

## Environmental Screening Report

### Kandy Drainage Improvement: Rehabilitation of Upstream of Kandy Lake (Heelpan-Kandura & Rajapihilla Streams)



Project Management Unit  
Strategic Cities Development Project

July 2015

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## Strategic Cities Development Project

### Environmental Screening Report

#### 1. Project Identification

Project title	Strategic Cities Development Project (SCDP)  Kandy Drainage Improvement: Improvements to Kandy Lake Upstream – Rajapihilla and Heelpenkandura
Project Proponent	SCDP of the Ministry of Urban Development, Water Supply and Drainage,

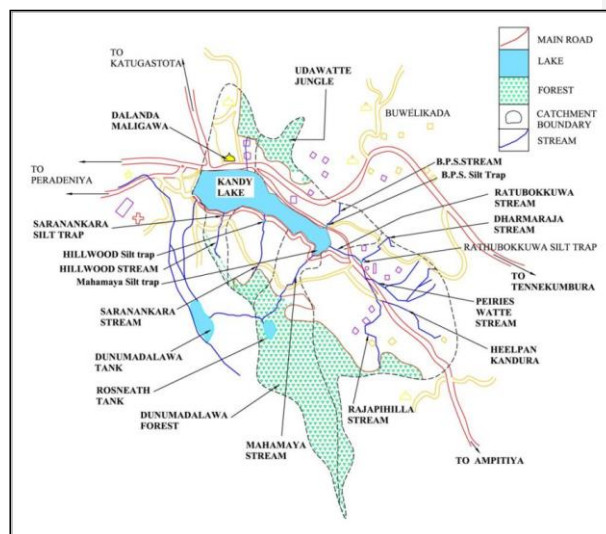
#### 2. Project Location

Location <i>(relative to the nearest town, highway)</i>	<p>Kandy, Central Province.</p> <p>The city of Kandy is located at the center of Sri Lanka, at an altitude of 488.6m (1629 Feet) above sea level. The city of Kandy is well known both locally and internationally for its historical significance and scenic beauty. Surrounded by the Hantanne Mountain range, the city has been established in the Valley of the Mahaveli River and covers a land area of 1917 square Kilometers. The Mahaveli River, which is the longest running river in Sri Lanka, flows on the Northern, Western and Eastern edges of the city. Referred to as “MahaNuwara,” which means “Great City,” it is the capital of the Central Province and Kandy District of Sri Lanka.</p> <p>The Kandy Lake is the main surface body of water in the center of the city. The upstream to the Kandy Lake is a semi-urbanized lake catchment showing a variety of land uses. A number of canals from the hilly regions along Rajapihilla_Mawatha and the Ampitiya area of the Kandy Lake upstream feed in to the Kandy Lake. Rajapihilla and Heelpen -Kandura streams are two such freshwater streams that feed the Kandy lake. These streams now function mainly as storm water outlet canals located in the upstream to the Kandy Lake.</p> <p>Location of the project is given in Annex 01</p>
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Definition of Project Area

*(The geographical extent of the project & areas affected during construction)*

The drainage system of the Kandy Municipal Council (KMC) area consists of a network of large natural and man-made open canals and smaller tributary canals. Rajapihilla and Heelpan -Kandura are two such natural streams that act as storm water outlet canals in the Kandy city basin. These two streams which are located upstream to the Kandy Lake are relatively steep and narrow. Therefore, high velocities are observed during heavy rains.



**Hydrological Network of Kandy Lake**

These two streams play a main role in flood mitigation in Kandy basin by conveying the water flow first to the Kandy Lake and then to the Mahaweli River via Meda Ela.

**Rajapihilla Stream**

This stream has taken its name “Rajapihilla” due to its usage as the place of bathing (Royal Bath) by the family of the then Kandian King. Archaeological evidences showing the place of Royal Bath are still visible at the site.

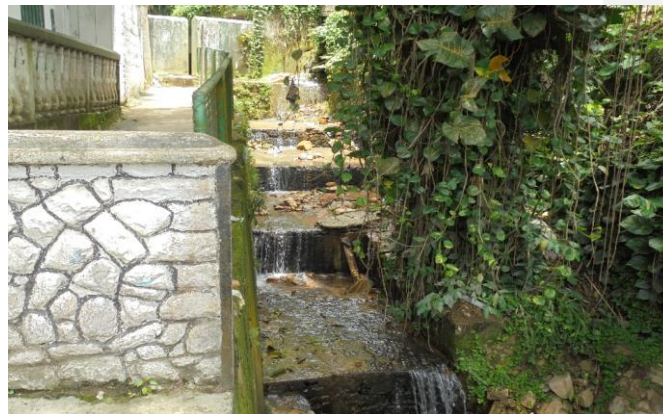


**Place of Royal Bath (Rajapihilla)**

The stream, approximately 266m long, commences from a dense forest called Vakara Estate and flows as an open stream from the point of start crossing the Rajapihilla Mawatha at Ch. 100m and Ampitiya Road at Ch. 230m and finally merges with Heelpan-Kandura stream at Ch. 266m. The stream flows through the Ampitiya North & Ampitiya South Grama Niladhari Divisions via populated areas in narrow channels. The width of the stream varies from 0.1m – 0.5m. The cascades have been installed between the Ch. 00m and Ch. 73m (upto the box culvert of Rajapihilla Mawatha), but these cascades are apparently in dilapidated state.



**(Public Bathing Place at the beginning of the Rajapihilla Stream  
- Ch. 00m)**



**Existing Cascades of Rajapihilla Stream  
(Ch. 00m to Ch. 73m)**

The starting and the end points of the existing bed levels of the stream are 553m MSL and 524m MSL respectively.

The following table provides some hydrologic parameters at key locations of the Rajapihilla stream.

Station – Chainage (m)	Max. Discharge (m <sup>3</sup> /s)	Slope	Max Water Depth(m)
0 – 28	3.91	0.41	0.62
28 – 55	4.27	0.11	0.72
55 – 73	4.34	0.21	0.62
73 – 100	3.72	0.23	0.52
100 – 117	3.66	0.04	0.38
117 – 224	5.03	0.04	0.46
224 – 266	9.33	0.04	1.08

The Rajapihilla stream possesses an average maximum discharge rate of 4.89 m<sup>3</sup>/s as per the above table while an average maximum water depth of 0.62m is recorded for the entire stream with a maximum of 1.08m recorded between (Ch. 224m -266m). The maximum discharge rates are gradually increasing from 3.91m<sup>3</sup>/s to 4.34m<sup>3</sup>/s between (Ch. 0-28m) and (Ch. 55 -73m), but there is a sudden drop between (Ch.73m - 100m). The discharge rate again increases from 3.66m<sup>3</sup>/s to 9.33m<sup>3</sup>/s between the (Ch. 100m-117m) and (Ch. 224m – 266m) although a uniform slope was observed between the corresponding chainages as per the above table.

#### **Heelpan -Kandura Stream**

Heelpan- Kandura stream has taken its name “Heelpan- Kandura” because of the cold freshness of its water in the ancient time. This stream, located upstream to the Kandy lake is steep and narrow. Drops with stiling basins have been constructed at Ch. 200m in order to reduce the flow velocities in the stream.





**Stilting Basin of Heelpan-Kandura Stream at Ch. 200m**



**Heelpan-Kandura Stream with unprotected Banks in Residential Areas**

The total length is approximately 850m and the width varies from 0.1m – 0.5m. The stream flows through populated areas in narrow channels as well as under permanent building structures in some places.



**Heelpan- Kandura Stream  
flowing through residential areas**

Like Rajapihilla stream, the Heelpan-Kandura stream also flows at greatly different elevations. The start and the end points of the existing bed levels of the stream are at 546m MSL and 523.5m MSL respectively. Rajapihilla stream merges with Heelpan-Kandura stream at Ch. 576m.

The following table provides some hydrologic parameters at key locations of the Heelpan -Kandura stream before the confluence (before it merges with the Rajapihilla stream).

<b>Station – Chainage (m)</b>	<b>Max. Discharge (m<sup>3</sup>/s)</b>	<b>Slope</b>	<b>Max Water Depth(m)</b>
0 – 179	2.21	0.04	0.38
179 – 204	2.33	0.12	0.47
204 – 236	2.42	0.18	0.48
236 – 352	3.05	0.03	0.55
352 – 362	3.20	0.03	0.66
362 – 562	4.30	0.02	0.79
562 – 572	4.32	0.02	0.81
572 - 576	4.34	0.03	1.09

As per the above table, water depths are gradually increasing from 0.38m to 1.09m (with an average depth of 0.65m) along the canal up

to the canal confluence and maximum water depth of 1.09m was recorded between Ch. 572m and Ch. 576m. Similarly, the water discharge rates are also recorded to be gradually increasing from 2.21m<sup>3</sup>/s to 4.34m<sup>3</sup>/s (with an average discharge rate of 3.27m<sup>3</sup>/s) up to the canal confluence and the maximum discharge rate of 4.34 m<sup>3</sup>/s were recorded between Ch. 572m and 576m. However, the slope varies (with an average slope of 0.06) along the stream and the maximum slopes of 0.12 and 0.18 were reported between the (Ch. 179m-204m) and the (Ch. 204m – 236m) respectively.

The following table provides some hydrologic parameters at key locations of the Heelpan -Kandura stream after the confluence.

<b>Station Chainage (m)</b>	<b>Max. Discharge (m<sup>3</sup>/s)</b>	<b>Slope</b>	<b>Max Water Depth(m)</b>
576 -595	16.20	0.01	1.09
595 – 732	19.18	0.01	1.25
732 – 779	20.47	0.01	1.19
779 - 850	22.37	0.01	

As per the above table, discharge rates are gradually increasing and an average maximum discharge rate of 19.55 m<sup>3</sup>/s was recorded along the entire canal stretch after the confluence (Ch. 576m - 850m), although a uniform slope was observed between the corresponding chainages.

The headwater of these streams is finally discharged into the Kandy Lake via Rathubokkuwa silt trap.



**Heelpan -Kandura Stream**

Adjacent land and features

Kandy lake is the main adjacent feature in the project area. The development section of the streams is packed with housing and few other business premises on both sides. The total population of the impact area is approximately 850 representing 240 residential units. 15 commercial establishments including a large tourist hotel (Devon Hotel -Ch. 450m of Heelpan - Kandura) and retail shops are located in the project area. Marshy area (Ch. 600m of Heelpan-Kandura), Nuwarawela Bodhiya (Ch.750m of Heelpan-Kandura), one archeological site named the “Royal Bath”, Nuwarawela playground (Ch. 800m of Heelpan-Kandura), one public bathing place (Ch.00m of Rajapihilla stream), abandoned five acre paddy field (Ch. 700m of Heelpan-Kandura) and five bus halts are also lying in the project area. Rathubokkuwa silt trap is also lying in the project area. The livelihoods of the people of the area are majority private and public sector employments, retail

	business, hotel industry including tourist inns, mobile business, self- employments and dailylabor. Ampitiya Road and Rajapihilla Mawatha are also adjacent to the project site.
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### 3. Project Justification

<p>Need for the project</p> <p><i>(What problem is the project going to solve)</i></p>	<p>The drainage system of the KMC area consists of a network of large open storm water canals and smaller tributary canals. Rajapihilla and Heelpan -Kandura are two such main storm water outlet canals in Kandy city basin. These two streams, located upstream to the Kandy Lake, flow in a relatively a steeply areas. The bed level of these two streams is gradually decreasing commencing from the point of start (553.5m MSL for Rajaphilla &amp; 546mMSL for Heelpan-Kandura) and ending at (524mMSL at canal confluence for Rajapihilla &amp; 523.5mMSL for Heelpan-kandura discharge point at Kandy Lake).Due to improper development along these two streams, the canal conveyance has been reduced. The existing canal conveyance capacity was not sufficient during high intensity of rainfall during the past. The canal banks of these two streams at certain locations thus lead to erosion. High level of siltation was observed and frequent flooding was caused due to decreasing the canal conveyance capacity. These reasons have caused frequent flooding in the upstream of the Kandy Lake. There are hardly any reservations of these streams which act as the sources of water supply to the Kandy Lake. As a consequence, these streams overtop during a rainy period causing heavy damages to the properties and carrying debris to the Kandy Lake.</p> <p>Illegal garbage disposal to these two streams is also observed as a severe environmental issue at present and garbage flows through creating a blockage for the water flow at certain places during the rainy days. This reason has also contributed to frequent flooding causing severe difficulties to the residences in the lake upstream. Since these two canals play a major role in controlling flooding in the lake upstream,—the SCDP has identified the need of</p>
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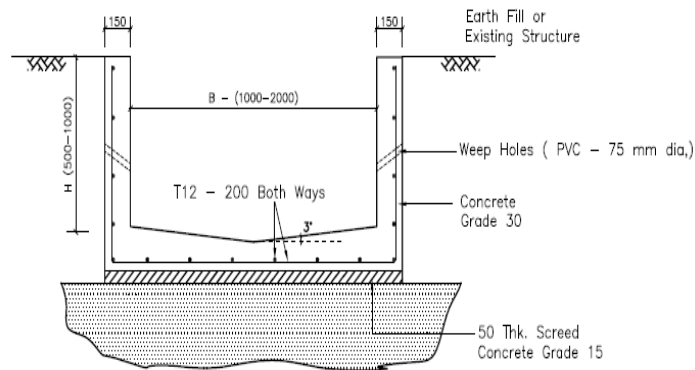
	<p>improving/rehabilitation of these two streams as one of the priority need to be addressed.</p> <p>Accordingly, the Lanka Hydraulics Institute (LHI) was awarded the consultancy contract to study the existing situation and design these two streams. As such the LHI has submitted the final Hydraulic model report with the engineering designs considering realignment of these two streams in identified locations. Canal deepening, lining, application of check dams, cascades and canal bank protection will be carried out as part of the project interventions. As a result of the proposed interventions, it is expected that the canal will be better maintained and improved to accommodate a greater flow of water. Health and sanitation condition of the surrounding households will also be improved.</p>
<p>Purpose of the project <i>(what is going to be achieved by carrying out the project)</i></p>	<p>This project is certainly a part of flood mitigation initiative. The purpose of the project is to derive the following benefits</p> <ul style="list-style-type: none"> <li>• Mitigation of flood in the upstream of Kandy Lake.</li> <li>• Enhancement of canal conveyance capacity, and discharge rate.</li> <li>• Protect the canal bank from erosion and collapsing</li> <li>• Prevent canal bed siltation and reducing the high velocity by installing check dams</li> <li>• Reduce regular operation and maintenance cost for Kandy Municipal Council</li> <li>• Improve the living condition for surrounding residences and other land users</li> <li>• Improve the surrounding scenic beauty</li> <li>• Increase the nearby land value/Improve the business opportunities</li> </ul>
<p>Alternatives considered <i>(different ways to meet the project need and achieve the project purpose)</i></p>	<p>Several discussions were carried out with the participation of officials of PMU, LHI, World Bank and KMC to identify the most suitable technical designs to meet an effective and efficient flood mitigation initiative for the Rajapihilla and Heelpan-Kandura streams. The need for the construction of a rectangular concrete drain was discussed during those discussions to enhance the canal conveyance capacity and the discharge rate. Other alternatives such</p>

	as installation of Gabions, check dams etc. along the canal banks were also discussed in those discussions. Gabion based technical alternative was considered not feasible due to technical requirements, non- availability of financial allocations, space etc.
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#### 4. Project Description

