | |
| | | | | | | | | | | | | | | | 319.000 | 0.064 | 0.064 | | | | | | |
| 41+821.253 | Roadway Bridge, 4.00 m. Roadway Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 368.435 | 368.280 | 364.430 | 368.980 | 369.780 | |
| | | | | | | | | | | | | | | | 178.747 | 0.036 | 0.036 | | | | | | |
| 42+000 | End of Sheet 12 & Beginning of Sheet 13 | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 368.399 | 368.244 | 364.394 | 368.944 | 369.744 | |
| | | | | | | | | | | | | | | | 141.253 | 0.028 | 0.028 | | | | | | |
| 42+141.253 | Roadway Bridge, 4.00 m. Roadway Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 368.371 | 368.216 | 364.366 | 368.916 | 369.716 | |
| | | | | | | | | | | | | | | | 394.000 | 0.079 | 0.079 | | | | | | |
| 42+535.253 | Drain Culvert 1-dia.1.00 m. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 368.292 | 368.137 | 364.287 | 368.837 | 369.637 | |

## Table 11.2.2 (3)-15 Hydraulic Computation of Kok-Ing Diversion Canal (9/11)

| Station (KM) | Structure | $Q_{req.}$ ($m^3/s$) | $Q_{des.}$ ($m^3/s$) | b (m) | d (m) | $H_c$ (m) | H (m) | L.S. | S.S. | n | A ($m^2$) | R (m) | V (m/s) | $h_V$ (m) | Distance, $\Delta L$ (m) | Head Losses (m) $\Delta H$ Calc. | Head Losses (m) $\Delta H$ Provide | Height of E.G.L. | FSL. | BL. | Top Conc Lining El. | TBL. | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | 50.000 | 0.010 | 0.010 | | | | | | |
| 42+585.253 | Drain Culvert 2-dia.1.00 m. (Huai Bong) | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 368.282 | 368.127 | 364.277 | 368.827 | 369.627 | |
| | | | | | | | | | | | | | | | 12.000 | 0.002 | 0.002 | | | | | | |
| 42+597.253 | Roadway Bridge, 4.00 m. Roadway Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 368.280 | 368.125 | 364.275 | 368.825 | 369.625 | |
| | | | | | | | | | | | | | | | 364.000 | 0.073 | 0.073 | | | | | | |
| 42+961.253 | Drain Culvert 1-dia.1.00 m. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 368.207 | 368.052 | 364.202 | 368.752 | 369.552 | |
| | | | | | | | | | | | | | | | 60.000 | 0.012 | 0.012 | | | | | | |
| 43+021.253 | Drain Culvert 2-dia.1.00 m. (Huai Tai Khua) | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 368.195 | 368.040 | 364.190 | 368.740 | 369.540 | |
| | | | | | | | | | | | | | | | 208.000 | 0.042 | 0.042 | | | | | | |
| 43+229.253 | Roadway Bridge, 4.00 m. Roadway Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 368.153 | 367.998 | 364.148 | 368.698 | 369.498 | |
| | | | | | | | | | | | | | | | 228.000 | 0.046 | 0.046 | | | | | | |
| 43+457.253 | Drain Culvert 2-dia.1.00 m. (Huai Jo) | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 368.107 | 367.952 | 364.102 | 368.652 | 369.452 | |
| | | | | | | | | | | | | | | | 24.000 | 0.005 | 0.005 | | | | | | |
| 43+481.253 | Drain Culvert 1-dia.1.00 m. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 368.102 | 367.947 | 364.097 | 368.647 | 369.447 | |
| | | | | | | | | | | | | | | | 356.000 | 0.071 | 0.071 | | | | | | |
| 43+837.253 | (Huai Tum) | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 368.031 | 367.876 | 364.026 | 368.576 | 369.376 | |
| | | | | | | | | | | | | | | | 340.000 | 0.068 | 0.068 | | | | | | |
| 44+177.253 | Roadway Bridge, 7.00 m. Roadway Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 367.963 | 367.808 | 363.958 | 368.508 | 369.308 | |
| | | | | | | | | | | | | | | | 440.000 | 0.088 | 0.088 | | | | | | |
| 44+617.253 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 367.875 | 367.720 | 363.870 | 368.420 | 369.220 | |
| | | | | | | | | | | | | | | | (417.253) | (0.083) | (0.083) | | | | | | |
| 44+200 | Station of Changing of TBL. El. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 367.958 | 367.803 | 363.953 | 368.503 | 369.303 | |
| | | | | | | | | | | | | | | | 755.253 | 0.151 | 0.151 | | | | | | |
| 44+955.253 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 367.807 | 367.652 | 363.802 | 368.352 | 371.718 | |
| | | | | | | | | | | | | | | | 244.747 | 0.049 | 0.049 | | | | | | |
| 45+200 | Station of Changing of TBL. El. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 367.758 | 367.603 | 363.753 | 368.303 | 372.500 | |
| | | | | | | | | | | | | | | | 33.253 | 0.007 | 0.007 | | | | | | |
| 45+233.253 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 367.751 | 367.596 | 363.746 | 368.296 | 372.500 | |
| | | | | | | | | | | | | | | | 74.000 | 0.015 | 0.015 | | | | | | |
| 45+307.253 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 367.736 | 367.581 | 363.731 | 368.281 | 372.500 | |
| | | | | | | | | | | | | | | | 66.000 | 0.013 | 0.013 | | | | | | |
| 45+373.253 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 367.723 | 367.568 | 363.718 | 368.268 | 372.500 | |
| | | | | | | | | | | | | | | | 18.000 | 0.004 | 0.004 | | | | | | |
| 45+391.253 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 367.719 | 367.564 | 363.714 | 368.264 | 372.500 | |

## Table 11.2.2 (3)-16 Hydraulic Computation of Kok-Ing Diversion Canal (10/11)

| Station (KM) | Structure | $Q_{req.}$ ($m^3/s$) | $Q_{des.}$ ($m^3/s$) | b (m) | d (m) | $H_c$ (m) | H (m) | L.S. | S.S. | n | A ($m^2$) | R (m) | V (m/s) | $h_v$ (m) | Distance, ΔL (m) | Head Losses (m) ΔH Calc. | Head Losses (m) ΔH Provide | Height of E.G.L. | FSL. | BL. | Top Conc Lining El. | TBL. | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | 108.747 | 0.022 | 0.022 | | | | | | |
| 45+500 | End of Sheet 13 & Beginning of Sheet 14 | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 367.697 | 367.542 | 363.692 | 368.242 | 372.500 | |
| | | | | | | | | | | | | | | | 472.253 | 0.094 | 0.094 | | | | | | |
| 45+972.253 | Roadway Bridge, 7.00 m. Roadway Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 367.603 | 367.448 | 363.598 | 368.148 | 372.500 | |
| | | | | | | | | | | | | | | | 8.000 | 0.002 | 0.002 | | | | | | |
| 45+980.253 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 367.601 | 367.446 | 363.596 | 368.146 | 372.500 | |
| | | | | | | | | | | | | | | | 135.000 | 0.027 | 0.027 | | | | | | |
| 46+115.253 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 367.574 | 367.419 | 363.569 | 368.119 | 372.500 | |
| | | | | | | | | | | | | | | | 162.000 | 0.032 | 0.032 | | | | | | |
| 46+277.253 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 367.542 | 367.387 | 363.537 | 368.087 | 372.500 | |
| | | | | | | | | | | | | | | | 222.747 | 0.045 | 0.045 | | | | | | |
| 46+500 | Station of Changing of TBL. El. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 367.497 | 367.342 | 363.492 | 368.042 | 372.500 | |
| | | | | | | | | | | | | | | | 637.253 | 0.127 | 0.127 | | | | | | |
| 47+137.253 | Overchute | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 367.370 | 367.215 | 363.365 | 367.915 | 373.233 | |
| | | | | | | | | | | | | | | | 362.747 | 0.073 | 0.073 | | | | | | |
| 47+500 | Station of Changing of TBL. El. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 367.297 | 367.142 | 363.292 | 367.842 | 373.650 | |
| | | | | | | | | | | | | | | | 460.853 | 0.092 | 0.092 | | | | | | |
| 47+960.853 | Highway No.1020 Bridge, 11.00 m. Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 367.205 | 367.050 | 363.200 | 367.750 | 373.650 | |
| | | | | | | | | | | | | | | | 39.147 | 0.008 | 0.008 | | | | | | |
| 48+000 | Station of Changing of TBL. El. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | vary | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 367.197 | 367.042 | 363.192 | 367.742 | 373.650 | |
| | | | | | | | | | | | | | | | 600.000 | 0.120 | 0.120 | | | | | | |
| 48+600 | Station of Changing of TBL. El. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 367.077 | 366.922 | 363.072 | 367.622 | 370.000 | |
| | | | | | | | | | | | | | | | 77.253 | 0.015 | 0.015 | | | | | | |
| 48+677.253 | Roadway Bridge, 4.00 m. Roadway Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 367.062 | 366.907 | 363.057 | 367.607 | 369.945 | |
| | | | | | | | | | | | | | | | 322.747 | 0.065 | 0.065 | | | | | | |
| 49+000 | End of Sheet 14 & Beginning of Sheet 15 | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 366.997 | 366.842 | 362.992 | 367.542 | 369.714 | |
| | | | | | | | | | | | | | | | 1,000.000 | 0.200 | 0.200 | | | | | | |
| 50+000 | Station of Changing of TBL. El. | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 366.797 | 366.642 | 362.792 | 367.342 | 369.000 | |
| | | | | | | | | | | | | | | | 33.253 | 0.007 | 0.007 | | | | | | |
| 50+033.253 | Roadway Bridge, 4.00 m. Roadway Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 366.790 | 366.635 | 362.785 | 367.335 | 369.000 | |
| | | | | | | | | | | | | | | | 474.000 | 0.095 | 0.095 | | | | | | |
| 50+507.253 | Roadway Bridge, 4.00 m. Roadway Width | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 366.695 | 366.540 | 362.690 | 367.240 | 369.000 | |
| | | | | | | | | | | | | | | | 1,992.747 | 0.399 | 0.399 | | | | | | |
| 52+500 | End of Sheet 15 & Beginning of Sheet 16 | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 366.296 | 366.141 | 362.291 | 366.841 | 369.000 | |