Proposed start date	January 2016																	
Proposed completion date	January 2017																	
Estimated total cost	LKR 515 Million																	
Present land ownership	Streams belong to the KMC.																	
Description of the project <i>(with supporting material such as maps, drawings etc attached as required)</i>	<p>In the context of improvement to the two streams, the following interventions will be undertaken in addition to the desilting and debris removal.</p> <p><b>Proposed Improvements to the Heelpan-Kandura Stream (before the Confluence).</b></p> <p>The following table shows the proposed improvements along the Heelpan-Kandura stream before it merges with the Rajaphilla stream.</p> <table border="1" data-bbox="418 1189 1091 1608"> <thead> <tr> <th>Station - Chainage (m)</th> <th>Proposed Improvements</th> </tr> </thead> <tbody> <tr> <td>0 – 179</td> <td rowspan="2">Concrete lined rectangular drain</td> </tr> <tr> <td>179 – 204</td> </tr> <tr> <td>204 – 236</td> <td>2 - Drop Structures</td> </tr> <tr> <td>236 – 352</td> <td>Concrete lined rectangular drain</td> </tr> <tr> <td>352 – 362</td> <td>Transition</td> </tr> <tr> <td>362 – 562</td> <td>Concrete lined rectangular drain</td> </tr> <tr> <td>562 – 572</td> <td>Transition</td> </tr> <tr> <td>572 – 576</td> <td>Concrete lined rectangular drain</td> </tr> </tbody> </table> <p>As shown in the above table, the canal banks and canal bed lying in the (Ch. 0 – 204m), (Ch. 236m – 352m), (Ch. 362m – 562m) and (Ch. 572m – 576m) will be concrete lined to create a rectangular concrete drain and a check dam has been proposed to be installed at Ch. 53m.</p>	Station - Chainage (m)	Proposed Improvements	0 – 179	Concrete lined rectangular drain	179 – 204	204 – 236	2 - Drop Structures	236 – 352	Concrete lined rectangular drain	352 – 362	Transition	362 – 562	Concrete lined rectangular drain	562 – 572	Transition	572 – 576	Concrete lined rectangular drain
Station - Chainage (m)	Proposed Improvements																	
0 – 179	Concrete lined rectangular drain																	
179 – 204																		
204 – 236	2 - Drop Structures																	
236 – 352	Concrete lined rectangular drain																	
352 – 362	Transition																	
362 – 562	Concrete lined rectangular drain																	
562 – 572	Transition																	
572 – 576	Concrete lined rectangular drain																	

Earth excavations will be carried out to receive the drain foundation for proposed drains and the check dams commencing at ground/formation level. As shown in the below diagram showing the cross section of the concrete drain, the bottom of the drain is proposed to be provided with 50mm thick Grade 15 screed concrete. The side walls of the drains are proposed to be provided with the Grade 30 (20mm thick) reinforced concrete. 12mm Tor steel are embedded in drain base and side walls to provide reinforcements. Weep holes, as shown in the drawing, provide openings in the side walls to facilitate drainage of any water collected at the back of the side walls. The weep holes may either be cast in-situ or consist of pipes embedded in the structure. The pipes are made out of PVC, or any other suitable material. When pipes are embedded in the earth retaining structures, they shall be laid to the slope as showing in the drawing and shall extend from the rear face to the front face of the structure. Furnishing and fixing of plywood sheets as a smooth finish formwork will be provided for the inner face of drain walls. The width and the height of stream will be 1000mm – 2000mm and 500mm – 1000mm respectively.



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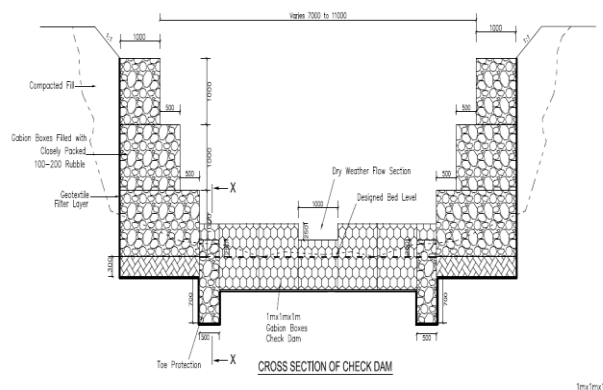
**Diagram: Cross Section of the Concrete Lined Drain  
(Proposed for (Ch. 00m – 204m), (Ch. 236m – 352m), (Ch. 362m – 562m) and (Ch. 572m – 576m) of Heelpan-Kandura Stream before the Confluence**



**Installation of a Check Dam at (Ch. 53m):-**

Check dams are either permanent or temporary barriers that prevent erosion and promote sedimentation by slowing flow velocities and/or to filtering concentrated flows. Check dams tend to pond water. Under low-flow situations, water ponds behind the structure and then seeps slowly through the check dam, infiltrates or evaporates. They provide relatively good removal of coarse and medium size sediment from runoff.

01m wide reinforced concrete check dam across Heelpan-Kandura stream at Ch. 53m will be constructed to act as a permanent erosion control measure.

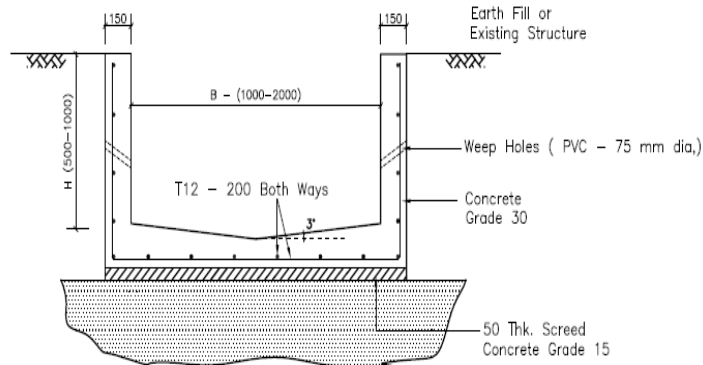


**Proposed Improvements to Heelpan-kandura after Confluence**

The following table shows the proposed improvements along the Heelpan-Kandura stream after it merges with the Rajaphilla stream.

<b>Station - Chainage (m)</b>	<b>Proposed Improvements</b>
576 – 595	Concrete lined rectangular drain
595 – 722	Gabion in left bank and earthen structure in right bank (as described below)
722 – 732	Gabion on both banks
750 - 779	Concrete lined rectangular drain
779 - 850	Existing Drain

As shown in the above table, the canal banks and the bed lying in the (Ch. 576 – 595m) and (Ch. 750m – 779 m) will be concrete lined as shown in the below diagram. Earth excavations will be carried out to receive the drain foundation for proposed drains commencing at ground/formation level. Bottom of the drains is proposed to be provided with 50mm thick Grade 15 screed concrete. The base and the side walls of the drains are proposed to be provided with the Grade 30 (20mm thick) reinforced concrete. 12mm Tor steel are embedded in drain base and side walls to provide reinforcements. Furnishing and fixing of plywood sheets as a smooth finish formwork will be provided for the inner face of drain walls. Weep holes, as shown in the drawings below, provide openings in side walls of the drain to facilitate drainage of any water collected at the back of the structure. The weep holes may either be cast insitu or consist of pipes embedded in the structure. The pipes is made out of PVC with 75mm diameter. When pipes are embedded in the earth retaining structures, they shall be laid to the slope as showing in the drawing and shall extend from the rear face to the front face of the structure. Furnishing and fixing of plywood sheets as a smooth finish formwork will be provided for the inner face of drain walls. The width and the height of stream will be 1000mm – 2000mm and 500mm – 1000mm respectively.



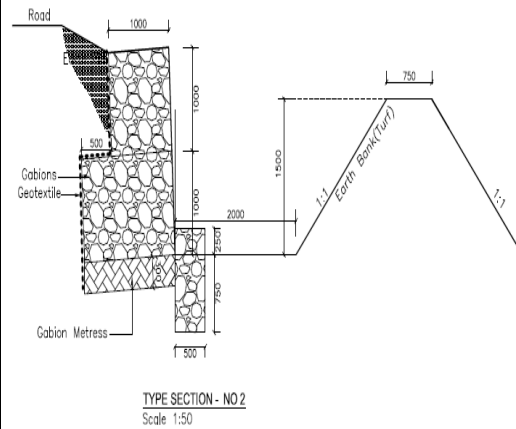
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**Diagram: Cross Section of the Rectangular Concrete Drained Wall for (Ch. 576 – 595m) and (Ch. 750m – 779 m) for Heelpan-Kandura after the Confluence**

**Installation of Gabions and Earthen Bank:-**

As shown in the above table, the canal stretch lying at Ch. (595m – 722m) after the confluence will be installed with Gabions in LHS and the corresponding chainage on the RHS will be provided with an earthen bank as shown in the below diagram. A small portion of 10m in the canal stretch (Ch. 722m – 732m) of Heelpan-Kandura after the confluence will be installed with Gabions on both sides. Gabions shall be PVC coated galvanized steel wire woven into a not more than 80x100mm hexagonal mesh. Broken rock for filling baskets shall be sizes varying from about 100mm in minimum dimension to 200mm in maximum dimension and they shall be hard and durable, free from weathered pieces and extraneous matter. The rock shall be reasonably well graded between the two limited sizes. These stones are hard enough to withstand abrasion, non-disintegrating and resistant to weathering. A layer of Gabion boxes is placed as shown below and the vertical sides of the boxes are tied with binding wire of the same diameter as the wire of the boxes. The height of the new Gabion wall constructed will be 2000mm. A 300mm thick mattress will be placed under the base of the Gabion wall and a Geo

textile filter cloth will be placed behind the Gabion wall as shown in the below diagram. The geotextile filter cloth is of approved filter fabric composed of polyester, polypropylene, polyethylene, polyamide, non-woven type or a combination of above. Drainage water will filter through the geotextile filter cloth into the Gabions and finally escape into the water flow in the drain. As per the diagram, an earth bank with a height of 1500mm, top width of 750mm, and a slope of 1:1 will be constructed on the RHS along the banks of the abandoned paddy field. The drain width will be 2000mm after the construction.



**Cross Section of the Gabion Wall (LHS)  
and the Earthen Bank(RHS) at (Ch 595m – 732m)**

**Proposed Improvements to Rajapihilla Stream**

Station/Chainage (m)	Proposed Improvements
0 – 28	Natural Drain with Dressed Stone Cascade system (as described below)
28 – 55	
55 – 73	
73 – 100	Existing Drain
100 – 117	Concrete lined rectangular drain
117-124	
224-266	

Dressed Stone Cascade System will be installed in the canal stretch between the Ch. 00m – 73m (from the public bathing place to the area lying close to the Rajapihilla Mawatha) and the canal banks and bed in the canal stretch lying in the Ch. 100m – 266m will be concrete lined to create a rectangular drain as shown in the above table. It is recorded that there will not be any improvements that will be undertaken at existing drain between Ch. 73m -100m.

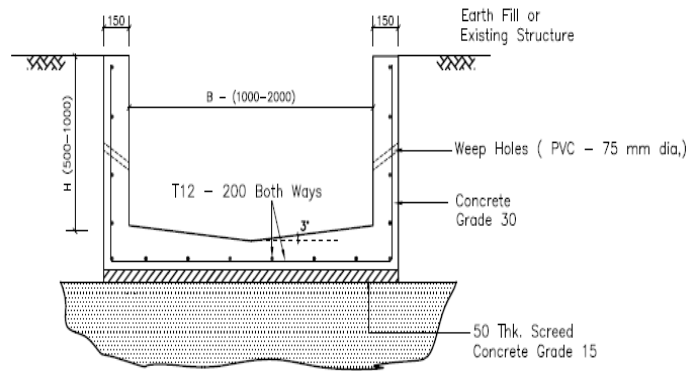
**Dressed Stone Cascade System for Rajapihilla Stream at(Ch. 00m – 73m):-**

This is an ecosystem based mechanism which facilitates to pass water to a lower elevation while controlling the energy and velocity of the water as it passes over. This system is mostly built on watercourses with steep gradients, they serve other purposes such as water oxygenation and erosion prevention. Drain bed is laid with 120mm thick dressed stones(stones that have been worked to a desired shape and ready for installation) to a dimension of 0.3m x 0.3m x 0.12m and the drop of the dressed stone wall be 0.5m x 0.15m x 0.12m. The gap between dressed stones shall not be more than 25mm to trap fine soil particles effectively.

**Installation of Concrete Drain for Rajapihilla Stream (100m -266m):-**

Earth excavations will be carried out to receive the drain foundation for proposed drains commencing at ground/formation level. Bottom of the drains is proposed to be provided with 50mm thick Grade 15 screed concrete. The base and the side walls of the drains are proposed to be provided with the Grade 30 (20mm thick) reinforced concrete. 12mm Tor steel are embedded in drain base and side walls to provide reinforcements. Furnishing and fixing of plywood sheets as a smooth finish formwork will be provided for the inner face of drain walls. Weep holes, as given in the drawings below, provide openings in side walls of the drain to facilitate drainage of any water collected at the back of the

structure. The weep holes may either be cast in-situ or consist of pipes embedded in the structure. The pipes is made out of PVC with 75mm diameter. When pipes are embedded in the earth retaining structures, they shall be laid to the slope as showing in the drawing and shall extend from the rear face to the front face of the structure. Furnishing and fixing of plywood sheets as a smooth finish formwork will be provided for the inner face of drain walls.



TYPE SECTION - NO 1  
Scale 1:100

**Diagram : Cross Section of the Concrete Drain  
for Ch. (100m -266m)**

Detailed Designs are given in Annex 04

Project Management Team

A Project Management Unit (PMU) has been established under the Ministry of Urban Development, Water Supply and Drainage to implement the proposed development activities in Kandy under the SCDP.