## Table 11.2.2 (3)-17 Hydraulic Computation of Kok-Ing Diversion Canal (11/11)

| Station (KM) | Structure | $Q_{req.}$ ($m^3/s$) | $Q_{des.}$ ($m^3/s$) | b (m) | d (m) | $H_c$ (m) | H (m) | L.S. | S.S. | n | A ($m^2$) | R (m) | V (m/s) | $h_v$ (m) | Distance, $\Delta L$ (m) | Head Losses (m) $\Delta H$ Calc. | Head Losses (m) $\Delta H$ Provide | Height of E.G.L. | FSL. | BL. | Top Conc Lining El. | TBL. | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | - | | | | | | | | 250.000 | 0.050 | 0.050 | | | | | - | |
| 52+750 | End of Conc. Lined Canal & Inclined Drop (u/s) | 140.00 | 139.412 | 15.00 | 3.850 | 4.55 | 5.35 | 1: 5,000 | 1: 1.5 | 0.016 | 79.984 | 2.769 | 1.743 | 0.155 | | | | 366.246 | 366.091 | 362.241 | 366.791 | 369.000 | |
| | | | | | | | | | | | | | | | 0.000 | 0.000 | 5.008 | | | | | | $\Delta$W.S.= 4.900 m. |
| 52+750 | Inclined Drop (d/s) & Beginning of Earth Canal | 140.00 | 140.344 | 30.00 | 3.900 | - | - | 1: 8,000 | 1: 2.0 | 0.025 | 147.420 | 3.107 | 0.952 | 0.046 | | | | 361.238 | 361.192 | 357.292 | - | 369.000 | |
| | | | | | | | | | | | | | | | 2,582.253 | 0.323 | 0.323 | | | | | | |
| 55+332.253 | End of Earth Canal at Nam Mae Loy | 140.00 | 140.34 | 30.00 | 3.900 | - | - | 1: 8,000 | 1: 2.0 | 0.025 | 147.420 | 3.107 | 0.952 | 0.046 | | | | 360.915 | 360.869 | 356.969 | - | 369.000 | |
| | | | | | | | | | | | | | | | | | | | | | | | |

**Table 11.2.2(3)-18 Canal Length and numbers of structures in Kok-Ing & Ing-Yot Diversion Canal**

| Canal & Structures | Type | Shape | Size | Unit | Numbers or Length Reach 1 | 2 | 3 | Total | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 1.Lined open canal | Concrete Lining | Trapezoid | W=15.00m,H=4.55 | m | 10,753 | 5,360 | 19,707 | 35,820 | |
| 2.Unlined open canal | Earth Lining | Trapezoid | W=30.00m | m | - | - | 2,582 | 2,582 | |
| 3.Culvert | Re.concrete | R.C Horse shoe | | m | - | 5459 | 1345 | 6804 | |
| 4.Siphon | Inverted | R.C box | 3.60m*3.60m*5 | m | 725 | - | - | 725 | |
| 5.Drop | Inclined Check drop | | | Nos. | - | - | 2 | 2 | |
| 6.Check | With slide gate | R.C Rectangular | | Nos. | 1 | 1 | 2 | 4 | |
| 7.Turnout | | | | | | | | | |
| | Gravity | R.C Pipe | | Nos. | - | - | 4 | 4 | |
| | Pumping | R.C Slab | | Nos. | 6 | 2 | 2 | 10 | |
| 8.Drain culvert | | | | | | | | | |
| Type-1 | R. C Box | Rectangular | | Nos. | 1 | - | - | 1 | |
| Type-2 | R.C Pipe | | | Nos. | - | - | 12 | 12 | |
| 9.Overchute | | | | Nos. | 29 | 5 | 12 | 46 | |
| 10.Bridge | | | | | | | | | |
| Type-1 | Highway bridge | R.C Slab | W=11.0m | Nos. | 3 | 1 | 2 | 6 | |
| Type-2 | Road way bridge | R.C Slab | W= 7.0m | Nos. | 7 | 2 | 18 | 27 | |
| Type-3 | Farm road bridge | R.C Slab | W=4.00m | Nos. | 10 | 6 | 14 | 30 | |
| | O&M bridge | R.C Slab | W=4.00m | Nos. | 4 | 0 | 0 | 4 | |
| 11.Sand trap | | | | Nos. | 1 | 1 | 1 | 3 | |

Reach-1 STA. : 0+725.000～ 12+281.199
Reach-2 STA. : 15+320.604～ 26+139.777
Reach-3 STA. : 31+557.254～ 55+332.253

Canal Length and numbers of structures - ING-YOT Diversion Canal

| Canal & Structures | Type | Shape | Size | Unit | Numbers Reach 1 | 2 | | Total | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 1.Lined open canal | Concrete Lining | Trapezoid | W=20.00m,H=4.55 | m | 1,476 | - | | 1,476 | |
| 2.Culvert | Re.concrete | R.C Horse shoe | | m | 360 | 285 | 8807 | 9452 | |
| 3.Siphon | Inverted | R.C box | 3.60m*3.60m*5 | m | - | 185 | | 185 | |
| 4.Sand trap | | | | Nos. | 1 | 1 | | 3 | |

Reach-1 STA. : 0+724.2500～ 2+560.00
Reach-2 STA. : 4+560.00～ 13+836.952

## Table 11.2.2 (3)-19 Kok-Ing Diversion Canal Length

| STA | Canal Type | Reeach/No. | Length (m) | | | | | Remarks |
|---|---|---|---|---|---|---|---|---|
| | | | OpenCanl | Culvert | Siphon | Structure | Tunnel | |
| 0 + 725.000 | | | | | | | | |
| | Open Canal | Reach-1 | 294.975 | | | | | |
| 1 + 19.975 | | | | | | | | |
| | No.1 Siphon | Nam Mae Kon | | | 140.500 | | | |
| 1 + 160.475 | | | | | | | | |
| | Open Canal | Reach-1 | 2459.200 | | | | | |
| 3 + 619.675 | | | | | | | | |
| | No.2 Siphon | Nam Mae Lao | | | 218.000 | | | |
| 3 + 837.675 | | | | | | | | |
| | Open Canal | Reach-1 | 5170.800 | | | | | |
| 9 + 8.475 | | | | | | | | |
| | No.3 Siphon | Huai Mae Han | | | 168.000 | | | |
| 9 + 176.475 | | | | | | | | |
| | Open Canal | Reach-1 | 2365.827 | | | | | |
| 11 + 542.302 | | | | | | | | |
| | Equation | Reach-1 | 0.000 | | | | | eq=78.722 |
| 11 + 621.024 | | | | | | | | |
| | Open Canal | Reach-1 | 64.381 | | | | | |
| 11 + 685.405 | | | | | | | | |
| | No.4 Siphon | Nam MaeSakon | | | 198.000 | | | |
| 11 + 883.405 | | | | | | | | |
| | Open Canal | Reach-1 | 397.715 | | | | | |
| 12 + 281.120 | | | | | | | | |
| | Tunnel | No.1 | | | | | 3039.484 | |
| 15 + 320.60 | | | | | | | | |
| | Culvert | Reach-2 | | 1279.396 | | | | |
| 16 + 600.00 | | | | | | | | |
| | Open Canal | Reach-2 | 5360.000 | | | | | |
| 21 + 960.000 | | | | | | | | |
| | Culvert | Reach-2 | | 4179.777 | | | | |
| 26 + 139.777 | | | | | | | | |
| | Tunnel | No.2 | | | | | 5417.477 | |
| 31 + 557.254 | | | | | | | | |
| | Open Canal | Reach-3 | 1402.746 | | | | | |
| 32 + 960.000 | | | | | | | | |
| | Drop | Reach-3 | | | | 0.000 | | |
| 32 + 960.000 | | | | | | | | |
| | Open Canal | Reach-3 | 2049.994 | | | | | |
| 35 + 9.994 | | | | | | | | |
| | Equation | Reach-3 | 0.000 | | | | | eq=11.080 |
| 35 + 21.074 | | | | | | | | |
| | Open Canal | Reach-3 | 503.926 | | | | | |
| 35 + 525.000 | | | | | | | | |
| | Culvert | Reach-3 | | 899.038 | | | | |
| 36 + 424.038 | | | | | | | | |
| | Equation | Reach-3 | | 0.000 | | | | eq=130.309 |
| 36 + 554.347 | | | | | | | | |
| | Culvert | Reach-3 | | 445.653 | | | | |
| 37 + 0.000 | | | | | | | | |
| | Open Canal | Reach-3 | 15750.000 | | | | | |
| 52 + 750.000 | | | | | | | | |
| | Drop | No.2 | | | | 0.000 | | |
| 52 + 750.000 | | | | | | | | |
| | Open Canal | Reach-3 | 2582.253 | | | | | |
| 55 +332.253 | | | | | | | | |
| | | | | | | | | |
| Total | | | 38401.817 | 6803.864 | 724.5 | 0.000 | 8456.961 | 54387.142 |
| | | | | | | | | |

**Table 11.2..2 (3)-20 List of Structures(1/3)**

1.Open Canal-Concrete Lining Canal

| Reeach | STA(m) from | STA(m) to | Lengih (m) | Type | Discharge (m3/s) | Section (m) | Remarks |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Reach-1 | 0 + 725.000 | 1 + 19.975 | 294.975 | Trapezoid | 140.00 | W=15.0,H=5.35 | |
| | 1 + 160.475 | 3 + 619.675 | 2459.200 | Trapezoid | 140.00 | W=15.0,H=5.35 | |
| | 3 + 837.675 | 9 + 8.475 | 5170.800 | Trapezoid | 140.00 | W=15.0,H=5.35 | |
| | 9 + 176.475 | 11 + 542.302 | 2365.827 | Trapezoid | 140.00 | W=15.0,H=5.35 | |
| | 11 + 542.302 | 11 + 621.024 | 0.000 | Trapezoid | 140.00 | W=15.0,H=5.35 | Eq = -78.722m |
| | 11 + 621.024 | 11 + 685.400 | 64.376 | Trapezoid | 140.00 | W=15.0,H=5.35 | |
| | 11 + 883.400 | 12 + 281.120 | 397.720 | Trapezoid | 140.00 | W=15.0,H=5.35 | |
| | Sub Total | | 10752.898 | | | | |
| | | | | | | | |
| Reach-2 | 16 + 600.00 | 21 + 960.00 | 5360.000 | Trapezoid | 140.00 | W=15.0,H=5.35 | |
| | | | | | | | |
| | Sub Total | | 5360.000 | | | | |
| | | | | | | | |
| Reach-3 | 31 + 557.254 | 32 + 960.000 | 1402.746 | Trapezoid | 140.00 | W=15.0,H=5.35 | |
| | 32 + 960.000 | 35 + 9.994 | 2049.994 | Trapezoid | 140.00 | W=15.0,H=5.35 | |
| | 35 + 9.994 | 35 + 21.074 | 0.000 | | | | Eq = -11.080m |
| | 35 + 21.074 | 35 + 525.000 | 503.926 | Trapezoid | 140.00 | W=15.0,H=5.35 | |
| | 37 + 0.000 | 52 + 750.000 | 15750.000 | Trapezoid | 140.00 | W=15.0,H=5.35 | |
| | Sub Total | | 19706.666 | | | | |
| | | | | | | | |
| Total | | | 35819.564 | | | W=30.0,d=3.90 | |
| | | | | | | | |

2.Open Canal-Earth Lining Canal

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Reach-3 | 52 + 750.000 | 55 + 332.253 | 2582.253 | Trapezoid | 140.00 | W=15.0,H=5.35 | |
| | | | | | | | |

3.Culvert

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CLT-1 | 15 + 320.60 | 16 + 600.00 | 1279.396 | RC Horse Shoe | 140.00 | H=8.70m | |
| CLT-2 | 21 + 960.00 | 26 + 139.777 | 4179.777 | RC Horse Shoe | 140.00 | H=8.70m | |
| | Sub Total | | 5459.173 | | | | |
| CLT-3 | 35 + 525.000 | 36 + 424.038 | 899.038 | RC Horse Shoe | 140.00 | H=8.70m | |
| CLT-4 | 36 + 424.038 | 36 + 554.347 | 0.000 | RC Horse Shoe | 140.00 | H=8.70m | Eq =-130.309 |
| CLT-5 | 36 + 554.347 | 37 + 0.000 | 445.653 | RC Horse Shoe | 140.00 | H=8.70m | |
| | Sub Total | | 1344.691 | | | | |
| | | | | | | | |
| Total | | | 6803.864 | | | | |
| | | | | | | | |

4.Sihon

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| S-1 | 1 + 160.475 | 1 + 19.975 | 140.500 | R.C Box | 140.00 | 3.60*3.60*4 | Nam Mae Kon |
| S-2 | 3 + 619.675 | 3 + 837.675 | 218.000 | R.C Box | 140.00 | 3.60*3.60*4 | Nam Mae Lao |
| S-3 | 9 + 176.475 | 9 + 8.475 | 168.000 | R.C Box | 140.00 | 3.60*3.60*4 | Huai Mae Hang |
| S-4 | 11 + 685.405 | 11 + 883.405 | 198.000 | R.C Box | 140.00 | 3.60*3.60*4 | Nam Mae Sakoen |
| Total | | | 724.500 | | | | |
| | | | | | | | |

5.Drop

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| D-1 | 32 + 960.000 | | | R.C Inclined | 140.00 | ΔH=2.55m | |
| D-2 | 52 + 750.000 | | | R.C Inclined | 140.00 | ΔH=5.05m | |
| | | | | | | | |

**Table 11.2.2 (3)-21 List of Structures (2/3)**

6.Weir/Check Structure

| ·Name | N0s. | STA(km) | Type | | Remarks |
|---|---|---|---|---|---|
| Check | CH-1 | 11+680 | With radial gate | | |
| | CH-2 | 21+960 | With radial gate | | |
| | CH-3 | 37+114 | With radial gate | | |
| | CH-4 | 46+115 | With radial gate | | |
| Check drop | CD-1 | 32+960 | With stop log gate | | |
| | CD-2 | 52+750 | With stop log gate | | |
| | | | | | |

7.Turn Out

| Name | Area | STA(km) | Type | Irrigation.A | Discharege | Remarks |
|---|---|---|---|---|---|---|
| | | | | (rai) | (cum/s) | |
| TOT- 1 | Kok-1 | 2+183.000 | Pump | 920 | 0.230 | |
| TOT- 2 | Kok-1 | 2+528.000 | Pump | | | |
| TOT- 3 | Kok-2 | 4+137.500 | Pump | 1,880 | 0.470 | |
| TOT- 4 | Kok-2 | 5+298.000 | Pump | | | |
| TOT- 5 | Kok-2 | 6+632.000 | Pump | | | |
| TOT- 6 | Kok-3 | 10+999.500 | Pump | 740 | 0.190 | |
| TOT- 7 | Tak-1 | 17+793.604 | Pump | 460 | 0.120 | |
| TOT- 8 | Tak-2 | 21+960.000 | Pump | 7,000 | 1.750 | |
| TOT- 9 | Ing-1 | 32+860.000 | Gravity | 7,940 | 1.990 | |
| TOT-10 | Ing-2 | 36+587.253 | Pump | 8,600 | 2.150 | |
| TOT-11 | Ing-3 | 37+000.000 | Gravity | 3,200 | 0.800 | |
| TOT-12 | Ing-4 | 41+450.000 | Gravity | 4,390 | 1.100 | |
| TOT-13 | Ing-5 | 42+500.000 | Gravity | 3,140 | 0.790 | |
| TOT-14 | Ing-6 | 46+115.253 | Pump | 7,530 | 1.880 | |
| Total | | | | 45,800 | 11.470 | |
| | | | | | | |

8.Drain Culvert

| Name | STA(km) | Type | Size | | | Remarks |
|---|---|---|---|---|---|---|
| | | | | | | |
| DC- 1 | 2+729.500 | RC Box | 2.0*2.0*3 | | | Nam Mae Hang |
| DC- 2 | 32+867.254 | RC Pipe | $\phi$ 1000*1 | | | |
| DC- 3 | 33+535.000 | RC Pipe | $\phi$ 1000*2 | | | |
| DC- 4 | 33+895.000 | RC Pipe | $\phi$ 1000*2 | | | |
| DC- 5 | 40+210.000 | RC Pipe | $\phi$ 1000*3 | | | |
| DC- 6 | 40+228.253 | RC Pipe | $\phi$ 1000*1 | | | |
| DC- 7 | 40+275.000 | RC Pipe | $\phi$ 1000*3 | | | |
| DC- 8 | 41+502.253 | RC Pipe | $\phi$ 1000*1 | | | |
| DC- 9 | 42+535.253 | RC Pipe | $\phi$ 1000*1 | | | |
| DC-10 | 42+961.253 | RC Pipe | $\phi$ 1000*1 | | | |
| DC-11 | 43+021.253 | RC Pipe | $\phi$ 1000*2 | | | |
| DC-12 | 43+457.253 | RC Pipe | $\phi$ 1000*2 | | | |
| DC-13 | 43+481.253 | RC Pipe | $\phi$ 1000*1 | | | |
| | | | | | | |
| | | | | | | |

**Table 11.2.2 (3)-22 List of Structures (3/3)**

9.Overchute

| Name | STA(km) |
|---|---|
| | |
| OVC-1 | 0+950.000 |
| OVC-2 | 1+339.000 |
| OVC-3 | 1+604.000 |
| OVC-4 | 2+183.000 |
| OVC-5 | 2+528.000 |
| OVC-6 | 3+070.000 |
| OVC-7 | 3+105.000 |
| OVC-8 | 3+251.000 |
| OVC-9 | 4+052.000 |
| OVC-10 | 4+137.500 |
| OVC-11 | 4+592.000 |
| OVC-12 | 4+811.000 |
| OVC-13 | 4+900.000 |
| OVC-14 | 5+037.000 |
| OVC-15 | 5+298.000 |
| OVC-16 | 5+674.000 |
| OVC-17 | 6+133.000 |
| OVC-18 | 6+632.000 |
| OVC-19 | 6+850.500 |
| OVC-20 | 7+987.000 |
| OVC-21 | 8+282.500 |
| OVC-22 | 8+530.000 |
| OVC-23 | 8+811.000 |
| OVC-24 | 8+889.700 |
| OVC-25 | 9+505.500 |
| OVC-26 | 9+927.000 |
| OVC-27 | 10+094.000 |
| OVC-28 | 10+494.500 |
| OVC-29 | 10+999.500 |
| OVC-30 | 17+124.604 |
| OVC-31 | 17+793.604 |
| OVC-32 | 18+400.604 |
| OVC-33 | 20+580.604 |
| OVC-34 | 21+937.604 |
| OVC-35 | 32+309.254 |
| OVC-36 | 37+114.253 |
| OVC-37 | 44+617.253 |
| OVC-38 | 44+955.253 |
| OVC-39 | 45+235.253 |
| OVC-40 | 45+307.253 |
| OVC-41 | 45+373.253 |
| OVC-42 | 45+391.253 |
| OVC-43 | 45+980.253 |
| OVC-44 | 46+115.253 |
| OVC-45 | 46+277.253 |
| OVC-46 | 47+137.253 |
| | |

10. Bridge

10-1High Way Bridge W=11.00m

| | Name | STA(km) | H.W No. | Type |
|---|---|---|---|---|
| | | | | |
| HB-1 | H/W Bridge | 1+393.000 | No.1232 | R.C Slab |
| HB-2 | H/W Bridge | 6+638.000 | No.1232 | R.C Slab |
| HB-3 | H/W Bridge | 8+156.000 | No.1173 | R.C Slab |
| HB-4 | H/W Bridge | 20+968.604 | No.1152 | R.C Slab |
| HB-5 | H/W Bridge | 38+307.253 | No.1174 | R.C Slab |
| HB-6 | H/W Bridge | 47+960.853 | No.1020 | R.C Slab |