**Agency**

Strategic City Development Project (SCDP)  
Ministry of Urban Development, Water Supply and Drainage

	<p><b>Contact person -</b></p> <p>Mr. Anura Dassanayake, Project Director Strategic Cities Development Project (SCDP), Ministry of Urban Development, Water Supply and Drainage 04<sup>th</sup> Floor, Sethsiripaya, Battaramulle Tel: Office:0112 887320</p> <p>Mrs. Gangadari Ranawaka, Deputy Project Director (Envt.) SCDP, Ministry of Urban Development, Water Supply and Drainage 04<sup>th</sup> Floor, Sethsiripaya, Battaramulle Tel: Office: 0112 887320 Exe : 115 Mobile: 077 5090190 Email: gangadariscdp@gmail.com</p> <p>List of consultation meetings held to comply with the process of stakeholder consultations is given below</p> <ol style="list-style-type: none"> <li>1. Discussion on designs carried out with the participation of officials of PMU, LHI, World Bank and KMC</li> <li>2. Site visits along the canal stretch by the officials of the PMU jointly with the LHI experts and KMC officials were undertaken on several occasions</li> </ol> <p>Community consultations were also carried out individually and as groups during the field inspections.</p>
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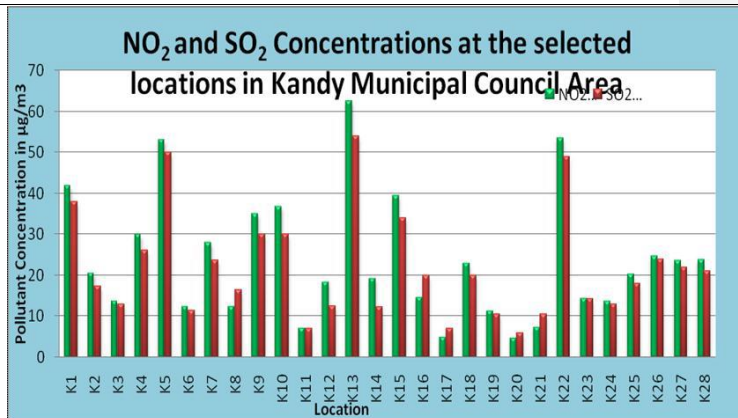
## 5. Description of the existing environment

<b>5.1 Physical features – Ecosystem components</b>	
Topography and terrain	Kandy City, where the project area is situated, is a plateau in the central mountainous region and lies at 492 MSL. Rajapihilla stream commences at 553.5m MSL while it ends at 524m MSL. Similarly, the Heelpan-Kandura stream commences at 546m MSL and ends at 523.5m MSL. The terrain is made up of a basin-like morphology and does not contain many steep, plunging slopes except in the surrounding mountains. The topography in

	<p>this plateau consists of undulating plains with hillocks and valleys formed by the drainage paths. Topographically, the terrain of the watershed of these two streams consist of rolling hills and valleys.</p>
<p>Soil (type and quality)</p>	<p>The soil cover mainly consisting of <i>Reddish Brown Latosolic</i> soils and loams made from the weathering of underlying rocks and boulders and rock outcrops. It is also located within a belt of Quartzite, quartz schist commonly with sillimanite adjacent to widespread area of Hornblende/Hornblende biotite gneiss.</p> <p>The main geological feature of the Kandy City and its surrounding area is a band of marble that extends up to 650m to one kilometer thick. This band is classified as coarse crystalline mainly made up of calcite. Calcsilicate gneiss intruded as bands within the host marble including scapolite and spinel as additional minerals. Collectively these two rock types give rise to red-brown overburden latosolic soil that on average ranges in thickness from one to three meters.</p> <p>Geologically, the location where these two streams are lying is on highly weathered quartzite, crystalline marble and gneisses. For most of its course, these streams flow through a crystalline limestone bed. The alluvial bed of the streams in the unpaved areas is highly silted.(Geology and Soil Map of the Project Area is given inannex 3).</p>
<p>Surface water (sources, distance from the site, local uses and quality)</p>	<p>The surface water sources are intermittent streams, creeks and canals associated with surface runoff which flows towards the Meda Ela and Kandy Lake.</p> <p>The other main surface water source existed in the vicinity is the Kandy Lake with which the Heelpan –Kandura stream finally merges with.The Meda Ela which is the main drainage path for the southern part of the city of Kandy is other main surface water source in the vicinity. Water in the Kandy Lake is not being used for drinking purposes. Fishing and bathing are prohibited in the Kandy Lake and the lake water is neither used for irrigation nor for other domestic purposes.</p> <p><b>Local uses</b></p>



	<p>The canal plays an important role in conveying surface drainage and stormwaters. Although the local people do not derive other benefits other than diverting their surface drainage into these two streams, the intrinsic function is vital and most important in draining flood waters of the upstream in Kandy lake. These two streams are subjected to severe human interferences. It could be observed the points where these two streams receive wastewater directly from residences lying in the canal banks.</p>
<p>Ground water <i>(sources, distance from the site, local uses and quality)</i></p>	<p>Groundwater in Kandy exists mostly in the form of semiconfined aquifers in the first 100 m of the bedrock. This groundwater exists both as small pockets of underground reservoirs and as fissure groundwater. The yields of these aquifers are not very well known and are limited as they recharge very slowly. In addition, there exists high-yielding groundwater resources along the alluvial flood plains of Mahaweli River that are mostly recharged by the river water. The obtained comparative results given in the Sustainable Groundwater Management in Asian Cities shown that the borehole yields and borehole success rates respectively. According to this comparison, it was observed that most of the analyzed wells had yields of less than 100 l/min; in fact 81% were less than 100 l/min, 16% between 100-1000 l/min, and only 3% greater than 1000 l/min (Sustainable Groundwater Management in Asian Cities, 2007).</p>
<p>Air quality <i>(any pollution issues)</i></p>	<p>Heavy vehicle movements along Ampitiya Road and the Rajapihilla Mawatha located nearby and other by-roads in the project area lead to high levels of air pollutant emissions, such as dust including particulate matters (PM 10 and 2.5), smoke including Carbon Monoxide (CO), Carbon Dioxide (CO<sub>2</sub>), Nitrogen Oxides (NO<sub>x</sub>), Sulphur Oxides (SO<sub>x</sub>) etc. Such air pollution episodes can aggravate during peak hours when traffic movements are impeded. Fugitive dust particles could escape into the atmosphere during construction activities and during transportation and subsequent storage and handling.</p>



Source: Air Quality Monitoring Program by National Building Research Organization (NBRO)-2011

Sampling location of the Kandy city

K1 Dalada Weediya	K15 Malwathu Viharaya
K2 Dalada Weediya(Swiss)	K16 Dalada Weediya
K3 Kotugodella Weediya	K17 Udawatta Kele
K4 Yatinuwara Weediya	K18 Asgiriya
K5 Infront Of Market	K19 Asgiriya
K6 Infront of Bogambara Prison	K20 Ab Damunupola Mw
K7 Wells Park	K21 Geroge E Silva Mw
K8 Dalada Maligawa	K22 General Hospital
K9 Trinity College	K23 Bogambara
K10 Meera Mackem Jumma Mosc	K24 Mahamaya M W
K11 Bahirawakanda Viharaya	K25 Katukele
K12 Bahirawakanda Road	K26 Tennis Court
K13 Good Shed	K27 Dharmaraja Junction
K14 Ehelapola Kumarihami Mw	K28 Mulgampola

The concentration of NO<sub>2</sub> and SO<sub>2</sub> at Tennis Courts which is closer to the project site was recorded to be 12 µg/m<sup>3</sup>, and 10 µg/m<sup>3</sup> respectively and the concentration of NO<sub>2</sub> and SO<sub>2</sub> at Mahamaya Vidyalaya which is situated closer to the project site was recorded to be 33 µg/m<sup>3</sup>, and 32 µg/m<sup>3</sup> respectively. These values calculated on the basis of 24 hour. NO<sub>2</sub> levels measured are below the permissible levels stipulated by the CEA and there are no WHO guidelines

	<p>for NO2 24hrs range. SO2 levels measured are also below the maximum permissible limits stipulated by the CEA but these location results exceeds the WHO limits according to the WHO guidelines for SO2 in the 24hrs basis.</p> <p>The PM10 concentration at the Tennis Court area is reported as 56 µg/m<sup>3</sup> which is below the National standards while this reports as the relatively highest among tested locations in Kandy City. Even this reading is below the WHO limits stipulated.</p>
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<b>5.2 Ecological features – Eco-system components</b>	
Vegetation (trees, ground cover, aquatic vegetation)	<p>During the field visits the following trees were identified in the project area.</p> <p>Jack Fruit (<i>Artocarpus heterophyllus</i>), Kottan (<i>Terminalia catappa</i>), Pare Mara (<i>Albizia saman</i>), Bo(<i>ficus religeosa</i>), Gini grass(<i>Panicum maximum</i>), Mango(<i>Mangifera indica</i>), Avacado (<i>Persea Americana</i>), Mana(<i>Syimboporgen confortiflorus</i>), Kithul(<i>Cariyota urens</i>), Kumbuk(<i>Terminalia arjuna</i>), Tebebuia (<i>Tabebuia rosea</i>), Coconut (<i>Cocos nucifera</i>)_Further the Rajapihilla stream originates from a dense forest called Varkarai Estate which contains luxuriant growth type of wet zone forest tree species</p>
Presence of wetlands	<p>A marshy land, <del>which can be considered as a manmade wetland</del> resulting from abandoned paddy-fields is located adjacent to the Heelpan – Kandura stream.</p>
Fish and fish habitats	<p>Fish sampling was not carried out and as per the available information with respect to fish fauna, in the Kandy lake is more or less a monoculture of cichlid fish, mainly <i>Oreochromis mossambicus</i> and <i>Oreochromis niloticus</i>. (Current Science, vol. 85, no. 6, 25 September 2003).</p> <p>However, fish were not abundantly seen in these two streams since water columns of these two streams may not be sufficient enough for the common inland fish species to live in. However, there have been no threatened or endemic species recorded in these two streams.</p>

Birds ( <i>waterfowl, migratory birds, others</i> )	Only the common crow, mina, and crane etc. were observed at the area during the field visits.
Presence of special habitat areas ( <i>special designations and identified sensitive zones</i> )	According to sensitive area map produced by the Central Environmental Authority (CEA) (Annexure 3), the whole area around the Kandy lake is a sensitive zone. Marking the sensitive area is based on area specified in the part III of the scheduled of the Gazette Extraordinary No.772/22 of 24 <sup>th</sup> June 1993 and subsequent amendments by the CEA except the flood protection areas declared under the SLLRDC Act No.52 of 1982 and Act No.35 of 2006. Therefore all developments within this area are subject to CEA approval.
<b>Other features</b>	
Residential/Sensitive Areas( <i>Eg, Hospitals, Schools</i> )	Nuwarawela Bodhiya, and Nuwarawela Cooperative Society are in close proximity to the project site. Most of the land uses bordering the canal are residential units. Almost all the areas could be specified as highly built up area.
Traditional economic and cultural activities	No any significant economic and cultural activity is taking place along these streams.
Archeological resources ( <i>recorded or potential to exist</i> )	Any specific archeological resources are not recorded and less potential to exist along the canal. The ‘Royal Bath’ was the only archeological monument which was observed during the screening, but this monument is far away from the project intervention area.

## 6. Public Consultation

Public consulted	Consultation method	Date	Details/Issues raised
Date: 12.05.2015			
Method of consultation: Informal discussions			
No.	Name and Position	Community Concerns	
1	Mr G.M.S Dassanayake, Retired Teacher, Rajapihilla Mawatha, Ampitiya	Experienced heavy flooding of his residence during a heavy rainfall. Therefore, appreciated the initiatives going to be taken on the improvements to the canal as a flood mitigation measure. Illegal dumping and littering of waste into the canal is another major concern. As the neighboring residents, they hold the responsibility of keeping the canal free of garbage.	
2	Mr Upul De Silva, Chef, 227A, Rajapihilla Mawatha, Ampitiya	Experienced most of the residences in the area get flooded during heavy rainfalls in the past. Emphasized the importance of having a proper institutional mechanism for the operation and maintenance of the Rajapihilla canal once the improvements are carried out to the canal. Also proposed that the authorities would take stern measures to prevent dumping of garbage into the canals since the canal is being used as an effluent dumping site.	
3	Mrs R.M Batagoda, Materials Engineer, Polwagura Handiya, Ampitiya	Experiences flood level to the height of two feet every year during a heavy rainfall. Appreciated the new developments and suggested to take early steps to make the affected communities aware of the proposed improvements to the canal since the other utility services and access to the residences get affected due to project interventions.	

## 7. Environmental Effects and Mitigation Measures

### 7a. Screening for Potential Environmental Impacts

	Screening question	Yes	No	Significance of the effect (Low, moderate, high)
1	Will construction and operation of the Project involve actions which will cause physical changes in the locality (topography, land use, changes in water bodies, etc)	Yes		<p><b>Low</b></p> <p>Most of the interventions are carried out along the canal banks such as construction of Dressed Stone Cascade (Ch. 00m -73m of Rajapihilla), check dam (Ch. 53m of Heelpan-Kandura), Gabion walls &amp; earthen structure (Ch. 595m– 722m of Heelpan-Kandura), deepening and lining of canal bed and walls. Increase in canal width will not be undertaken by the project. Since all the physical constructions are within the existing canal, no considerable physical changes in topography, landform and water bodies will be taking place due to project activities. The <u>flood conveyance</u> functionality of the canal will be enhanced due to project interventions mitigating the flood risk due to high intensity of rainfall.</p>
2	Will the Project involve use, storage, transport, handling or production of substances or materials which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health?	Yes		<p><b>Low to Medium</b></p> <p>Transport of material and construction activities including excavation, demolition of existing structures, material piles will emit dust, and fugitive particles. However, as the affected area is small and mitigation is straight forward. Therefore, significance of the effect can be considered as medium. Debris to be removed from the canals has not been laboratory tested to make sure that no harmful contents.</p> <p>Dust and other particulate matter will be created health hazards to vulnerable persons in the neighborhood. However, this effect would be limited to a short time</p>

				period and could be mitigated with proper construction practices.
3	Will the Project produce solid wastes during construction or operation?	<b>Yes</b>		<p><b>Moderate to high</b></p> <p><u>During Construction:</u></p> <p>Due to de-silting and construction activities, there will considerable amount of debris will be generated. The total debris removal during construction is estimated at 300-350m<sup>3</sup> from which 60% will be reuse for refilling. ID can be guided the Contractor to dump the silt at the same place where they use to dump the debris during maintenance. The PMU &amp; KMC will collaboratively identify a suitable temporary dumping site close to the project site to keep the wet debris until it gets dry and transported them into the final disposal site.</p> <p>There will be construction debris produced during construction phase due to leftover of materials and others.</p> <p>Waste from Labour camps will be there which need to be disposed through KMC.</p>
4	Will the Project release pollutants or any hazardous, toxic or noxious substances to air?	<b>Yes</b>		<p><b>Low</b></p> <p>Exhaust fumes from use of construction machinery and vehicles will add to existing air pollution in the areas. However, this is short lived and can be mitigated.</p>
5	Will the Project cause noise and vibration or release of light, heat energy or electromagnetic radiation?	<b>Yes</b>		<p><b>Low to Moderate</b></p> <p>The project activities will cause noise and vibration during demolition of existing structures, excavation, and compaction and during transportation and unloading of material etc. These impacts are temporary in nature and will cause inconveniences</p>

				mainly for the neighboring people. It is to be noted that no release of light, heat, energy or electromagnetic radiation due to construction activities proposed.
6	Will the Project lead to risks of contamination of land or water from releases of pollutants onto the ground or into surface waters, groundwater or coastal waters?	<b>Yes</b>		<p><b>Low</b></p> <p>Stock piling of material will lead to wash away of soil and may infiltrate into the ground water temporarily during the construction but can be mitigated with good management practices.</p> <p>The canal bank has to be excavated to build Gabion walls and the earth bank in Ch. 595m – 722m of the Heelpan-Kandura stream and the canal bed is also excavated in some parts. Such excavation material should be disposed properly. Excavation of canal bank and storage might increase erosion risk of top soil layers and cause siltation downstream (including the lake), if best engineering practices are not adopted during construction.</p> <p>Proper construction practices like soil compaction and stabilization, proper shoring, etc. will improve soil stability, reducing erosion risk and siltation effects during the construction phase and in the aftermath of project completion.</p>
7	Will the project cause localized flooding and poor drainage during construction  Is the project area located in a flooding location?	<b>Yes</b>		<p><b>Low</b></p> <p><u>Construction Phase:</u></p> <p>In-canal construction work and Stock piling of construction debris and other materials on canal banks and drainage paths, may block existing flow causing flow stagnation leading to localized inundations on temporary basis. However, ensuring proper construction practices like provision of drainage diversion for the stream flow</p>