10-2.Road Way Bridge W=7.00--4.00m

| | Name | STA(km) | R/W No. | Type |
|---|---|---|---|---|
| | | | | |
| RB- 1 | R/W Bridge | 4+440.000 | | R.C Slab |
| RB- 2 | R/W Bridge | 4+597.500 | | R.C Slab |
| RB- 3 | R/W Bridge | 5+664.000 | | R.C Slab |
| RB- 4 | R/W Bridge | 8+887.000 | | R.C Slab |
| RB- 5 | R/W Bridge | 9+639.000 | | R.C Slab |
| RB- 6 | R/W Bridge | 9+924.000 | | R.C Slab |
| RB- 7 | R/W Bridge | 11+008.000 | | R.C Slab |
| RB- 8 | R/W Bridge | 17+130.104 | | R.C Slab |
| RB- 9 | R/W Bridge | 17+743.604 | | R.C Slab |
| RB-10 | R/W Bridge | 32+086.254 | | R.C Slab |
| RB-11 | R/W Bridge | 33+767.254 | | R.C Slab |
| RB-12 | R/W Bridge | 34+865.000 | | R.C Slab |
| RB-13 | R/W Bridge | 36+704.253 | | R.C Slab |
| RB-14 | R/W Bridge | 37+133.253 | | R.C Slab |
| RB-15 | R/W Bridge | 40+224.253 | | R.C Slab |
| RB-16 | R/W Bridge | 40+224.253 | | R.C Slab |
| RB-17 | R/W Bridge | 40+564.253 | | R.C Slab |
| RB-18 | R/W Bridge | 40+947.253 | | R.C Slab |
| RB-19 | R/W Bridge | 41+821.253 | | R.C Slab |
| RB-20 | R/W Bridge | 42+141.253 | | R.C Slab |
| RB-21 | R/W Bridge | 42+597.253 | | R.C Slab |
| RB-22 | R/W Bridge | 43+229.253 | | R.C Slab |
| RB-23 | R/W Bridge | 44+177.253 | | R.C Slab |
| RB-24 | R/W Bridge | 45+972.253 | | R.C Slab |
| RB-25 | R/W Bridge | 48+677.253 | | R.C Slab |
| RB-26 | R/W Bridge | 50+033.253 | | R.C Slab |
| RB-27 | R/W Bridge | 50+507.253 | | R.C Slab |
| | | | | |

10-3. Farm Road Bridge W=4.00m 30

10-4. O&M Road Bridge W=4.00m 4

**Table 11.2.2 (3)-23 Quantities(1/4)**

Kok-Ing Diversion Canal(1/3)
km. 0+725.00 to km. 12+281

Reach-1 (From BP to No.1Tunnel)
Kok basin L=11.478 m

| Items | Spec | Unit | Open Canal | Culvert | Siphon | | | | | Struture & Restoration | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L=11,478m | L=0m | No.1 | No.2 | No.3 | No.4 | Total | Name | Spec | Unit | Quantity | Remarks |
| | | | | | | | | | | | | | | |
| Site Clearing | | rai | 729 | - | - | - | - | - | | Bridge | | | | |
| | | | | | | | | | | Highway | W=11.0m | Nos. | 3 | |
| Stripping | | cu.m | 193,000 | - | - | - | - | - | | Road way | W=7.0m | Nos. | 7 | |
| Excavation | Soil | cu.m | 1,874,000 | - | 9,360 | 12,960 | 9,780 | 9,800 | 41,900 | Farm road | W=3.0m | Nos. | 10 | |
| | Rock | cu.m | 0 | - | - | - | - | - | | O/M road | W=4.0m | Nos. | 4 | |
| Compacted Fill | 95% | cu.m | 240,000 | - | 8,230 | 10,350 | 7,980 | 7,120 | 33,680 | | | | | |
| Disposal soil | L=2 km | cu.m | 1,827,000 | - | 1,130 | 2,610 | 1,800 | 2,680 | 8,220 | Overchute | R.C | Nos. | 29 | |
| Laterite | Compacted | cu.m | 17,470 | - | 107 | 107 | 107 | 107 | 428 | | | | | |
| Rip rap | | cu.m | - | - | 625 | 625 | 940 | 625 | 2,815 | Drainage Culvert | R.C | Nos. | 1 | |
| Sodding | | sq.m | 244,000 | - | - | - | - | - | - | | R.C pipe | Nos. | - | |
| Sand drain | with w.h & valv | ea. | 11,770 | - | - | - | - | - | - | | | | | |
| | | | | | | | | | | | | | | |
| Concrete | Lining S=1:1.5 | cu.m | 53,260 | - | - | - | - | - | - | Turn-out | Pipe | Nos. | 6 | |
| | Lean C. | cu.m | - | - | 223 | 354 | 270 | 321 | 1,168 | | | | | |
| | Reinforced | cu.m | - | - | 2,750 | 4,570 | 3,375 | 4,116 | 14,811 | Check Structure | Gate | Nos. | 1 | With spillway |
| Form work | Lining | sq.m | 188,300 | - | - | - | - | - | - | | | | | |
| | Structure | sq.m | - | - | 3,100 | 5,240 | 3,835 | 4,704 | 16,879 | Restoration work | | | | On the culvert |
| Reinforcing bar | | ton | - | - | 330 | 548 | 405 | 494 | 1,777 | Highway | | Nos. | 0 | |
| Concrete Joint | | ea. | 3,930 | - | - | - | - | - | - | Road way | | Nos. | 0 | |
| Elastic Filler | t=2cm | sq.m | - | - | 118 | 210 | 141 | 190 | 659 | Canal | | Nos. | 0 | |
| Water stop | Type B | m | - | - | 215 | 375 | 255 | 335 | 1,180 | River | | Nos. | 0 | |
| Trash rack | | kg | - | - | 21,000 | 21,000 | 21,000 | 21,000 | 84,000 | Detour | river | Nos. | 5 | |
| Safety facility | Fence,rope,ladd | m | 23,000 | - | - | - | - | - | - | | road | Nos. | 10 | |
| U-flume | 300*300 | m | 23,000 | - | - | - | - | - | - | | | | | |
| Tree plantation | @3.00m | noose | 7,670 | - | - | - | - | - | - | Land acquisition | | ha | 120 | |
| Steel | Pipe,ladder | m,ea. | 24eq. | - | - | - | - | - | - | Compensation | paddy | ha | 120 | |
| Sand trap | L=36m H=1.0m | L.S | 1 | | | | | | | | | | | |
| | | | | | | | | | | | | | | |

**Table 11.2.2(3)-24 Quantities (2/4)**

Reach-2(From end of No.Tunnel to No2 Tunnel)
km. 15+320.60 to km. 26+197.79 Tak basin L=10,819 m

| Items | Spec | Unit | Culvert No.1 L=1279.40m | Open Canal L=5,360m | Culvert No.2 L=4179.77m | Total |
|---|---|---|---|---|---|---|
| | | | | | | |
| Site Clearing | | rai | 40 | 418 | 160 | 618 |
| | | | | | | |
| Stripping | | cu.m | 32,000 | 119,000 | 128,000 | 279,000 |
| Exacavation | Soil | cu.m | 636,200 | 1,581,000 | 3,233,000 | 5,450,200 |
| | Rock | cu.m | 33,500 | 0 | 170,200 | 203,700 |
| Compacted Fill | 95% | cu.m | 557,600 | 155,000 | 3,010,300 | 3,722,900 |
| Disposal soil | L=1 km | cu.m | 144,100 | 1,545,000 | 520,900 | 2,210,000 |
| Laterite | Compacted | cu.m | 1,830 | 8,710 | 6,230 | 16,770 |
| Rip rap | | cu.m | - | - | - | 0 |
| Sodding | | sq.m | - | 205,000 | - | 205,000 |
| Sand drain | with w.h & valve | ea. | - | 5,360 | - | 5,360 |
| | | | | | | |
| Concrete | Lining S=1:1.5 | cu.m | - | 31,400 | - | 31,400 |
| | Lean Conc. | cu.m | 1,410 | - | 4,600 | 6,010 |
| | Reinforced Conc | cu.m | 34,350 | - | 129,220 | 163,570 |
| Form work | Lining | sq.m | | 87,940 | | 87,940 |
| | Structure | sq.m | 6,655 | - | 22,700 | 29,355 |
| Reinforing bar | | t | 4,122 | - | 15,510 | 19,632 |
| Concrete Joint | | ea. | | 1,785 | | 1,785 |
| Elastic Filler | t=2cm | sq.m | | | | |
| Water stop | Type B | m | | | | |
| Trashrack | | kg | | | | |
| Safety facility | Fence,rope,laddr | m | - | 10,720 | | 10,720 |
| U-flume | 300*300 | nos | - | 10,720 | | 10,720 |
| Tree plantation | @3.00m | nos | - | 3,580 | | 3,580 |
| Steel | Pipe,ladder | m,ea. | - | 11ea. | | 11ea. |
| Sand trap | L=36m H=1.0m | L.S | | 1 | | 1 |
| | | | | | | |

| Structures & others | | | | |
|---|---|---|---|---|
| Name | Spec | Unit | Quantity | Remarks |
| | | | | |
| Bridge | | | | |
| Highway | W=11.0m | Nos | 1 | |
| Road way | W=7.0m | Nos | 2 | |
| Farm road | W=3.0m | Nos | 6 | |
| O/M road | W=4.0m | Nos | 0 | |
| | | | | |
| Overchute | R.C | Nos | 5 | |
| | | | | |
| Drainage Culvert | R.C | Nos | - | |
| | R.C pipe | Nos | - | |
| | | | | |
| | | | | |
| Turn-out | Pipe | Nos | 2 | |
| | | | | |
| Check Structure | Gate | Nos | 1 | Tak |
| | | | | |
| Restoration work | | | | On the culvert |
| Highway | | Nos. | 0 | |
| Road way | | Nos. | 3 | |
| Canal | | Nos. | 4 | |
| River | | Nos. | 1 | |
| Detour | river | Nos. | 3 | |
| | road | Nos. | 6 | |
| | | | | |
| Land acquisition | | ha | 110 | |
| Compensation | paddy | ha | 220 | O-100m,C-300n |
| | Plantation | ha | 10 | Teak |
| | | | | |

**Table 11.2.2 (3)-25 Quntities (3/4)**

Kok-Ing Diversion Canal (3/3-1) Ing basin
km. 31+557.25 to km. 55+332.253

1.Open canal Km.31+557.25 to km.35+525.00 L= 3,958.74m
2.Culvert No.1 Km.35+525.00 to km.37+000.00 L= 1,344.69m
3.Open canal Lined Km.37+000.00 to km.52+750.00 L=15,750.00m
4.Open canal Unlined Km.52+750.00 to km.55+332.25 L= 2,582.25m

| Items | Spec | Unit | Ing basin | | | | River Training | Total | Drop structures | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Open Canal | Culvert No.1 | Open Canal | Open Canal | Mae Loi | | No.1 Drop | No.2 Drop | Total | |
| Site Clearing | | rai | 281 | 34 | 1,115 | 188 | 15 | 1,633 | | | | |
| | | | | | | | | | | | | |
| Stripping | | cu.m | 65,000 | 27,200 | 264,000 | 89,000 | 7,220 | 452,420 | | | | |
| Exacavation | Soil | cu.m | 650,000 | 499,800 | 2,267,000 | 707,000 | 155,600 | 4,279,400 | 9,705 | 9,705 | 19,410 | |
| | Rock | cu.m | 0 | 26,300 | 0 | 0 | 0 | 26,300 | 0 | 0 | 0 | |
| Compacted Fill | 95% | cu.m | 94,000 | 411,600 | 395,000 | 474,000 | 77,800 | 1,452,400 | 8,040 | 8,040 | 16,080 | |
| Disposal soil | L=6 km | cu.m | 621,000 | 141,700 | 2,136,000 | 322,000 | 85,020 | 3,305,720 | 1,665 | 1,665 | 3,330 | |
| Laterite | Compacted | cu.m | 6,350 | 2,120 | 25,600 | 4,090 | 1,350 | 39,510 | 140 | 140 | 280 | |
| Rip rap | | cu.m | - | - | - | | | | | 410 | 410 | |
| Sodding | | sq.m | 69,400 | - | 287,800 | 132,930 | 20,600 | 510,730 | | 164 | 164 | |
| Sand drain | with w.h & valve | ea. | 3,970 | - | 15,750 | | | 19,720 | | | | |
| | | | | | | | | 0 | | | | |
| Concrete | Lining S=1:1.5 | cu.m | 19,701 | - | 79,820 | | | 99,521 | | | | |
| | Lean Conc. | cu.m | - | 1,480 | - | | | 1,480 | 160 | 160 | 320 | |
| | Plain concrete | cu.m | - | - | - | - | | 0 | 140 | 140 | 280 | |
| | Reinforced Conc | cu.m | - | 34,520 | - | - | | 34,520 | 1,550 | 1,350 | 2,900 | |
| Form work | Lining | sq.m | 64,940 | - | 258,380 | - | | 323,320 | | | | |
| | Structure | sq.m | - | 6,840 | - | - | | 6,840 | 1,900 | 1,900 | 3,800 | |
| Reinforing bar | | t | - | 4,142 | - | - | | 4,142 | 186 | 162 | 348 | |
| Concrete Joint | | ea. | 1,320 | | 5,250 | - | | 6,570 | | | | |
| Elastic Filler | t=2cm | sq.m | | | | | | 0 | 65 | 65 | 130 | |
| Water stop | Type B | m | | | | | | 0 | 123 | 123 | 246 | |
| Trashrack | | kg | - | - | - | - | | 0 | | | | |
| Safety facility | Fence,rope | m | 7,920 | - | 31,500 | - | | 39,420 | | | | |
| U-flume | 300*300 | m | 7,920 | - | 31,500 | - | | 39,420 | | | | |
| Tree plantation | @3.00m | nos | 2,640 | - | 10,500 | - | | 13,140 | | | | |
| Steel | Pipe,ladder | m,ea. | 8ea. | | 32ea. | | | | 56m | 56m | 112m | |
| Bulk gate | | set | | | | | | | 4 | 4 | 8 | |
| Sand trap | L=36m H=1.0m | L.S | 1 | | | | | 1 | | | | |
| | | | | | | | | | | | | |

**Table 11.2.2 (3)-26 Quantities (4/4)**

Kok-Ing Diversion Canal (3/3-2)
Ing basin
km. 31+557.25 to km. 55+332.253

1.Open canal Km.31+557.25 to km.35+525.00 L= 3,958.74m
2.Culvert No.1 Km.35+525.00 to km.37+000.00 L= 1,344.69m
3.Open cnal Lined Km.37+000.00 to km.52+750.00 L=15,750.00m
4.Open canal Unlined Km.52+750.00 to km.55+332.25 L= 2,582.25m

| Structures & others | | | Ing basin | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | Spec | Unit | Open Canal Lined | Culvert No.1 | Open Canal Lined | Open Canal Unlined | River Training Mae Loi | Total | | | | Remarks |
| Bridge | | | | | | | | | | | | |
| Highway | W=11.0m | Nos | - | - | 2 | - | | 2 | | | | |
| Road way | W=7.0m | Nos | 4 | - | 14 | - | | 18 | | | | |
| Farm road | W=3.0m | Nos | 4 | - | 10 | | | 14 | | | | |
| O/M road | W=4.0m | Nos | - | - | - | - | | 0 | | | | |
| | | | | | | | | | | | | |
| Overchute | R.C | Nos | 1 | - | 11 | - | | 12 | | | | |
| | | | | | | | | | | | | |
| Drainage Culve | R.C | Nos | - | - | - | - | | 0 | | | | |
| R.Cpipe | D=1.00m*1rows | Nos | 1 | - | 5 | | | 6 | | | | |
| | D=1.00m*2rows | Nos | 2 | - | 2 | | | 4 | | | | |
| | D=1.00m*3rows | Nos | - | - | 2 | | | 2 | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Turn-out | Pipe | Nos | 2 | - | 4 | - | | 6 | | | | |
| Check Struture | With gate | Nos | 1 | | 2 | | | 3 | | | | |
| | | | | | | | | | | | | |
| Restoration work | | | | | | | | | | | | On the culvert |
| Highway | | Nos. | | 0 | | | | 0 | | | | |
| Road way | | Nos. | | 5 | | | | 5 | | | | |
| Canal | | Nos. | | 2 | | | | 2 | | | | |
| River | | Nos. | | 2 | | | | 2 | | | | |
| Detour | River | Nos. | | 2 | 5 | | | 7 | | | | Temporary |
| | Road | Nos. | 4 | 5 | 16 | | | 25 | | | | |
| | | | | | | | | | | | | |
| Land acquisition | | ha | 50 | 10 | 180 | 40 | | 280 | | | | |
| Compensation | Paddy | ha | 40 | 40 | 160 | 30 | | 270 | | | | |
| | Plantation | ha | | 10 | | | | 10 | | | | Orcchard, teak |
| | | | | | | | | | | | | |

## Table 11.2.2 (3)-27 Spoil Bank Volume and Area (1/2)

Kok-Ing Canal (1/2)

| Reach | Canal Type | STA(km) From | STA(km) To | Length (m) | Eath work volume('1000m3) Stripping | Excavation | Fill | Balance | Proposed Area & Volume No. | Area (ha) | Height (m) | Volume ('1000m3) | Sumup ('1000m3) | H=F.GL-GL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Open | 0+725 | 12+281 | | 193 | 1,875 | 240 | 1,828 | | | | | | |
| 1-1 | Open | From B.P to Kok-Lao siphon | | | | | | | | | | | | |
| | | 0+725 | 3+620 | 2895 | | $120^{m3/m}*2895^{m}=$ | | 347 | 1 | 10 | 1.0 | 100 | | H=390.5-389.5 |
| | | | | | | | | | 2 | 4 | 1.0 | 40 | | H=390.5-389.5 |
| | | | | | | | | | 3 | 37 | 1.0 | 370 | | H=389.0-388.5 |
| | | S.Total | | | | | | | | 51 | | 510 | 510 | |
| 1-2 | Open | From Kok-Lao to Nam Mae Hang Siphon | | | | | | | | | | | | |
| | | 3+620 | 9+000 | 5,380 | | $150^{m3/m}*5380^{m}=$ | | 807 | 4 | 3 | 1.5 | 45 | | H=393.0-391.5 |
| | | | | | | | | | 5 | 35 | 1.5 | 525 | | H=388.7-387.2 |
| | | S.Total | | | | | | | | 38 | | 570 | 1,080 | |
| 1-3 | Open | From Nam Mae Hang Siphon to Kok-Ing No.1 Tunnel | | | | | | | | | | | | |
| | | 9+000 | 12+281 | 3,203 | Eq =78.72 | 1828-(347+807)= | | 674 | 6 | 15 | 1.5 | 225 | | H=387.0-385.5 |
| | | | | | | | | | 7 | 10 | 1.5 | 150 | | -do- |
| | | | | | | | | | 8 | 7 | 1.5 | 105 | | -do- |
| | | | | | | | | | 9 | 18 | 1.5 | 270 | | -do- |
| | | | | | | | | | | 50 | | 750 | 1,830 | |
| | | S.Total | | 11,478 | | | | 1,828 | | 139 | | 1830 | | |
| | Total | | | | | | | | | | | | | |