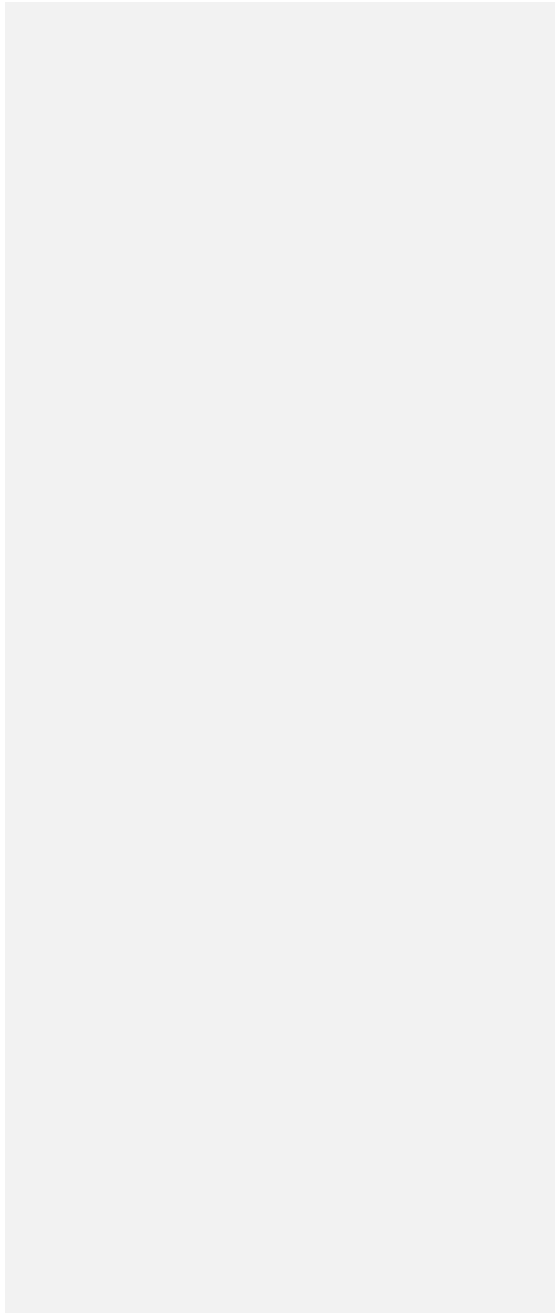


				and improved drainage network around the construction site, will improve drainage conditions, reducing flood risk during the construction phase and in the aftermath of project completion.
8	Will there be any risks and vulnerabilities to public safety due to physical hazards during construction or operation of the Project?	<b>Yes</b>		<b>Low</b> Construction work will cause unavoidable minor issues to the nearest properties, and neighboring residents. These issues may occur due to temporary storage facilities including excavated materials, and use of construction machinery and vehicles
9	Are there any transport routes on or around the location which are susceptible to congestion or which cause environmental problems, which could be affected by the project?	<b>Yes</b>		<b>Low</b> As per the site requirements, there will be traffic congestion from time to time and will cause inconveniences to the users of the access road due to operation of construction vehicles or machineries. Availability of many other connecting roads in the area will help minimize this impact. Traffic congestion will have to be managed with the assistance of Traffic Police.
10	Are there any routes or facilities on or around the location which are used by the public for access to recreation or other facilities, which could be affected by the project?		<b>No</b>	Some roads used as access for residential areas may be temporary affected but not completely cut off.
11	Are there any areas or features of high landscape or scenic value on or around the location which could be		<b>No</b>	Along canal stretches there are no high landscape or aesthetically attractive places that exist as viewing areas and are of scenic value.

	affected by the project?			
12	Are there any other areas on or around the location which are important or sensitive for reasons of their ecology e.g. wetlands, watercourses or other water bodies, the coastal zone, mountains, forests which could be affected by the project?	<b>Yes</b>		<b>Low</b> At the downstream the Heelpan-Kandura stream is connected to Kandy Lake. The silt laden run off from the construction areas may have great impact on Kandy Lake water quality, but this effect can be easily mitigated with good erosion control practices.
13	Are there any areas on or around the location which are used by protected, important or sensitive species of fauna or flora e.g. for breeding, nesting, foraging, resting, migration, which could be affected by the project?		<b>No</b>	No protected, important or sensitive fauna and flora species were identified in the project stretch during rapid environment assessment carried out during the screening process.
14	Is the project located in a previously undeveloped area where there will be loss of green field land		<b>No</b>	The project is located in a developed area and there will be no loss of green field land.
15	Will the project cause the removal of trees in the locality?	<b>Yes</b>		<b>Low</b> During the construction of Gabion Walls in Ch. 595m – 732m (After the confluence upto the end of abandoned paddy field)of the Heelpan-Kandura stream, there maybe a possibility for the removal of 02 number of trees, the activity of which needs to be

				closely monitored. Location, variety & size of trees to be removed are given in Annex – V.
16	Are there any areas or features of historic or cultural importance on or around the location which could be affected by the project?		<b>No</b>	The only feature of historic importance close to the project area is the Royal Bath which is located in a considerable distance away from the Rajapihilla Stream, but no project interventions are undertaken closer to the Royal Bath.
17	Are there existing land uses on or around the location e.g. homes, gardens, other private property, industry, commerce, recreation, public open space, community facilities, agriculture, forestry, tourism, mining or quarrying which could be affected by the project?	<b>Yes</b>		<b>Low</b> The adjacent project area consists of residences, small scale commercial premises which will be affected by project interventions. Mainly houses will have a great difficulties in accessing their places. Accessibility difficulties will be temporary in nature and will be mitigated with the provision of temporary accesses.
18	Are there any areas on or around the location which are densely populated or built-up, which could be affected by the project?	<b>Yes</b>		<b>Moderate</b> The project area is observed as a densely populated (built-up area) area and temporary inconvenience could be expected. Mainly the general public will be disturbed in accessing their places and due to generation of potential dust and noise during construction period. The Environmental Management Plan will guide the contractor in how to mitigate these impacts.
19	Are there any areas on or around the location which	<b>Yes</b>		<b>Low</b>

	are occupied by sensitive land uses e.g. hospitals, schools, places of worship, community facilities, which could be affected by the project			Nuwarawela Bodhiya Temple, Nuwarawela Cooperative Society, Devon Hotel closer to Heelpan-Kandura Stream will be affected temporally due to construction activities and material transportations. Noise and emission of dust during the construction period may also affect temporally.
20	Are there any areas on or around the location which contain important, high quality or scarce resources e.g. groundwater, surface waters, forestry, agriculture, fisheries, tourism, minerals, which could be affected by the project?	<b>Yes</b>		<b>Low</b> Rehabilitation of two streams including de-silting will have an impact over water quality of the Kandy Lake. Cutting of canal banks, de-silting and other rehabilitation activities will cause silt –laden run off to enter the Kandy Lake which in return can cause DO and turbidity levels of the Lake water to be changed.
21	Are there any areas on or around the location which are already subject to pollution or environmental damage e.g. where existing legal environmental standards are exceeded, which could be affected by the project?	<b>No</b>		No location where any environmental standards exceeded or are severely environmentally polluted exist in the project area  By rehabilitation and cleaning the canal, it is expected to improve the condition and this will have a positive impact over health & sanitation condition of the people who are residing along the canal.



## 7b. Environment Management Plan for Implementation

Activities	Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
				Implement	Supervision
<b>Preliminary Stage</b>					
<b>1</b>	<b>Information Disclosure among Stakeholders</b>				
	Carry out discussions with the residents and small, & medium industries reside around the immediate vicinity of the streams; provide them with information on the project activities muster their views for possible impact mitigation as this will also ensure a good rapport and less complaints.	Immediate vicinity of the Rajapihilla & Heelpan-Kandura Streams	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant, Police
	Provide advance notice to communities and the industries on the both sides of the canal banks by way of information boards or leaflet about the schedule of construction activities, interruption to services and access etc.	Immediate vicinity of the Rajapihilla & Heelpan-Kandura Streams	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant, Police
	Develop and establish contractor's own procedure for receiving, documenting and addressing complaints from the affected public and nearby communities.	During the Construction Stage	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant
	The contractor should inform the concerned houses near to the two streams prior to breaching access of the houses.	Immediate vicinity of the Rajapihilla & Heelpan-Kandura Streams	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant, Police
	The rights of landowners and road users bordering the canal stretch will be safeguarded by consultation with affected communities <u>and</u> by ensuring <del>alternate</del> <u>alternative access routes</u> , de-tours <u>and temporary accesses</u> etc. are suggested as mitigation measures during the canal improvement period. The affected road users and landowners will be made aware of day-night work shifts etc.	Immediate vicinity of the Rajapihilla & Heelpan-Kandura Streams	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant, Police

Activities		Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
					Implement	Supervision
		A Grievance Redress Mechanism (GRM) will be made accessible to affected persons capable of responding to a wide scope of issues so that affected persons can approach it easily with their diverse concerns including canal trace-related grievances, land acquisition and compensation-related grievances, construction-related grievances and resettlement sites-related grievances.				
		Ensure to keep a copy of the EMP at all times at the project supervision office on site.	During all Stages of the Project		Contractor	KMC, PMU
<b>2</b>	<b>Siting of Construction Camps</b>					
		<p>If construction camps, labor camps, stock yards, vehicle refuelling areas etc. are located near sensitive areas such as wetlands, conservation zones and places of scenic beauty or recreational value, or any waterbody, those areas may be adversely affected. Social problems owing to alien labour gangs. E.g. communal diseases.</p> <p><b>Mitigation Measures:</b> Care will be taken not to disturb the sensitive areas when selecting sites to locate construction camps, labour camps, stock yards, vehicle refuelling areas etc.</p> <p>In addition, strict labour supervision should be undertaken. There should be labour awareness programs to educate the labourers about their general behaviour while at work as well as their own safety. Labour supervision, and labour welfare should be on site.</p>	All possible sites in/near the project sites	Engineering Cost	Contractor	PMU, KMC, Construction Supervision Consultant, CEA
		Submit the location, layout and basic facility provision of labor camps to Engineer prior to their construction and obtain the written approval of the Engineer before the commencements of the constructions	Prior to commencement of the Construction Activities	Engineering Cost	Contractor	KMC, PMU Construction Supervision Consultant
		The contractor shall provide necessary living	Labor Camps	Engineering	Contractor	KMC,

Activities	Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
				Implement	Supervision
	accommodation and ancillary facilities in functional and hygienic manner and as approved by the Engineer.		Cost		PMUConstruction Supervision Consultant
	All temporary accommodation must be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking and washing. The sewage & <u>solid waste disposal</u> system for the camp must be planned and implemented with concurrence from the Local Public Health Inspector (PHI)	Labor Camps	Engineering Cost	Contractor	KMC, PMUConstruction Supervision Consultant
	Provide adequate health care for the work force. The layout of the construction camp and details of the facilities provided should be prepared and shall be approved by the engineer.	Design Stage	Engineering Cost	Contractor	KMC, PMUConstruction Supervision Consultant
	Clear labor camp sites after use and the site should be reinstated to previous condition at the close of the construction work	Labour Camps	Engineering Cost	Contractor	KMC, PMUConstruction Supervision Consultant
<b>3</b>	<b>Removal of Trees or Root Pruning</b>				
	It may be required to remove trees along the canal banks where Gabion walls are proposed to be established. Trees and vegetation shall be felled / removed only if that impinges directly on the permanent works or necessary temporary works. In all such cases contractor shall take prior approval from the Engineer.	Ch. 595m – 732m of the Heelpan-Kandura stream  Location, variety & size of trees to be removed are given in Annex – V.	Engineering Cost	Contractor	KMC, PMUConstruction Supervision Consultant



Activities		Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
					Implement	Supervision
		Contractor shall make every effort to avoid removal and/or destruction of places with cultural and aesthetic significance. If such action is unavoidable the Engineer shall be informed in advance and carry out public consultation and report on the same should be submitted to the Engineer.	Applicable along the canal banks where trees are required to be removed	Engineering Cost	Contractor	KMC, PMUConstruction Supervision Consultant
		Remove trees from the construction sites before commencement of construction with prior permission from the KMC. During removing, attention should be paid to maintain minimum disturbances to soil cover and also care should be taken not to damage adjoining trees.	Applicable along the canal banks where trees are required to be removed	Engineering Cost	Contractor	KMC, PMUConstruction Supervision Consultant
		Carry out compensatory plantation by way of replanting double the number of trees that will be removed in the project area	Suitable sites for replanting collaboratively identified by the KMC, and PMU	Engineering Cost	Contractor	KMC, PMUConstruction Supervision Consultant
		If any trimming/pruning of roots of existing trees anticipated during Gabion Walls construction, it should be consulted with the PMU-Env team before trimming of roots and make sure that the livability and stability of the tree will not have impact from trimming.	Applicable along the canal banks where tree roots are required to be pruned/trimmed	Engineering Cost	Contractor	PMU, KMCCConstruction Supervision Consultant
4	<b>Removal of Public Utilities</b>					
		If any relocation of utility services (temporary or permanently) be required such as electricity, water supply, telecom, etc., and therefore, there may be fugitive dust and high noise levels will be emanated from machinery and equipment being used. Localized ponding/inundation due to disruption to existing drainage paths and erosion risk inconvenience to public due to temporary interruption of services. This is potential undertake as there are large number of houses, industries, public places, etc for which utility services must have been provided.  Unsafe roadside conditions due to excavations, storage of equipment,	Project area	Engineering Cost	Contractor	PMU, KMC, CEB, Construction Supervision ConsultantTelecom, Water

Activities	Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
				Implement	Supervision
	<p>poles, material etc., Parking and operation of heavy machinery will make inconveniences to the neighbourhood due to congestion of roads</p> <p><b>Mitigation Measures:</b> if any relocation of utility services anticipated, prepare inventory of utilities at proposed sites via plans from service providers plus surveys if necessary. Liaise with NWS&amp;DB (eg. Rock garden), CEB, SLT &amp; obtain utility plans &amp; shifting arrangement, machine operator awareness about utilities.</p> <p>Plan improvement areas and facility sites to avoid existing utilities wherever possible.</p> <p>If any utilities must be moved, prepare relocation plans with service providers.</p> <p>Arrange for service providers to attend to the site immediately to deal with any accidental damage to utilities. If any public or private structures are damaged (including vibration), replace the structures or compensate owners.</p> <p>Plan improvement areas and facility sites to avoid existing utilities wherever possible.</p> <p>Make sure the sounds of the machineries do not exceed the noise limits gazetted by the CEA (during construction in the daytime maximum noise level is 75dB and if any activities anticipated during night time with proper justification by the contractor maintain the noise level below 50dB (subjective to the location).</p>				
5	<b>Demolition of structures</b>				
	Removal or demolition of structures and rebuilding of structures particularly along the two streams such as dismantling of concrete footpaths, brick masonry, random rubble, concrete structures include, paving slabs, culverts, parapet walls, property access, and objectionable or obstructions materials along the construction boundary	Along the Canal	Engineering Cost	Contractor	PMU, KMCC construction Supervision Consultant