**Table 11.2.2 (3)-28 Spoil Bank Volume and Area (2/2)** Kok-Ing Canal (2/2)

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | | 15+321 | 26+140 | 10,819 | | Kok-Ing No.1 Tunnel to Kok-Ing No.2 Tunnel | | | | | | | | |
| 2-1 Culvert | | From Kok-Ing No.1 Tunnel to end of culvert | | | | | | | | | | | | |
| | | 15+321 | 16+600 | 1,279 | 32 | 669 | 558 | 143 | 10 | 33 | 1.0 | 330 | 330 | On the culvert |
| 2-2 Open | | From end of culvert to Huai Tin Non | | | | | | | | | | | | |
| | | | | | 119 | 1581 | 155 | 1545 | | | | | | |
| | | 16+600 | 18+600 | 2,000 | | $250^{m3/m}*2000^{m}=$ | | 500 | 11 | 21 | 1.5 | 315 | 645 | H=384.0-382.5 |
| | Open | Huai Tin Non to BP of culvert | | | | | | | | | | | | |
| | | 18+600 | 21+960 | 3,360 | | 1350-500= | | 1,045 | 12 | 8 | 3.0 | 240 | | H=(390-384)/2 |
| | | | | | | | | | 13 | 13 | 1.5 | 195 | | H=(390-387)/2 |
| | | | | | | | | | 14 | 16 | 3.0 | 480 | | H=390.0-287.0 |
| | | S.Total | | | | | | 1,545 | | 37 | | 915 | 1560 | |
| 2-3 Culvert | | 21+960 | 26+140 | 4,180 | 128 | 3,403 | 3,010 | 521 | 15 | 30 | 2 | 600 | 2160 | H=395.0-393.0 |
| | Total | | | 10,819 | | | | 2,209 | | 121 | | 2,160 | | |
| 3 | | 31+557 | 55+332 | 23,634 Eq =-141 | | From Kok-Ing No.2 Tunnel to end of canal | | | | | | | | |
| 3-1 Open | | 31+557 | 35+525 | 3,957 Eq = -11 | | | | | | | | | | |
| | | | | | 65 | 650 | 94 | 621 | 16 | 43 | 1.5 | 645 | 645 | |
| 3-2 Culvert | | 35+525 | 37+000 | 1,345 Eq = -130 | | | | | | | | | | |
| | | | | | 27 | 526 | 412 | 143 | 17 | 12 | 1.2 | 144 | 789 | H=367.0-365.8 |
| 3-3 | | | | | 353 | 2,974 | 869 | 2,458 | | | | | | |
| | Open | 37+000 | 48+000 | 11,000 | | From end of culvert to highway 1020 | | | | | | | | |
| | | | | | | $137^{m3/m}*11,000^{m}=$ | | 1,507 | 18 | 150 | 1.0 | 1,500 | 2289 | H=360.3-359.3 |
| | Open | 48+000 | 55+332 | 7,332 | | From highway 1020 to end of canal | | | | | | | | |
| | | | | | | 2458-1507= | | 951 | 19 | 80 | 1.2 | 960 | 3249 | |
| | Total | | | 23,634 | | | | 3,222 | | 285 | | 3,249 | | |

### 11.2.3 Ing Weir

#### (1) Design Concept and Criteria

(a) Diversion Weir and Intake Site

It is proposed that the Ing diversion weir is constructed at the upstream of the confluence with the Lao River, and that an intake structure is provided at 100 m upstream of the proposed weir on the right bank. The diversion weir site and surrounding area lower than EL. 364 m is remained as uncultivated area of 500 ha and have a large retardation effect against flood from the tributaries as well as the Ing River.

(b) Concept of Structural Design

It is required to preserve the current regulating function not only for flood control but also for the existing natural environment. Also, this function is necessary to be effectively utilized for taking water from the Ing River and the diverted water of the Kok river.

Whilst, during the dry season, there is scarce water resources and the farmers have desired water for irrigation use. Furthermore, it is possible to enhance freshwater fishery by storing river water flow in the reservoir at the end of the wet season.

Based on the mentioned basic consideration for facilities, the design water level of the gate is studied to enable farmers to use stored water for irrigation in the surrounding area and enhance fishery during the dry season.

There will be possible impact on fish migration when the gates are closed. Therefore, it is necessary to design the diversion weir with fish-way.

(c) Design Water Levels for Diversion Weir and Intake Structure

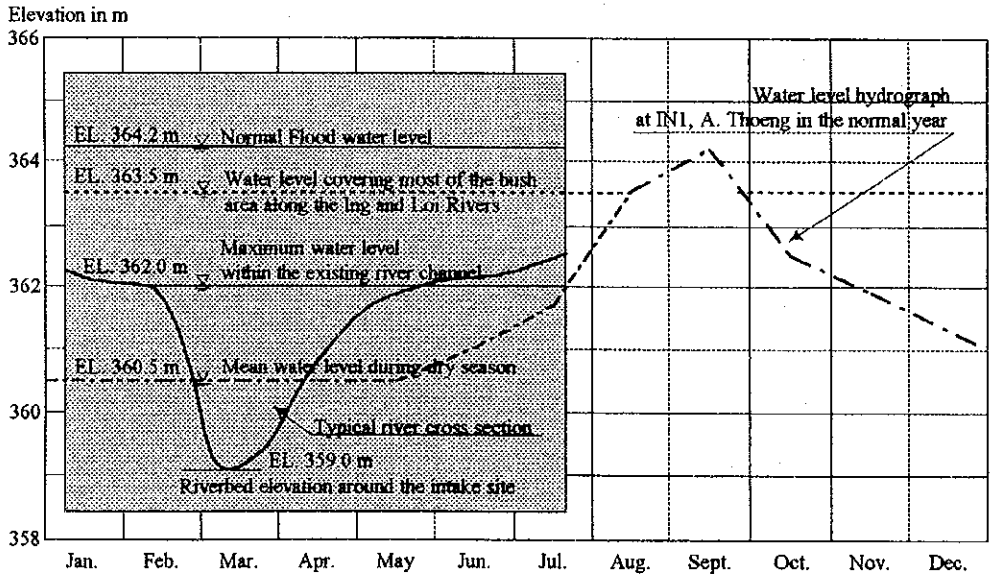


**Figure 11.2.3-1 Water Level Hydrograph at Ing Diversion Weir Site**

Setting the design water level at EL. 363.5 m, the river water level is required to be controlled, excluding the peak wet season from August to September. Due to this change of river water level in

the upstream of the Ing diversion weir, the existing bush or reed areas will be inundated through a year.

The environmental study of the Team J/V indicated that there is no rare and endangered animals and species in the wet lands along the Ing river, and that the creation of ponds during the dry season will provide a habitat area for fishes and an opportunity of water use for farmers living in the upstream reaches.

Consequently, the water level of EL. 363.5 m is applied for design of the proposed diversion weir and an intake gates.

Design flood water level of EL 368.9 m is proposed based on hydraulic analysis for the design flood discharge of 760 cu.m/s with a probability of once in 100 years. The crest elevation of concrete weir and flood embankment is set at EL. 370.4 m, adding free board of 1.5 m to the aforesaid design flood water level.

(d) Gate type of diversion weir

The Team J/V proposed a rubber gate with a span length of 90 m in the Interim Report and afterwards selects the steel slide gates with four (4) leaves in the draft Final Report, since it is identified that the existing rubber gates in Thailand are sometimes broken by the inhabitants due to water allocation problems and that it is subject to smooth closing of gates, though the rubber gate have an advantage on cheaper construction cost and simple operation.

However, the objective of the diversion weir is to control the river water level at EL 363.5 m for about two (2) months at the beginning and end of the wet season and it is low possibility that the rubber gate is broken due to water allocation problems. The appropriate number of spans will solve the second problems above-mentioned.

The JICA Study Team recommends adopting the rubber gate type for diversion weir.

(e) Layout and conditions of the diversion weir and intake structures

The proposed diversion weir comprises; a) concrete weir with two (2) rubber gates, b) three (3) types of fish-way, c) a bridge structure connecting the right and left riverbanks for operation and maintenance, and d) river structures such as revetment and riverbed protection works.

The proposed intake structures consists of; a) a silting basin, b) an intake tower and gate(s), c) flood embankment surrounding intake tower, and d) river structures such as revetment and riverbed protection works.

It is designed to provide the rubber gate of two (2) spans with an unit span length of 32 m and the bridge structure laid out at the downstream of the rubber gates.

A silting basin is planned to be provided between the existing river channel of the Ing and the intake tower, in order to deposit the river sand with a grain size of more than 0.3 mm to be conveyed by the Ing River and the diverted water.

Slide steel gate is selected from the advantage on accurate operation comparing with the tender-gate type, in order to strictly control the amount of the diverted water according to fluctuating river water level. Size and number of gates are determined taking into account economical and operational view points.

Such river structures as revetment and riverbed protection works are planned to provide at

downstream of the diversion weir, inlet portion of the silting basin and in front of the intake tower.

### (2) Review of Structural Design Made by the Team J/V

Through exchanging the design concept and criteria, the following differences are identified:

**Table 11.2.3-1 Comparison of Main Features designed by Team J/V and JICA Study Team**

| Main Features | Team J/V | JICA Study Team |
|---|---|---|
| 1) Ing Diversion Weir | | |
| a) Weir site | 5 km upstream of the existing bridge | Same location |
| b) DWL | EL. 363.5 | EL. 363.5 m |
| c) DFWL | EL. 368.21 m | EL. 368.9 m |
| d) Type of gates | Fixed wheel gate | Rubber gate |
| e) No. of gates | 12.5 m @ 4 nos. | 4.8 m x 32 m @ 2 nos. and 5 m x 3.5 m @ 1 no. |
| f) Width of weir | 57.5 m | 66 m |
| g) Fish-way | Provided | Three types: ladder, vertical slot and slope types |
| 2) Ing Intake | | |
| a) Intake structure site | Same location of the diversion weir | Same location |
| b) Design Intake W.L. | EL. 363.5 m | EL. 363.5 m |
| c) Width of silting basin | 65 m with a length of 300 m | 230 m with a length of 415 m |
| d) Width of Intake | 27.6 m | 77.5 m |
| e) Type of Gate | Roller gate | Fixed wheel gate |
| f) No. of gates | 6 m @ 4 nos. | 5 m@2 nos., 10 m@4 nos., and 12 m @ 1 no. |

Through the review of study made by the Team J/V, it is concluded that the concept of design applied to the study is reasonable, but further consideration about sedimentation and gate types are required to be given in the next stage of the Project.