Activities	Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
				Implement	Supervision
	<p>and rebuilding of boundary of such structures may create air pollution in terms of suspended particulate matters.</p> <p>Erosion risk due to exposed slopes, disruption to existing drainage paths, washout of fines and silting of waterways, local earth slips due to soil over saturation.</p> <p><b>Mitigation Measures</b>  Frequent wetting may reduce the air-borne particles hence lesser nuisance to neighboring community especially closer to sensitive locations.</p> <p>Provide temporary protection against erosion, divert waterways/provide temporary drainage, locate soil stockpiles outside drainage paths, provide temporary barriers at gullies to avoid movement of increased volumes of solid materials (Best Practices in Waste Management is attached as Annex 8 which can be practiced by the contractor) from stockpiles to drains and to the Sea during construction stage, schedule activities during dry periods, adequate slope protection where necessary.</p> <p>Location of the disposal sites will be finalized prior to the commencement of works and shall be approved by the solid waste management division of the KMC.</p> <p>Re-use of debris: Non-bituminous debris generated shall be suitably re-used in the proposed construction provided such material is suitable for construction purposes with the approval of the Engineer. Unutilized debris shall be suitably disposed of by the contractor either through handing over to other projects which can make use of the material or at suitable landfill sites or disposal sites as approved by the solid waste management division of the KMC.</p>				



Activities	Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
				Implement	Supervision
	Location of disposal site: The contractor should identify sites for debris disposal which should be finalized prior to commencement of pipe laying taking into account the following: (i) The dumping does not affect natural drainage courses and is located far away from any waterbodies (ii) The dumping site does not have a high water table (iii) No endangered/rare fauna or flora is affected by such dumping. The contractor will take reasonable precaution to prevent workmen or any other persons from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body and hunting of any animal. (iv) Should be located in non –residential areas located on the downwind side (v) Avoid disposal on productive land (vi) Should be located with the consensus of the KMC.				
6.	<b>Material Procurement</b>				
	<p>There will be massive procurement of materials involved. It may be required to procure construction materials which involves loading to vehicles and it will create both noise and dust problems. Improper Management borrow pits may cause severe environmental issues such as spreading of invasive species, mosquito breeding.</p> <p><b>Mitigation Measures:</b> Source material from locations close to construction sites. Search thoroughly for materials sources as close to the project site as possible. Use alternative materials as much as possible. Reduce waste by re-using spoil in this project (removed soil may be used as backfill) or provide materials to other projects. During the borrow pits management, follow the specific guidelines given in Annex III and IV. In addition, contractor should make sure that the borrow pits selected with proper licenses, clearing of borrow areas after construction, take necessary actions to avoid spreading of invasive species, etc</p>	Project area and sourcing site	Engineering Cost	Contractor	PMU, KMCConstruction Supervision Consultant
7.	<b>Design for culverts, leader ways, silt traps and catch pits</b>				
	For <a href="#">leaderways</a> designs should be considered for smooth	Along the two	Engineering	Contractor	KMC, PMU,

Activities	Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
				Implement	Supervision
	<p>flow without any blocking</p> <p>For silt traps designs should be considered for trapping of silt in proper manner</p> <p>For catch pits appropriate designs should be considered in order to drain out rain water without blocking / flooding</p> <p>Designed drainage facilities must be capable of disposing of the runoff generated in a given water catchment without inundating the surrounding land (adjacent properties and utilities or land uses) in an event of a twenty five year return period flood”.</p>	streams	Cost		Construction Supervision Consultant
8	<b>Material Sourcing</b>				
	Ensure that sand, aggregates and other quarry material is sourced from licensed sources.	Borrow Sites	Engineering Cost	Contractor	KMC , PMUConstruction Supervision Consultant
	The contractor is required to obtain the necessary licenses and environmental clearances for all burrow and quarry material they are sourcing to obtain soil, fine aggregate and coarse aggregate.	Borrow Sites	Engineering Cost	Contractor	KMC , PMUConstruction Supervision Consultant
	Sourcing of any material from protected areas and/or designated natural areas are strictly prohibited.	Borrow Sites		Contractor	KMC , PMUConstruction Supervision Consultant
	If the contractor uses non-commercial burrow/quarry sites, the sites should be remediated accordingly once material sourcing has been completed. The Project Supervision Engineer will require maintaining the numbers and relevant details of all necessary licenses etc. and report of their status accordingly.	Non- commercial burrow sites/quarry sites	Engineering Cost	Contractor	KMC , PMUConstruction Supervision Consultant


Activities	Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
				Implement	Supervision
9.	<b>Planning of Temporary Traffic Arrangements</b>				
	<p>Canal excavation, material transport and sediment transport may cause temporary disruption to road traffic.</p> <p>In the case of improvement works in the two streams, traffic congestion during construction can be expected especially in the immediate surrounding of Rajaphilla junction, Ampitiya Junction, Nuwarawela Bodhiya Junction, Rajapihilla Mawatha, Ampitiya Road etc. during daytime. Full closure of surrounding roads is not anticipated but, temporary traffic congestion on the road may affect the roads.</p> <p><b>Mitigation:</b> It may require to have traffic diversion plan to other routes should be prepared/implemented.</p> <p>Prepare a traffic management plan with the RDA/PRDA in consultation with the KMC and Traffic Police: plan routes to avoid access narrow roads, access to other roads and highly populated areas. Validate routes by considering condition of roads, present traffic loads, safety records etc. Consult responsible authorities and prepare plans to improve condition of whole road before and after use. <u>The traffic control plan should be submitted to the Engineer for approval.</u></p> <p>Since the rehabilitation area is predominantly a built-up area, care should be taken not to create high noise levels during working hours particularly during sleeping hours if works carried out in the night. The interim standard on noise levels caused by vehicular movement should be complied with (during construction in the daytime maximum noise level is</p>	Prior to Construction Activities	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant, Traffic Police

Activities	Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
				Implement	Supervision
	<p>75dB and if any activities anticipated during night time with proper justification by the contractor maintain the noise level below 50dB (subjective to the location)</p> <p>Idling of vehicles should be controlled as practical as possible in order to lessen the air pollution events. Engines of all vehicles, mobile and fixed plant on site are not left running unnecessarily. Maximizing energy efficiency (this may include using alternative modes of transport, maximizing vehicle utilization by ensuring full loading and efficient routing). All commercial road vehicles used in construction must meet the Sri Lankan standards of vehicle running.</p> <p>Proper traffic control devices as per the Manual on Traffic Control Devices published by RDA (August 2007) should be used together with traffic diversion and control in order to provide adequate safety measures to ensure the safety of road users and workmen.</p>				

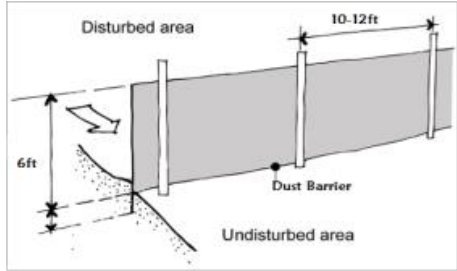



Activities		Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
					Implement	Supervision
		 				
<b>Construction Stage</b>						
10	<b>Cut &amp; Fill Activities</b>					
		<p>Since the canal rehabilitation activities are expected to carry out cut &amp; fill activities for the Gabion Walls, check dams, and stoned wall cascade constructions, emission of air pollutants is very likely. High noise and vibration levels are likely from equipment and machinery. Impacts are temporary in nature.</p> <p><b>Mitigation Measures:</b> Suitable surface finishing should be provided to minimize erosion of new formations and also to ensure ease of access to regular maintenance activities. Proper dust barriers should be arranged especially closer to sensitive receptors such as Nuwarawela Bodhiya, public bathing place at Rajaphilla stream (Ch. 00m) etc. Some sort of guiding figures are given below. The maximum height of barriers should be 6ft at minimum. Material such as Amano roofing sheets, fine mesh geo textiles are recommended materials to be used for setting up dust barriers. Ensure no burning of waste materials takes place on site, ensure an adequate water supply on the site, ensure regular cleaning of hard standings using wet sweeping methods, not</p>	<p>Along the Heelpan-Kandura Stream where gabion walls, check dams are expected to be constructed and Rajaphilla Stream where cascades are expected to be constructed.</p>	<p>Engineering Cost</p>	<p>Contractor</p>	<p>KMC, PMUConstruction Supervision Consultant</p>



Activities	Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
				Implement	Supervision
	<p>allow dry sweeping of large areas, etc can be practiced to reduce dust emission.</p>  <p><b>Dust and Noise Barrier</b></p> <p>If rehabilitation activities are expected to be carried out in the night time, approval should be obtained from the KMC, and the Traffic Police.</p> <p>Suitable back-fill material (soil) with required grading and strength characteristics should be used either from on-site burrow areas or outside. Make sure the sounds of the machineries do not exceed the noise limits gazetted by the CEA which are referred above. All equipment's and machineries must be checked for their workability performances on regular basis.</p>				
	<p>Limit noise generating work to day time (6:00AM to 6:00PM). Other type of construction work which will not disturb the environment by noise or vibration could be carried out during the night time. No work that generates excessive noise should be carried out during night hours (from 6:00PM to 6:00AM on the following day).</p> <p>Even during day time use of the access road should be minimized during departure times (7:00AM to 8:30AM), school time (1:00PM-2:00PM) and arrival times (After 4:30PM -6:00PM). This will not only reduce noise levels but also help mitigate congestion issues in the area due to the</p>	Canal Rehabilitation Site	Engineering cost	Contractor	KMC Construction Supervision Consultant,P MU

Activities	Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
				Implement	Supervision
	construction activities.				
	All equipment and machinery should be operated at noise levels that do not exceed the permissible level of 75 dB (during construction) for the day time. For all construction activities undertaken during the night time, it is necessary to maintain the noise level at below 50 dB as per the Central Environmental Authority (CEA) noise control regulations	Canal Rehabilitation Site	Engineering Cost	Contractor	KMC PMU Construction Supervision Consultant
	All equipment should be in good serviced condition. Regular maintenance of all construction vehicles and machinery to meet noise control regulations stipulated by the CEA in 1996 (Gazette Extra Ordinary, No 924/12) must be conducted for vehicles/machinery that will be used in construction on site and for transport.	Canal Rehabilitation Site	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant
	Make sure not to carry out noise generating work during public holidays and religious days. Special care should be taken as there is a temple nearby.	Canal Rehabilitation Site		Contractor	KMC, PMU, Construction Supervision Consultant
	Labor gangs should be warned to work with minimum noise. Strict labor supervision should be undertaken in this respect. Number of night time resident laborers should be minimized.	Canal Rehabilitation Site		Contractor	KMC, PMU, Construction Supervision Consultant
	Temporary sound barriers also should be erected around buildings or premises as appropriate to shield residents if there are complaints from them.	Canal Rehabilitation Site	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant
	Carry out continual water sprinkling in the work and fill areas where gabion walls, cascades, earthen bank will be established and the access road if dust stir is observed.		Engineering Cost	Contractor	KMC, PMU, Construction

Activities	Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
				Implement	Supervision
	<p>Water sprinkling should be done more frequently on days that are dry and windy (at least four time's day) as the levels of dust can be elevated during dry periods.</p> <p>Dust barriers should be used during all construction activities, especially in areas along roads with heavy traffic, commercial and residential areas.</p>  <p>The maximum height of barriers should be 6ft at minimum. Material such as Amano roofing sheets, fine mesh geo textiles are recommended materials to be used for setting up dust barriers</p>				Supervision Consultant
	<p>Impacts on existing structures such as buildings, embankments, roads, drainage structures, etc (such as cracking, breaking, tilting, settlement )</p> <p><b>Mitigation Measure</b> Shoring, Sheet covering, Amano sheet covering, at the locations earmarked for rehabilitation.</p>	Along Rajaphilla & Heelpan-Kandura Streams	Engineering Cost	Contractor	KMC, PMU,Construction Supervision Consultant
	Construction materials shall be stored in places not subjected to flooding and in such a manner that these materials will not be washed away by runoff.	All water bodies located around the Rajapihilla & Heelpan-Kandura streams eg: Kandy lake	Engineering Cost	Contractor	KMC, PMU,Construction Supervision Consultant

Activities		Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
					Implement	Supervision
		Temporary soil dumps should be placed at least 200m away from all water bodies	All water bodies located around the Rajapihilla & Heelpen-Kandura streams eg: Kandy lake	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant
		If temporary soil piles are left at the site for a long time those piles should be covered with thick polythene sheets 	Soil piles located around the Rajapihilla & Heelpen-Kandura Streams	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant
		All fills, back fills and slopes should be compacted immediately to reach the specified degree of compaction	Along the canal banks wherever applicable	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant
11	<b>Desilting, Deepening, Dewatering and Disposal of bottom sediments</b>					
		It is proposed to improve the condition of the canal beds of two streams by desilting and deepening (approximately 0.5m to 1m) to a uniform slope. The following impacts are expected to be generated due to this project activity. Excavation of canal bottom average about 0.25m depth and width average about 1.5m in Heelpenandura and 1.2m in Rajapihilla will generate a mixed spoilage estimated about 300-350m <sup>3</sup> consisting of soil from the banks, solid waste and sediments from canal bed.				