### (3) Design by JICA Team

The Ing diversion weir has been designed on the basis of the mentioned consideration and conditions. Figures 11.2.3-2 to -5 show the general layout plan and profile of the Ing intake structures by means of non-conventional design method applying the design flow velocity of 0.2 m/s in the silting basin and 0.8 m/s at the intake gates. The main feature of the structures is given as follows:

*Ing Diversion Weir*

- Catchment area : 4,400 $km^2$
- Design flood discharge : 760 cu.m/s with a probability of once in 100 years
- Flood water level : 368.9 m
- Width of weir : 66.0 m
- Sill elevation : 358.7 m
- Crest elevation : 370.4 m
- Gate type : Rubber gate
- Gate size : 2 nos. with 32.0 m (width) and 4.8 m (height)

*Ing Intake*

| | | |
|---|---|---|
| • Flood water level | : | 368.9 m |
| • Design water level for intake gate | : | 363.5 m |
| • Design discharge | : | 175 cu.m/s |
| • Width of intake | : | 77.5 m |
| • Width of silting basin | | 230 m |
| • Sill elevation | : | 360.0 m |
| • Crest elevation | : | 370.4 m |
| • Gate type | : | Fixed wheel gate |
| • Gate size | : | 1 no. with 12.0 m (width) and 2.0 m (height)<br>4 nos. with 10.0 m (width) and 2.0 m (height)<br>2 nos. with 5.0 m (width) and 2.0 m (height) |

### 11.2.4 Ing-Yot Diversion Canal

(a) Hydraulic condition

Basic hydraulic design dimensions and formula are follows.

*Basic design dimension*

- Maximum design dischargeIng-Yot diversion canal 175 cum/s
- Ing intake water level NWL363.50 m M.S.L
- Yao flood control dam NWL 320.00 m M.S.L

*Hydraulic formula*

Manning's formula is applied in canals and flow condition is designed as uniform flow

Manning's formula $Q=A \times V$ $V=R^{2/3} \times S^{1/2} / n$

Maximum flow velocity and free board are same as description of Kok-Ing diversion canal.

*Hydraulic Gradient*

Hydraulic gradients of Ing-Yot diversion canal are applied same value as Kok-Ing diversion canal. Hydraulic heads is appropriately enough for canal design.

- Open canal with Lining 1/5,000
- Culvert 1/2,500

(b) Open Canal

*Canal Type and Lining*

Open canal type would be applied for trapezoid concrete lining type by the reason of widespread in Thailand, with technical, economical and constructional experience.

*Longitudinal gradient of canal slope*

Relating with canal velocity and cross section, canal section with steep slope shows high velocity in small section and increases the excavation depth. Canal longitudinal slope would be generally decided taking followings into consideration.

- Purpose of canal and lining condition
- Required water level at turn out
- Total energy and arrangement of canal type
- Topographical condition
- Balance of earthwork volume (Excavation and filling volume)
- Hydraulic most effective cross section, Allowable velocity

This diversion canal is excavated type under the ground, and has no turnouts. Longitudinal slope is decided as S=1/5,000 for open canal and S=1/2,500 for culvert and tunnel taking hydraulic

conditions. The canal dimensions are shown in Table 11.2.4-2

Longitudinal gradients and velocity in open canal is shown in Table11.2.4-4.

**Table 11.2.4-4 Longitudinal Gradients and Velocity in Open Canal**

| Gradient | D=3.00m | | d=3.50m | | d=3.795m | | Remarks |
|---|---|---|---|---|---|---|---|
| | W(m) | V(m/s) | W(m) | V(m/s) | W(m) | V(m/s) | |
| I/ 3,000 | 23.70 | 2.07 | 17.70 | 2.18 | 15.00 | 2.23 | |
| 1/ 5,000 | 31.00 | 1.65 | 23.40 | 1.75 | 20.00 | 1.80 | $V_{max}$=1.80 |
| I/ 7,000 | 36.80 | 1.41 | 28.00 | 1.51 | 24.20 | 1.55 | |
| 1/10,000 | 44.20 | 1.20 | 33.90 | 1.28 | 29.10 | 1.33 | |

Where d: Water depth (m) W: Bottom width V: Velocity (m/s)

*Free board*

Free board (Fb) and lining height (Hc) of canal would be employed 0.70m and 4.50 m, respectively.

Incase of flood or miss operation of gates, discharge of 237 cu.m/s, which is 1.35 times of design capacity, can flow with in free board.

(c) Culvert

*Culvert Section*

The culvert covered by backfill is used for deep excavation portion, which excavation depth is over 15 meter. Culver canal type would be applied for concrete horseshoe type reinforced by steel bar taking earth/hydraulic pressure and economical conditions into consideration. Culver canal is generally classified as Table 11.2.4-5.

**Table 11.2.4-5 Land Acquisition Width and Excavation Volume in Culvert Types**

In case of Q=140 cu.m/s, S=1/2,500 and water surface 15m under ground level

| Canal type (Reinforced concrete) | Water Depth | Size H*B*rows | Excavation Width | Excavation Volume | Cost |
|---|---|---|---|---|---|
| Rectangular type | 3.85 m | 4.55*3.85*6 | 72 m | 790 cu.m | High |
| Circular type | 7.20 m | D=9.00 m | 57 m | 640 cu.m | Medium |
| Horse shoe type | 7.00 m | D=8.70 m | 56 m | 620 cu.m | Medium |

*Longitudinal Gradient of Culvert*

Longitudinal gradient of culvert is designed with more rapidly velocity than open canal to reduce cross section. Longitudinal slope of culvert is decided as S=1/2,500 taking hydraulic conditions including total energy from kok to Ing river into consideration.

Longitudinal Gradients and Velocity in culvert is shown in Table11.2.2.4-6 and Table 2.4.-7.

**Table 11.2. 4-6 Longitudinal Gradients and Velocity in Culvert**

| Gradient | Rectangular | | Circular | | Horse shoe | | Remarks |
|---|---|---|---|---|---|---|---|
| | W(m) | V(m/s) | D(m) | V(m/s) | D(m) | V(m/s) | |
| I/ 2,000 | 21.40 | 1.70 | 8.60 | 2.83 | 8.40 | 2.80 | |
| 1/ 2,500 | 23.10 | 1.57 | 9.00 | 2.61 | 8.70 | 2.57 | |
| I/ 5,000 | 32.10 | 1.13 | 10.20 | 2.01 | 10.00 | 1.99 | |

Where D: Diameter (m) W: Bottom width V: Velocity (m/s)

Culvert section with diameter 8.70 m and water depth of 7.00 m is selected taking water velocity into consideration. The dimensions of canal section are as follows.

| Discharge Q(cu.m/s) | Diameter (m) | Water depth d(m) | Flow area A(sq.m) | Coefficient Roughness n | Longitu .Slope | Velocity V(m) | Remarks |
|---|---|---|---|---|---|---|---|
| 140.00 | 8.70 | 7.00 | 54.56 | 0.015 | 1/2,500 | 2.57 | |

(d) Siphon

*Location*

Lao siphon with capacity of 175 cu.m/s is placed at down stream of tunnel to cross under Lao river. Inverted siphons with covering of 1 or 1.5 m earth is buried under the riverbed. Trash rack would be provided for maintenance and safety in front of inlet of siphon. And bridge for maintenance road would also provided.

- LengthL=185 m (No.4+845 to 5+030)
- Water level381.44 m.M.S.LRiver bed level384.6 m.M.S.L

*Cross section*

The section of siphon is usually decided with about 1.5 times velocity of open canal one to reduce cross section area, without hydraulic restriction. Siphon type would be applied for circular type because of large section. D=8.25m,V=2.70 m/s

*Loss Head*

Loss head by siphon consist of transition loss, trash rack loss, friction loss, bend loss and Inlet-outlet loss. Total head loss is calculated as 0.85m.

(e) Detail hydraulic calculation

Diversion canal length and detail hydraulic calculations are shown in Table 11.2.4-8 and 9. Results of calculation is shown in Data Base Map

(f) Quantity

Quantities are shown in Table in 11.2.4-10

(g) Spoil bank volume and area

Calculations of spoil bank volume and area are shown in Table 11.2.4-11 and location of spoil bank area is shown in Data Base Map.

## Tabke 11.2.4-7 Hydraulic Dimensions in Ing-Yot Culvert

Q=175m3/s

Rectangular type

| d m | b m | Section | z | P m | n | I (slope) | | A sq. | R m | V m/s | Q cum/s |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.795 | 26.50 | H=4.55 B=3.80*7 | 0.00 | 79.63 | 0.015 | 1/2000 | 0.000500 | 100.57 | 1.26 | 1.74 | 175.16 |
| 3.795 | 29.90 | H=4.55 B=3.75*8 | 0.00 | 90.62 | 0.015 | 1/2500 | 0.000400 | 113.47 | 1.25 | 1.55 | 175.76 |
| 3.795 | 33.00 | H=4.55 B=3.70*9 | 0.00 | 101.31 | 0.015 | 1/3000 | 0.000333 | 125.24 | 1.24 | 1.40 | 175.57 |
| 3.795 | 41.80 | H=4.55 B=3.90*11 | 0.00 | 125.29 | 0.015 | 1/5000 | 0.000200 | 158.63 | 1.27 | 1.10 | 175.04 |

d/2r=1.60 d/r=0.80 V<3.00m/s Qn/(I^0.5*r^(8/3))

| d/2r | α=A/r^2 | P/r | β=R/r | β^(1/2) | β^(2/3) | α β^(2/3) | Q m3/s | n | I (slope) | | r m | | A sq. | R m | V1 m/s | Q m3/s | d m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Circular type | | | | | | | | | | | | | | | | | |
| 0.80 | 2.6943 | 4.4286 | 0.6084 | 0.78 | 0.718 | 1.9435 | 175.00 | 0.015 | 1/2000 | 0.000500 | 4.65 | 4.70 | 59.517 | 2.859 | 3.003 | 178.74 | 7.52 |
| 0.80 | 2.6943 | 4.4286 | 0.6084 | 0.78 | 0.718 | 1.9435 | 175.00 | 0.015 | 1/2500 | 0.000400 | 4.85 | 4.90 | 64.690 | 2.981 | 2.762 | 178.66 | 7.84 |
| 0.80 | 2.6943 | 4.4286 | 0.6084 | 0.78 | 0.718 | 1.9435 | 175.00 | 0.015 | 1/3000 | 0.000333 | 5.02 | 5.05 | 68.711 | 3.072 | 2.572 | 176.75 | 8.08 |
| 0.80 | 2.6943 | 4.4286 | 0.6084 | 0.78 | 0.718 | 1.9435 | 175.00 | 0.015 | 1/5000 | 0.000200 | 5.53 | 5.55 | 82.991 | 3.377 | 2.122 | 176.11 | 8.88 |
| Horse shoe | | | | | | | | | | | | | | | | | |
| 0.80 | 2.8696 | 4.6785 | 0.6134 | 0.7832 | 0.7219 | 2.0716 | 175.00 | 0.015 | 1/2000 | 0.000500 | 4.54 | 4.55 | 59.408 | 2.791 | 2.955 | 175.55 | 7.28 |
| 0.80 | 2.8696 | 4.6785 | 0.6134 | 0.7832 | 0.7219 | 2.0716 | 175.00 | 0.015 | 1/2500 | 0.000400 | 4.74 | 4.75 | 64.745 | 2.914 | 2.720 | 176.11 | 7.60 |
| 0.80 | 2.8696 | 4.6785 | 0.6134 | 0.7832 | 0.7219 | 2.0716 | 175.00 | 0.015 | 1/3000 | 0.000333 | 4.90 | 5.00 | 71.740 | 3.067 | 2.569 | 184.33 | 8.00 |
| 0.80 | 2.8696 | 4.6785 | 0.6134 | 0.7832 | 0.7219 | 2.0716 | 175.00 | 0.015 | 1/5000 | 0.000200 | 5.40 | 5.40 | 83.678 | 3.312 | 2.095 | 175.30 | 8.64 |