Activities	Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
				Implement	Supervision
	<p>Stockpiling of such excavated material may block surface drainage paths causing localized flooding during construction period.</p> <p>If not properly stored and adequately covered washout of fine material may contribute to further deterioration of surface water quality in the canal as well as other water bodies such as Kandy Lake, and may increase risk of siltation and blockage of structures.</p> <p>If not properly disposed the excavated material will pollute water sources at location where it is disposed</p> <p>Dewatering for foundations of Gabion walls, and lining of canal bed, foundations for check dam which may need to be carried out during construction activities, may cause slope instability, transport of fines and surface ponding of water if proper drainage is not provided.</p>				
	<p>Silt and sediment quality in the canal should be established to understand the potential risk of contamination by heavy metals (and the leachability) and to determine the most suitable disposal method for the excavated debris and sediments. If contamination is established according to accepted reference criteria, the following mitigation measures are proposed to be implemented.</p> <p>(a). Location of disposal site: The contractor should identify sites for debris disposal which should be finalized prior to commencement of canal rehabilitation taking into account the following: (i) The dumping does not affect natural drainage courses and is located far away from any waterbodies (ii) The dumping site does not have a high water table (iii) No endangered/rare fauna or flora is affected by such dumping. The contractor will take reasonable precaution to prevent workmen or any other persons from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body and hunting of any animal. (iv) Should be located in non – residential areas located on the downwind side (v) Avoid disposal on productive land (vi) Should be located with the consensus of the KMC.</p>	Prior to Construction Activities	Engineering Cost	Contractor	KMC, PMU Construction Supervision Consultant

Activities		Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
					Implement	Supervision
		<p>If contamination is ruled out, the excavated matter along with other construction debris will be disposed to the solid waste dumping site operated by the KMC at Gohagoda temporary location to dump disposal site, which is located within 10 Km radius from the canal site. The Contractor shall obtain the prior approval in writing from the KMC before the debris is disposed at the site operated by the KMC. A location for temporary dumping of wet debris should also be collaboratively identified by the PMU, and KMC as wet debris may not be able to be transported immediately to a distance of 10km. The contractor shall obtain the prior approval to use this temporary site from the KMC. It will also be necessary to cover the material fully to prevent any particles from being air borne. Any accidental leakages will be immediately attended to by the contractor and the area should be cleaned up before the public can be exposed to any hazards.</p> <p>The PMU shall undertake sediment sampling and if sediment analysis confirms the canal to contain contaminated sediments, the contractor should be instructed to carry out excavation in such a way that bottom sediments/debris is isolated (to the extent possible) from the rest of soil/spoilage, so that quantities needing special disposal would be minimal. Also, separating excavated soil from the bank from the rest of the debris should be pursued if the soil is considered suitable as a backfill for the gabions.</p>				
	Rainfall at sites may cause erosion and silt-laden run-off through		Along Rajapihilla	Engineering	Constructi	KMC,



Activities	Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
				Implement	Supervision
	drainages cause blockage of drainages, flooding in the project area	& Heelpan-Kandura Streams	Cost	on Contractor	PMU, Construction Supervision Consultant
	Mitigation Measures: 1. Plan construction schedules to conduct excavation in the dry season and to avoid the SW Monsoon in May-September	-do-	-do-	-do-	-do-
	2.Limit linear construction foot print to 300 m of the stream stretch at a time.	-do-	-do-	-do-	-do-
	3. Protect exposed surfaces with geo-textile fabric during rainfall	-do-	-do-	-do-	-do-
	3. Compact filled surfaces as soon as the surfaces are completed to avoid erosion	-do-	-do-	-do-	-do-
	4. Build earth bunds beside drainage channels to avoid overspill	-do-	-do-	-do-	-do-
	<u>4.</u> Hold drainage water in ponds to reduce the sediment content and by use of silt traps etc. prior to discharge to waterbodies, especially if soil is stockpiled; obtain permission from the KMCs prior to discharge to surrounding water bodies				
	<u>4-5.</u>				
	<u>5-6.</u> Avoid erosion by rapid seeding of exposed soil with grass				

Activities	Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility		
				Implement	Supervision	
	<p>At the bottom end of the construction perimeter, a silt trap should be established, either excavated or build using berms (sand bag), to trap silt from the overflow or stagnant water pumped out from the construction area, before releasing downstream. The silt trap should be 1-1.5 m deep, at least 10m in length for the given canal width.</p>					
12.	<b>Excavation for the Gabion wall construction</b>					
	It is proposed to stabilize the banks with Gabion walls from Ch. 595m to Ch. 732 for Heelpan-Kandura Stream after the confluence. The construction of gabion walls along the canal embankment for bank strengthening and stabilization would require substantial excavation closer to the existing earth embankments. Such deep excavations in saturated weak soil could result in collapsible vertical soils and increased susceptibility to erosion and liquefaction leading to bank failures. This activity will generate a mixed spoilage consisting of soil, solid waste, sediments etc.					
	Use impermeable cover (PVC or Plastic cover) on the ground to avoid ground seepage	Along the two streams	Engineering Cost	Contractor	KMC , PMU Construction Supervision Consultant	
	Use the excavated material for backfilling purposes as much	Along the two	Engineering	Contractor	KMC , PMU	

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Activities		Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
					Implement	Supervision
		as possible	streams	Cost		Construction Supervision Consultant
		Obtain site clearance/approval from the KMC for the dumping site to dispose excavated material	Dumping site approved	Engineering Cost	Contractor	KMC , PMU Construction Supervision Consultant
		Make use of sheet piles to avoid the bank collapse wherever necessary	Along the two streams	Engineering Cost	Contractor	KMC , PMU Construction Supervision Consultant
		Use hydraulic system for fixing of sheet pile rather than using of old techniques which may cause significant noise and vibration issues	Along the two streams	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant
13	<b>Transport and Storage of construction materials</b>					
		Identify sites for storage of construction materials without affecting the traffic and other common utilities that will lead to access issues as the compound is operational.	Prior to commencement of construction Activities	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant


Activities	Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
				Implement	Supervision
	<p>All material should be transported in fully covered trucks. Overloading of vehicles with materials should be controlled and done in a manner to suit the trucks capacity.</p> 	During the transportation of materials	Engineering Cost	Contractor	KMC PMU Construction Supervision Consultant
	<p>Store construction material such as cement, sand and metal in closed structures or in a contained manner.</p> 		Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant
	<p>Make sure not to permit idling of temporary trucks or other equipment during periods of loading / unloading or when they are not in active use. The practice must be ensured</p>	Sensitive areas such as Nuwarawela		Contractor	KMC, PMU, Construction

Activities		Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
					Implement	Supervision
		along the two streams where there is a high density of residences, commercial establishments such as Devon Hotel and sensitive areas such as Nuwarawela Bodhiya, and the Nuwarawela Play Ground.	Bodhiya, Nuwarawela Cooperative Society and the Nuwarawela Play Ground and commercial establishments such as Devon Hotel			Supervision Consultant
		Keep stationary construction equipment at least 500m away from sensitive receptors, where possible. These include Hospitals, schools, Temples and areas where there is a high density of residences along the canal.	Nuwarawela Bodhiya, Nuwarawela Cooperative Society and the Nuwarawela Play Ground	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant
		<u>Transport of construction material will be restricted to after 6.30 pm or before 6 am</u>				
14	<b>Solid, hazardous waste and debris management</b>					
	(a)	Improper disposal may create foul odour, more mosquito breeding sites, unpleasant visual quality, increased flies, rodents and stray animals. <b>Mitigation Measures:</b> Dispose of all waste material from worksites and labor camps to the sites designated by the LAs, without causing visual or leachate pollution or hazards to other users of the disposal site.	Project sites, labour camps, stores, Dumping Sites, etc	Engineering cost	Contractor	KMC, PMU, Construction Supervision Consultant
	(b)	Spills of oil, grease, fuel and other toxic materials used on-site can pollute surface and groundwater.				

Activities		Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
					Implement	Supervision
		<p><b>Mitigation Measures:</b> Adopt effective pollution prevention/ abatement measures on-site: store fuel, oil etc. in leak-proof areas with concrete floors and bunds; avoid storing toxins near sensitive sites</p> <p>Adopt good site management practices to avoid accidental spills and set up contingency plans for immediate removal of any spill. As much as possible apply oil traps wherever oil, grease or any lubricants are stored</p> <p>Please also refer to the Waste Management Guidelines in the Annexure VI</p>				
15	<b>Movement of vehicles, machinery and equipment</b>					
		Vehicles, Machineries and equipment's cause air and noise pollution which could be a nuisance in populated areas.				
		Contractor shall submit the list of high noise/vibration generating machinery & equipment to the KMC/Engineer for approval.	Prior to commencement of Construction Activities	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant
		Carry out regular servicing of all construction vehicles and machinery and check the effectiveness of exhaust silencers during routine servicing operations, and replace if found defectives	During construction period	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant
		Maintenance of vehicles, equipment and machinery shall be regular and up to the satisfaction of the Engineer to keep noise levels at the minimum	During construction period	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant
		The contractor shall ensure that all construction vehicle	Designated	Engineering	Contractor	KMC,

Activities	Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
				Implement	Supervision
	parking location, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance and refueling sites shall be located in designated locations/ service stations approved by the engineer	locations approved by the Engineer	Cost		PMU, Construction Supervision Consultant
	Contractor shall ensure that all vehicle/machinery and equipment operation, maintenance and refueling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the two streams and the ground.	During the construction period	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant
	Contractor shall arrange for collection, storing and disposal of oily wastes to the pre-identified disposal sites (list to be submitted to Engineer) and approved by the Engineer. All spills and collected petroleum products will be disposed-off in accordance with standards set by the CEA.	Pre-identified Disposal Sites	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant
	Engineer will certify that all arrangements comply with the guidelines of CEA or any other relevant laws.	-	Engineering Cost	Contractor	KMC, PMU
16	<b>Reinstatement of storm water drainage connections (Hume pipes) to Rajapihilla and Heelpan-Kandura streams through gabion walls and introduction of catch pits wherever required</b> Because of this project activity, there could be erosion of soil adjacent to structures leading to loosening of canal bank support. This will weaken the interlocking of rubble used causing immature failure of gabion structure before its intended design life. There could also be blockage of drain pipes due to accumulation of solids.				
	Storm water connections across the gabion walls should be provided using hume pipes or box culverts of adequate size according to pre-determined design storm events and return periods.	Design Stage	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant
	Catch pits should be provided at suitable spacing to remove excessive fine particles through settlement. Catch pits should	Design Stage	Engineering Cost	Contractor	KMC, PMU, Construction

Activities	Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
				Implement	Supervision
	be regularly cleaned and maintained in proper order. Fine particles removed should be properly disposed to avoid them joining flow paths again				Supervision Consultant
	Proper slopes, invert levels and adequate opening sizes should be maintained to facilitate the entering of cross drainage flows to the canal	Design Stage	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant
	Where through flow is expected, adequate protection should be provided with coir mats/geotextile membranes to curtail washout of fine particles through gabion structures, weakening surrounding soil layers.	Design Stage	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant
17	<b>Health &amp; Safety of Workers &amp; the General Public</b>				
	Contactors must comply with the provisions in Health and Safety regulations under the Factory ordinance with regards to provisions of health and safety measures and amenities at work places.	Along Heelpan-Kandura & Rajaphilla streams and associated sites	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant
	Ensure appropriate safety equipment, tools and protective clothing are provided to workers and that safe working methods are applied. A safety inspection checklist should be prepared taking into consideration what the workers are supposed to be wearing and monitored during specific construction activities.	Along Heelpan-Kandura & Rajaphilla streams and associated sites	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant

Activities	Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
				Implement	Supervision
					
	Ensure prevention of risks from electrocution by regular	Along Heelpan-	Engineering	Contractor	KMC,

Activities		Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
					Implement	Supervision
		inspection and maintenance of all electric power driven machines used on the construction site. They must be kept way from permanent/ temporary pedestrian walkways	Kandura & Rajaphilla streams and associated sites	Cost		PMUConstruction Supervision Consultant
		The canal rehabilitation site should be barricaded at all time in a day with adequate marking, safety tape, flags, reflectors etc. for safety of individuals using the compound on a daily basis. (Items such as parking cones, lights, tubular markers, orange and white strips and barricades of a luminous nature for night visibility) The construction site should be clearly demarcated by the above means and restriction of access to public to the site will help the safety of public. Safety signboards should be displayed at all necessary locations.	Along Heelpan-Kandura & Rajaphilla streams and associated sites	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant
		The contractor should obtain a Third party insurance to compensate any damages, injuries caused to the public or laborers during the construction period.	Prior to Commencement of Construction Activities	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant
		All construction vehicles should be operated by experienced and trained operators under supervision	Along Heelpan-Kandura & Rajaphilla streams and associated sites	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant
		Basic onsite safety training should be conducted for all laborers during the EMP training prior to the start of the construction activities	Along Heelpan-Kandura & Rajaphilla streams and associated sites	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant



Activities		Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
					Implement	Supervision
		All digging and installation work should be completed in one go, if this task is not accomplished the area should be isolated using luminous safety tape and barricading structures surrounding the whole area. Construction wastes should be removed within 24 hours from the site to ensure public safety.	Along Heelpan-Kandura & Rajaphilla streams and associated sites	Engineering Cost	Contractor	KMC, PMU, Construction Supervision Consultant
18	<b>Occupational Health &amp; Safety</b>					
		Contractor's Project Manager/Engineer should hold Toolbox Meetings to increase workers awareness about occupational safety in addition to formal training sessions regarding occupational safety. Toolbox meetings will be held every day lasting between five to ten minutes by the supervisor to different sets of workers on-site to explain different aspects of occupational safety. Adopt all standard site safety measures. Warnings, awareness, protective clothing, masks for workers, first aid, training to work safely & regular safety checks.	Project Site	Engineering Cost	Contractor	KMC, PMU Construction Supervision Consultant
19	<b>Protection of Archaeological, Cultural and Religious Places and Properties</b>					
		During construction activities the contractor should take all necessary and adequate care to minimize impacts on cultural properties which includes cultural sites and remains and places of worship.  Workers should not be allowed to trespass in to such areas. All structures and other remains or things of geological or archaeological interest discovered on the site shall be the property of the Government and shall be dealt with as per provisions of the relevant legislation.	Along Heelpan-Kandura & Rajaphilla streams	Engineering Cost	Contractor	Heritage Committee, PMU, Department of Archaeology, KMC, Religious leaders, Construction Supervision

Activities		Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
					Implement	Supervision
		<p>The contractor will take reasonable precautions to prevent his workmen or any other persons from removing and damaging any such article or thing. They will, immediately upon discovery thereof and before removal acquaint the Engineer of such discovery and carry out the instructions for dealing with the same, waiting which all work shall be stopped.</p> <p>The Engineer will seek direction from the Archaeological Department of Sri Lanka and inform the project Safeguard Officer to follow the Chance Find Procedures set forth.</p>				Consultant
20	<b>Environment Enhancement</b>					
		On completion of the works, the temporary structures shall be cleared away in full, all rubbish burnt, waste dumps and septic tank shall be filled and closed and roadsides, workplaces and labor camps, cleared and cleaned.	Along Heelpan-Kandura & Rajaphilla streams and associated sites	Engineering cost	Contractor	KMC, PMU, Construction Supervision Consultant
		Re-vegetation of Rajapihilla and Heelpankandura canal embankments wherever suitable, edge treatment of these two canals shall be taken up as per either detailed design or typical design guidelines given as part of the Bid Documents. The contractor also shall remove all debris, piles of unwanted earth, spoil material, away from the roadsides and from other work places and disposed at locations designated or acceptable to the Engineer.	Along Heelpan-Kandura & Rajaphilla streams and associated sites	Engineering cost	Contractor	KMC, PMU, Construction Supervision Consultant
21	<b>Handling Environmental Issues During Construction</b>					
		The Contractor will appoint a suitably qualified <b>Safeguard Environment, Health and Safety (SHE)</b> Officer following the award of the contract. The Safeguard Officer will be the primary point of contact for assistance with all environmental issues during the pre-construction and	For the entire sub project during the construction period	Engineering cost	Contractor	KMC, PMU Construction Supervision Consultant

Activities	Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
				Implement	Supervision
	construction phases. He/ She shall be responsible for ensuring the implementation of EMP.				
	<del>Safeguard</del> <u>SHE</u> Officer shall be responsible for community liaison and to handle public complaints regarding environmental/ social related matters. All public complaints will be entered into the Complaints Register. He will promptly investigate and review environmental complaints and implement the appropriate corrective actions to arrest or mitigate the cause of the complaints. A register of all complaints is to be passed to the Engineer within 24 hrs they are received, with the action taken by the Environmental /Social Officer on complains thereof.	For the entire sub project during the construction period	Engineering cost	Contractor	PMU, KMCConstru ction Supervision Consultant
	Contractor shall develop suitable method to receive complaints. The complaint register shall be placed at a convenient place, easily accessible by the public	For the entire sub project during the construction period	Engineering cost	Contractor	PMU, KMCConstru ction Supervision Consultant
	Contractor shall prepare detailed Programme of Actions based on the EMP equivalents clearly stating the approach, actions and manner in which the EMP is implemented.	For the entire sub project during the construction period	Engineering cost	Contractor	PMU, KMC, Constr uction Supervision Consultant
22	<b>Other Project Activities</b>				
	The proposed project activities could come into conflict with other planned projects in the same area and related other activities. Proposed project activities make the landowners and road users bordering the project area experience day to day hardships due to difficulties in accessing their properties	For the entire sub project during the construction period	Engineering Cost	Contractor	PMU, KMC, Constr uction Supervision Consultant