**Table 11.2.4-8 Diversion Canal Length of Ing Yot Diversion Canal**

| STA | Canal Type | Reeach/No. | Length (m) | | | | | Remarks |
|---|---|---|---|---|---|---|---|---|
| | | | OpenCanl | Culvert | Siphon | Structure | Tunnel | |
| 0 + 724.250 | | | | | | | | |
| | Open Canal | Reach-1 | 1475.750 | | | | | |
| 2 + 200.000 | | | | | | | | |
| | Culvert | Reach-1 | | 360.000 | | | | |
| 2 + 560.000 | | | | | | | | |
| | Tunnel | | | | | 2000.000 | | |
| 4 + 560.000 | | | | | | | | |
| | Culvert | Reach-2 | | 285.000 | | | | |
| 4 + 845.000 | | | | | | | | |
| | Siphon | Nam Mae Lao | | | 185.00 | | | |
| 5 + 30.000 | | | | | | | | |
| | Culvert | Nam Mae Lao | | 8806.952 | | | | |
| 13 + 836.952 | | | | | | | | |
| | | | | | | | | |
| Total | | | 1475.750 | 9451.952 | 185 | 2000.000 | 0 | 13112.702 |
| | | | | | | | | |

## Table 11.2.4-9 Hydraulic Computation of Ing-Yot Diversion Canal

| Station (KM) | Structure | $Q_{req.}$ ($m^3/s$) | $Q_{des.}$ ($m^3/s$) | b (m) | d (m) | $H_C$ (m) | H (m) | L.S. | S.S. | n | A ($m^2$) | R (m) | V (m/s) | $h_v$ (m) | Distance, ΔL (m) | Head Losses (m) ΔH Calc. | Head Losses (m) ΔH Provide | Height of E.G.L. | FSL. | 'BL. | Top Conc Lining El. | TBL. | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0+030.750 | Beginning of Approach Channel | 175.00 | 174.216 | 230.00 | 4.000 | - | vary | 1: 700,000 | 1 2.0 | 0.016 | 952.000 | 3.840 | 0.183 | 0.002 | | | | 363.502 | 363.500 | 359.500 | - | 370.100 | |
| | | | | | | | | | | | | | | | 384.250 | 0.001 | 0.001 | | | | | | |
| 0+415 | End of Approach Channel | 175.00 | 174.216 | 230.00 | 4.000 | - | vary | 1: 700,000 | 1 2.0 | 0.016 | 952.000 | 3.840 | 0.183 | 0.002 | | | | 363.501 | 363.499 | 359.499 | - | 370.100 | |
| | | | 175.000 | Intake Structure | | 10-12.00x2.00 m. | | Fixed Wheel Gates | | | | | | | 340.000 | 0.400 | 0.237 | | | | | | ΔW.S.= 0.399 m. |
| 0+755 | Beginning of Concrete Lined Canal | 175.00 | 175.018 | 20.00 | 3.795 | 4.50 | vary | 1: 5,000 | 1 1.5 | 0.016 | 97.503 | 2.895 | 1.795 | 0.164 | | | | 363.264 | 363.100 | 359.305 | 363.805 | 370.100 | |
| | | | | | | | | | | | | | | | 1,445.000 | 0.289 | 0.289 | | | | | | |
| 2+200 | End of Concrete Lined Canal | 175.00 | 175.018 | 20.00 | 3.795 | 4.50 | vary | 1: 5,000 | 1 1.5 | 0.016 | 97.503 | 2.895 | 1.795 | 0.164 | | | | 362.975 | 362.811 | 359.016 | 363.516 | 370.100 | |
| | | | | | | | | | | | | | | | 30.000 | 0.104 | 0.104 | | | | | | ΔW.S.= 0.317 m. |
| 2+230 | Beginning of Cut & Cover Conduit | 175.00 | 175.093 | r=4.75 | 7.550 | H=9.500 | - | 1: 2,500 | - | 0.015 | 64.373 | 2.913 | 2.720 | 0.377 | | | | 362.871 | 362.494 | 354.944 | 364.444 | - | |
| | | | | | | | | | | | | | | | 330.000 | 0.132 | 0.132 | | | | | | |
| 2+560 | End of Cut & Cover Conduit | 175.00 | 175.093 | r=4.75 | 7.550 | H=9.500 | - | 1: 2,500 | - | 0.015 | 64.373 | 2.913 | 2.720 | 0.377 | | | | 362.739 | 362.362 | 354.812 | 364.312 | - | |
| | | | | | | | | | | | | | | | 30.000 | 0.017 | 0.017 | | | | | | ΔW.S.= 0.000 m. |
| 2+590 | Inlet of Tunnel No.1 | 175.00 | 174.981 | r=5.45 | 6.692 | H=8.175 | - | 1: 2,500 | - | 0.015 | 65.807 | 2.817 | 2.659 | 0.360 | | | | 362.722 | 362.362 | 355.670 | 363.845 | - | |
| | | | | | | | | | | | | | | | 910.000 | 0.364 | 0.364 | | | | | | |
| 3+500 | End of Sheet 1 & Beginning of Sheet 2 | 175.00 | 174.981 | r=5.45 | 6.692 | H=8.175 | - | 1: 2,500 | - | 0.015 | 65.807 | 2.817 | 2.659 | 0.360 | | | | 362.358 | 361.998 | 355.306 | 363.481 | - | |
| | | | | | | | | | | | | | | | 1,030.000 | 0.412 | 0.412 | | | | | | |
| 4+530 | Outlet of Tunnel No.1 | 175.00 | 174.981 | r=5.45 | 6.692 | H=8.175 | - | 1: 2,500 | - | 0.015 | 65.807 | 2.817 | 2.659 | 0.360 | | | | 361.946 | 361.586 | 354.894 | 363.069 | - | |
| | | | | | | | | | | | | | | | 30.000 | 0.015 | 0.015 | | | | | | ΔW.S.= 0.032 m. |
| 4+560 | Beginning of Cut & Cover Conduit | 175.00 | 175.093 | r=4.75 | 7.550 | H=9.500 | - | 1: 2,500 | - | 0.015 | 64.373 | 2.913 | 2.720 | 0.377 | | | | 361.931 | 361.554 | 354.004 | 363.504 | - | |
| | | | | | | | | | | | | | | | 285.000 | 0.114 | 0.114 | | | | | | |
| 4+845 | Beginning of Nam Mae Lao Siphon | 175.00 | 175.093 | r=4.75 | 7.550 | H=9.500 | - | 1: 2,500 | - | 0.015 | 64.373 | 2.913 | 2.720 | 0.377 | | | | 361.817 | 361.440 | 353.890 | 363.390 | - | |
| | | | 175.000 | Design Section of Siphon | | | | 1-∅ 8.25 m. | | 0.016 | 53.456 | 2.063 | 3.274 | 0.546 | 185.000 | 0.440 | 0.514 | | | | | | ΔW.S.= 0.514 m. |
| 5+030 | End of Nam Mae Lao Siphon | 175.00 | 175.093 | r=4.75 | 7.550 | H=9.500 | - | 1: 2,500 | - | 0.015 | 64.373 | 2.913 | 2.720 | 0.377 | | | | 361.303 | 360.926 | 353.376 | 362.876 | - | |
| | | | | | | | | | | | | | | | 1,970.000 | 0.788 | 0.788 | | | | | | |
| 7+000 | End of Sheet 2 & Beginning of Sheet 3 | 175.00 | 175.093 | r=4.75 | 7.550 | H=9.500 | - | 1: 2,500 | - | 0.015 | 64.373 | 2.913 | 2.720 | 0.377 | | | | 360.515 | 360.138 | 352.588 | 362.088 | - | |
| | | | | | | | | | | | | | | | 3,500.000 | 1.400 | 1.400 | | | | | | |
| 10+500 | End of Sheet 3 & Beginning of Sheet 4 | 175.00 | 175.093 | r=4.75 | 7.550 | H=9.500 | - | 1: 2,500 | - | 0.015 | 64.373 | 2.913 | 2.720 | 0.377 | | | | 359.115 | 358.738 | 351.188 | 360.688 | - | |
| | | | | | | | | | | | | | | | 3,336.952 | 1.335 | 1.335 | | | | | | |
| 13+836.952 | End of Cut & Cover Conduit and | 175.00 | 175.093 | r=4.75 | 7.550 | H=9.500 | - | 1: 2,500 | - | 0.015 | 64.373 | 2.913 | 2.720 | 0.377 | | | | 357.780 | 357.403 | 349.853 | 359.353 | - | |
| | Inlet of Ing-YodTunnel (Tunnel No.2) | | | | | | | | | | | | | | | | | | | | | | |