Activities		Protection and preventive measures	Locations/ Project phase	Mitigation cost	Institutional Responsibility	
					Implement	Supervision
		<p>during construction. Therefore, grievances could arise within the affected community in an unforeseen manner in relation to the project.</p> <p><b>Mitigation Measures:</b> Obtain details of planned projects from relevant agencies and if conflicts occur (e.g., same site or a site adjacent to the Rajapihilla and Heelpan-Kandura streams being chosen by different projects) discuss and resolve with implementing agencies</p> <p>JICA Greater Kandy Sewerage project may have project activities which may conflict with rehabilitation of Rajapihilla &amp; Heelpan-Kandura streams and if so, as mentioned above, the contractor is required to make a consolidate plan which should not clash each other.</p>				

## 8. Cost of Mitigation

	Cost Item	Unit	Quantity	Rate	Estimated Amount (LKR)
1	Provision of drains required to divert water flows, storm water and wastewater mgt, etc	Item			
2	Obtaining Approvals such as night-time works, CEA clearances, etc (if required)	PS			25,000.00
3	Arrange proper dust barriers especially closer to sensitive receptors such as Nuwarawela Bodhiya, highly residential areas, public bathing places at Rajapihilla	Item			
4	Use of thick polythene sheets to cover temporary	Item			

	soil piles (if available) left at the site for a long time and use of tarpaulin sheets to cover materials when transporting the materials				
5	Preparation disposal yards, operation & maintenance and landscaping after construction	<b>Item</b>			
6	Information disclosure among the residents and small, medium & large industries residing around the immediate vicinity of the two canals; provide them with information on the project activities	<b>Item</b>			
7	Appointing a suitably qualified Safeguard Officer following the award of the contract.	<b>PS</b>	<b>24</b>	<b>50,000.00</b>	<b>1,200,000.00</b>
	<b>Total</b>				

Other than above mentioned line items of cost of mitigation related to environment safeguards, all the other line items are included in the Engineering Bill of Quantities.

## 9. Conclusion and Screening Decision

### Summary of environmental effects:

Assuming that all mitigation measures are implemented as proposed, the following effects can be predicted

Key project activities	Potential Environmental Effects	Significance of environmental effect with mitigation in place N/S - Effect not significant, or can be rendered insignificant with mitigation SP - Significant positive effect SN - Significant negative effect U - Outcome unknown or cannot be predicted, even with mitigation
<b>Siting of Construction Camps</b>	If construction camps, labor camps, stock yards, vehicle refuelling areas etc. are located near sensitive areas such as wetlands, conservation zones and places of scenic beauty or recreational value, or any waterbody, those areas may be adversely affected. Social problems owing to alien labour gangs. E.g. communal diseases.	N/S
<b>Removal of trees or root pruning</b>	There is a possibility for the removal of 02 trees along the canal banks due to the Gabion wall construction. The benefits that are derived from the existence of trees such as loss of habitats for the flora and fauna, air purification, provision of shade and the scenic beauty, embankment protection due to soil binding capacity by the roots will be lost because of this activity	N/S
<b>Removal of public utilities</b>	If any relocation of utility services (temporary or permanently) be required such as electricity, water supply, telecom, etc., and therefore, there may be fugitive dust and high noise levels will be emanated from machinery and equipment being used.	N/S
<b>Planning of temporary traffic arrangements</b>	Material transport and sediment transport may cause temporary disruption to road traffic during day time. Full closure of surrounding roads is not anticipated but, temporary traffic congestion on the road may affect the roads.	N/S

<b>Cut &amp; Fill Activities</b>	Since the canal rehabilitation activities are expected to carry out cut & fill activities for the Gabion wall earthen bank constructions, emission of air pollutants is very likely. High noise and vibration levels are likely from equipment and machinery. Impacts are temporary in nature.	N/S
<b>Desilting, Deepening, Dewatering and Disposal of bottom sediments</b>	<p>Desilting and deepening of canal bottom will generate a mixed spoilage consisting of soil from the banks, solid waste and sediments from canal bed.</p> <p>Stockpiling of such excavated material may block surface drainage paths causing localized flooding during construction period.</p> <p>If not properly stored and adequately covered washout of fine material may contribute to further deterioration of surface water quality in the two streams and may increase risk of siltation and blockage of structures.</p> <p>If not properly disposed the excavated material will pollute water sources at location where it is disposed</p> <p>Dewatering for foundations of Gabion walls, lining of canal bed, Bridge construction foundation/base (if any), may cause slope instability, transport of fines and surface ponding of water if proper drainage is not provided.</p>	S/N
<b>Transportation and storage of construction materials</b>	Transportation of material and equipment will cause dust, noise and vehicle emissions along the canal. Storage of construction material will lead to access issues	N/S
<b>Excavation for the Gabion wall construction</b>	The construction of gabion walls along the canal embankment for bank strengthening and stabilization would require substantial excavation close to the existing earth embankments. Such deep excavations in saturated weak soil could result in collapsible vertical soils and increased susceptibility to erosion and liquefaction leading to bank failures. This activity will generate a mixed spoilage consisting of soil, solid waste, sediments etc. If not properly disposed the excavated material will pollute water sources at location where it is	N/S

	disposed	
<b>Demolition or Removal of structures</b>	Removal or demolition of structures and rebuilding of structures particularly along the two streams may create air pollution in terms of suspended particulate matters. Erosion risk due to exposed slopes, disruption to existing drainage paths, washout of fines and silting of waterways, local earth slips due to soil over saturation.	U
<b>Solid, Hazardous waste and debris management</b>	Improper disposal may create foul odour, more mosquito breeding sites, unpleasant visual quality, increased flies, rodents and stray animals.	NS
<b>Movement of vehicles, equipment and machineries</b>	Vehicles, Machineries and equipment cause air and noise pollution which could be a nuisance in populated areas.	N/S
<b>Reinstatement of storm water drainage connections (Hume pipes) to two streams through gabion walls</b>	Because of this project activity, there could be erosion of soil adjacent to structures leading to loosening of canal bank support. This will weaken the interlocking of rubble used causing immature failure of gabion structure before its intended design life. There could also be blockage of drain pipes due to accumulation of solids.	N/S



#### **10. EMP Implementation responsibilities and Costs**

The sub projects titled “Rehabilitation of Meda Ela”, “Rehabilitation of Upstream of Kandy Lake” and “Construction of Silt Traps” will be amalgamated and implemented as one package under Kandy drainage improvement. A supervision consultant is expected to be recruited to review the progress of implementation of this package of sub projects. The overall responsibility of ensuring compliance with regards to safeguard requirements during the implementation of this package of projects will also lie with the supervision consultants under the guidance of the PMU and the KMC. The contractor will be responsible for implementing the provisions of the EMP. In addition, the supervision consultant will be directly responsible for reviewing the proposed design to ensure that all design related mitigation measures mentioned herein are implemented. The overall supervision will be carried out by the in-house staff of the PMU supported by KMC who is responsible for the overall design and supervision of the proposed package of sub projects. Any consequent design modification will be reflected in the project cost.

Environmental monitoring will be carried out largely through visual observations and compliance monitoring using the Environmental Monitoring Data Sheet provided by the PMU. The Environmental Officer of the contractual party is expected to carry out field visit on weekly basis and shall report the issues and performance on EMP implementation to the KMC and PMU.

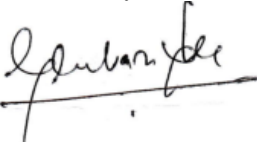
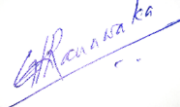
#### **11. Screening decision recommendation**

Of the potentially adverse impacts anticipated during project implementation, the most important is the disposal of mixed debris from the canal bed/banks which will contain silt, solid waste and embankment soil generated from desilting and canal deepening and gabion construction. In order to determine the site of disposal of this debris, it is necessary to establish the quality of sediments with regards to heavy metal contamination and likelihood of contaminants leaching out at the disposal site. Nevertheless it is important to follow the EMP in handling this issue. If careful disposal is warranted based on sediment test results, the supervision consultant under the guidance of the PMU should prepare a sediment disposal plan covering storing, loading, unloading, disposal and monitoring. Contractor should be responsible for safe handling of solid waste and KMC and PMU is responsible to monitor frequently.

Considering the physical characteristics of the area and the proposed interventions, most of the environmental impacts described in the EMP caused by project activities are not expected to have any significant or irreversible impact and are related to dust/noise generation, siltation, safety hazards, traffic congestion and other general impacts which can be mitigated with good construction, site management and public safety practices. The areas affected during rehabilitation work are mainly confined to the canal corridor. The requirement to remove trees will be minimal with the decision to preserve all large trees in the canal embankments and incorporate them in to the embankment layout. However, not all trees will be saved and it is important to evaluate and document each case of tree removal and follow guidelines of this EMP.

Given the above, it is considered that a standalone EIA is not needed for the proposed project and that the EMP thus prepared is suffice to manage the potentially adverse impacts.

**12. Details of Persons Responsible for Environmental Screening**

<p>Screening report completed by          Gamini Subhasinghe          Asst. Project Director (Env)  <a href="mailto:gaminiscdp@gmail.com">gaminiscdp@gmail.com</a></p> <p><i>Name/Designation/Contact information</i></p>	<p>Date: 24<sup>th</sup> July 2015</p>  <p><i>Signature</i></p>
<p>Screening report reviewed by          Gangadari Ranawaka          Deputy Project Director (Env)  <a href="mailto:gangadariscdp@gmail.com">gangadariscdp@gmail.com</a></p> <p><i>Name/Designation/Contact information</i></p>	<p>Date: 27<sup>th</sup> July 2015</p>  <p><i>Signature</i></p>

**Annex 1: Location Map of the Project Area**

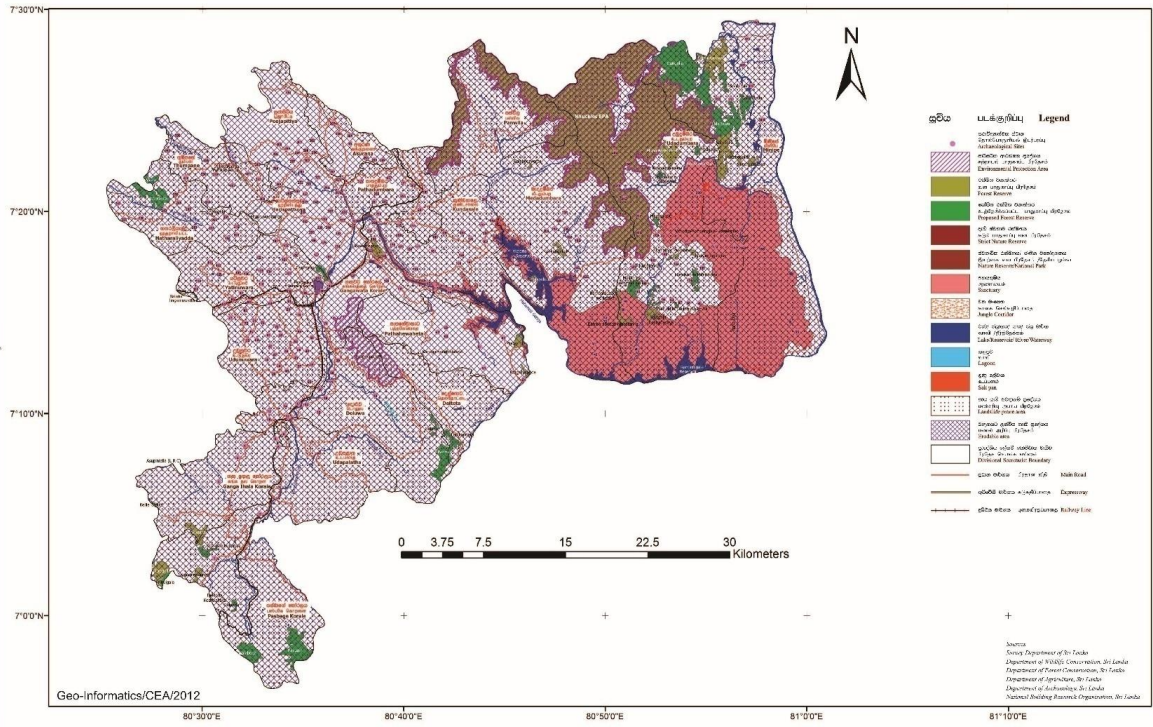


**Annex 2: Geology and Soil Map of the Project Area**



**Annex 3: Environmental Sensitive Areas of Kandy**

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 இலகுவில் பாதிக்கப்படும் சுற்றாடல் இடர்ப்பரப்பு - கண்டி மாவட்டம்  
**Environmental Sensitive Areas - Kandy District**

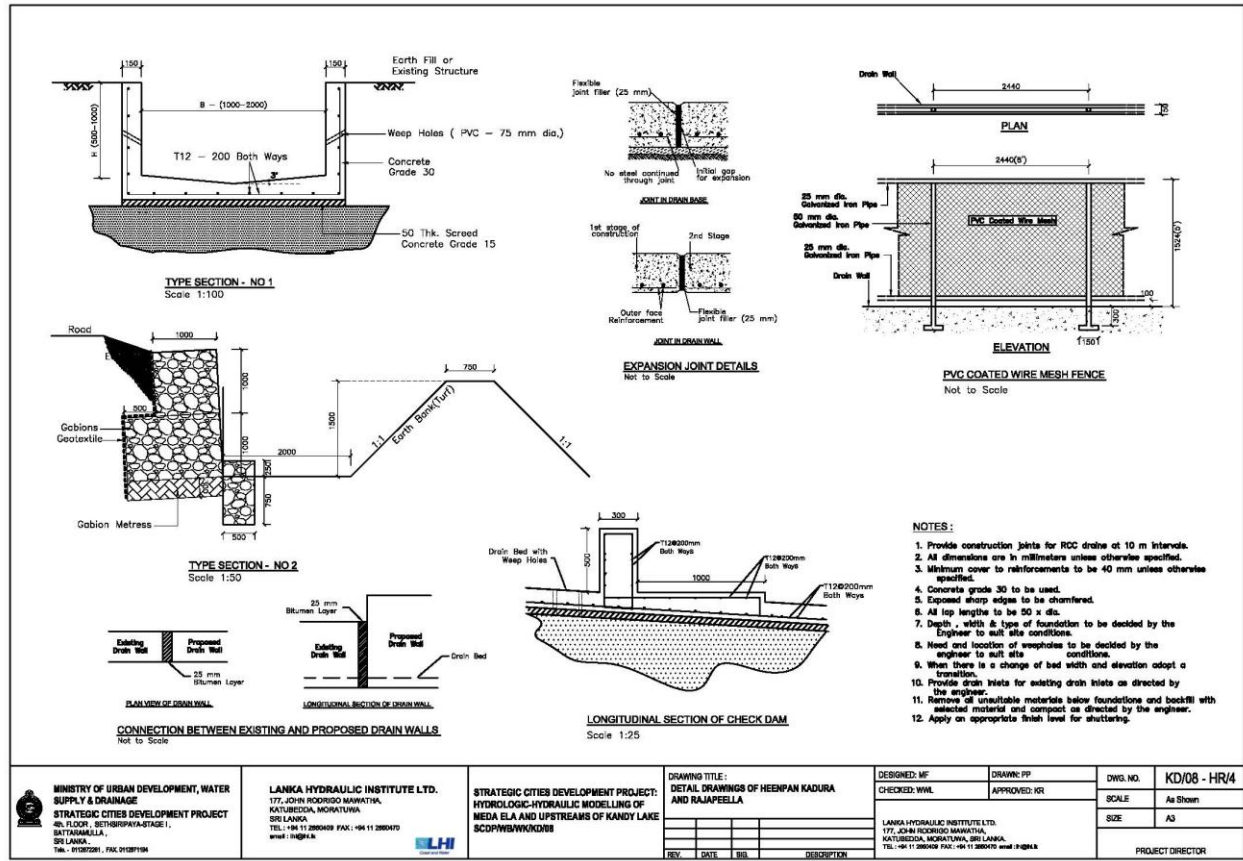


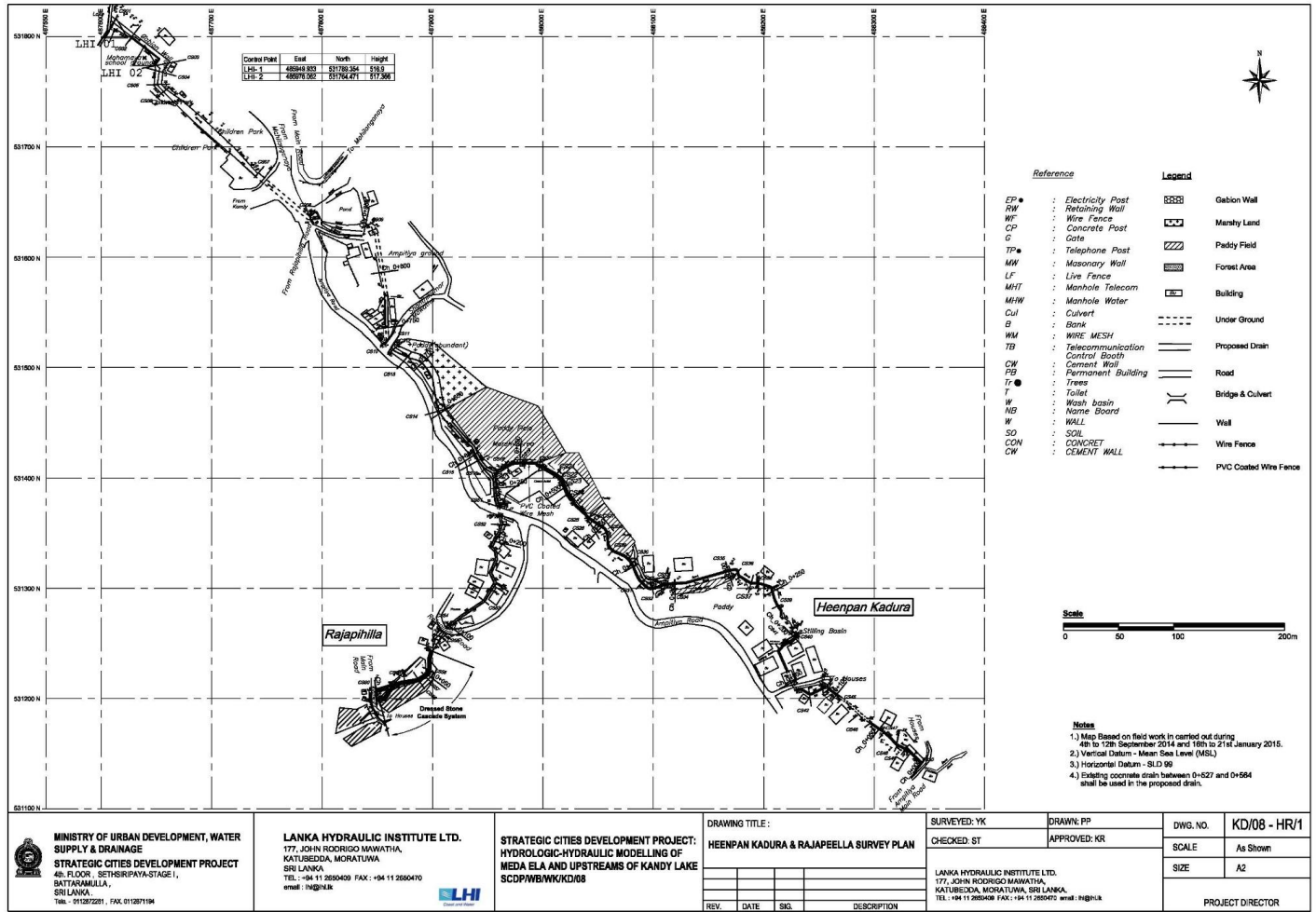
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மத்திய சுற்றாடல் அதிகாரசபை

Central Environmental Authority

Annex 4: Design Drawings of Rajapihilla and Heelpan -Kandura Streams






**MINISTRY OF URBAN DEVELOPMENT, WATER SUPPLY & DRAINAGE**  
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**STRATEGIC CITIES DEVELOPMENT PROJECT:**  
**HYDROLOGIC-HYDRAULIC MODELLING OF**  
**MEDA ELA AND UPSTREAMS OF KANDY LAKE**  
**SCDP/MB/WK/D/8**

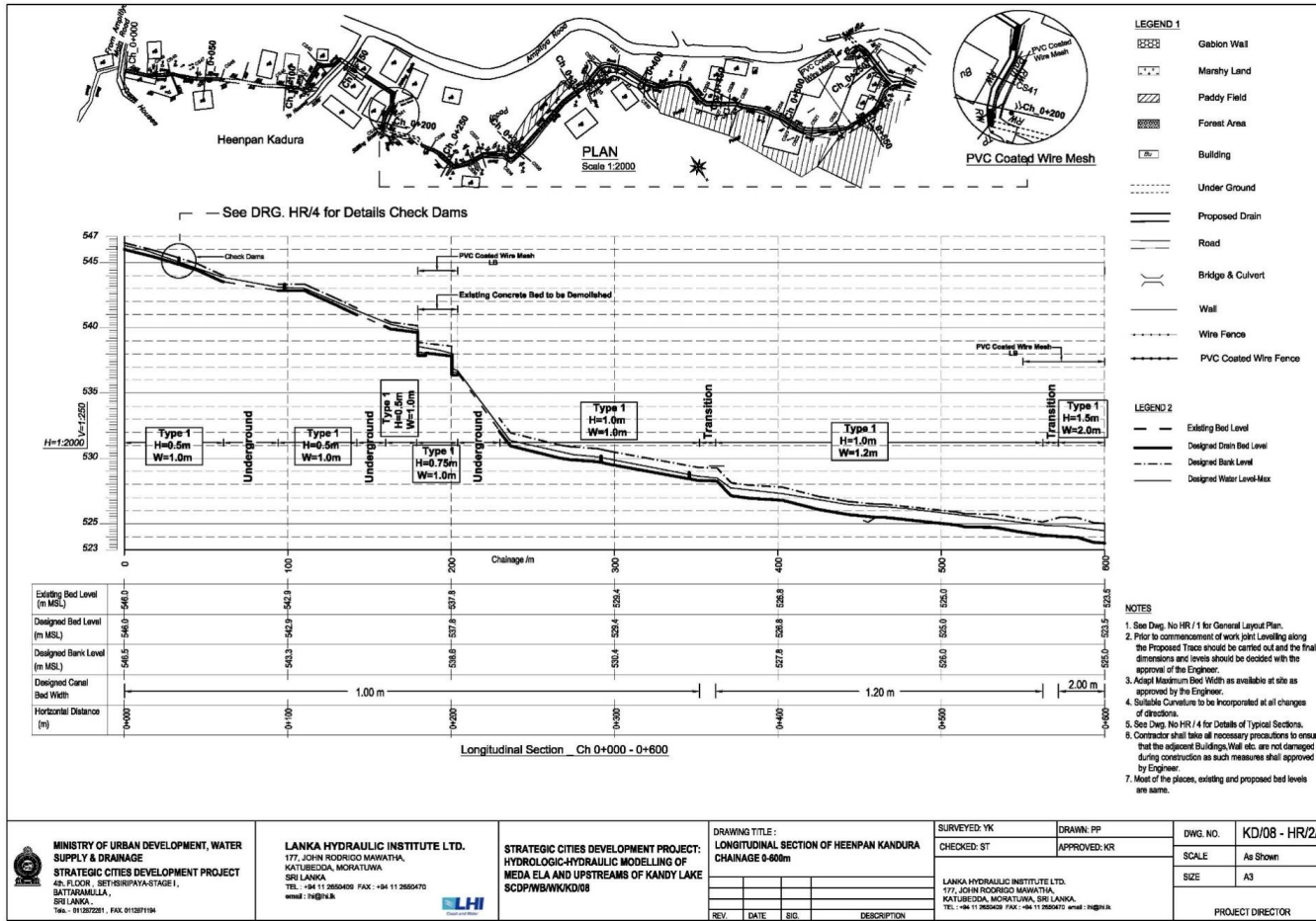
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REV.	DATE	SIG.	DESCRIPTION

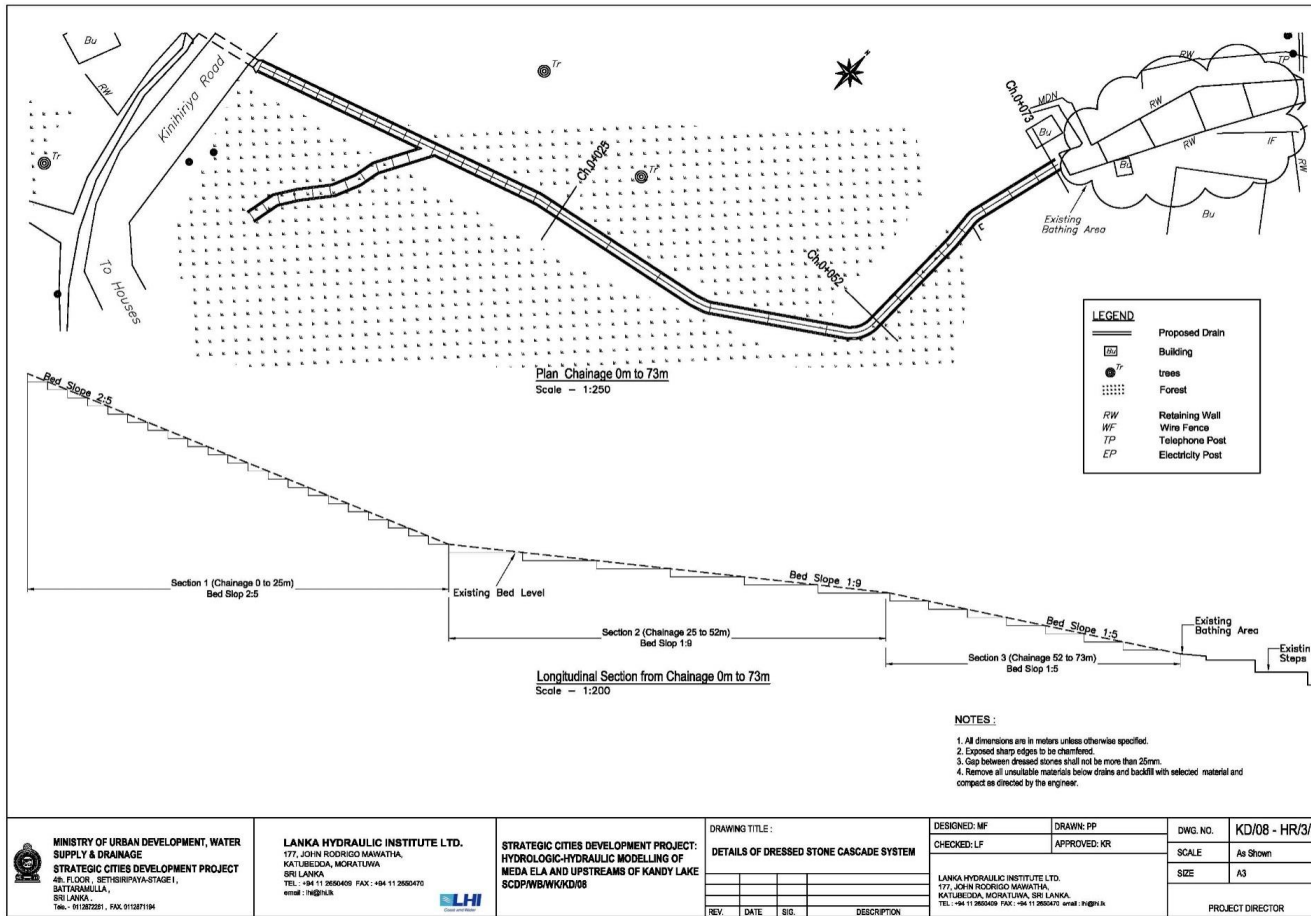
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CHECKED: ST	APPROVED: KR
LANKA HYDRAULIC INSTITUTE LTD. 177, JOHN RODRIGO MAWATHA, KATUBEDDA, MORATUWA, SRI LANKA. TEL: +94 11 2850429 FAX: +94 11 2850470 email: <a href="mailto:INH@LHI.lk">INH@LHI.lk</a>	

DWG. NO.	<b>KD/08 - HR/1</b>
SCALE	As Shown
SIZE	A2
PROJECT DIRECTOR	





<p><b>MINISTRY OF URBAN DEVELOPMENT, WATER SUPPLY &amp; DRAINAGE</b> STRATEGIC CITIES DEVELOPMENT PROJECT 4th FLOOR - BETHSIRIPAYA-STAGE 1, SATTARAMULLA, SRI LANKA. Tel : +91 93202251, Fax: 912021194</p>	<p><b>LANKA HYDRAULIC INSTITUTE LTD.</b> 177, JOHN RODRIGO MAWATHA, KATUBEDDA, MORATUWA, SRI LANKA. TEL : +94 11 2650409 FAX : +94 11 2650470 email : lhi@lhi.lk</p>	<p><b>STRATEGIC CITIES DEVELOPMENT PROJECT: HYDROLOGIC-HYDRAULIC MODELLING OF MEDA ELA AND UPSTREAMS OF KANDY LAKE SCDPWBWKKD/08</b></p>	DRAWING TITLE: LONGITUDINAL SECTION OF HEENPAN KANDURA CHAINAGE 0-600m	SURVEYED: YK CHECKED: ST	DRAWN: PP APPROVED: KR	DWG. NO. SCALE SIZE
			<p>LANKA HYDRAULIC INSTITUTE LTD. 177, JOHN RODRIGO MAWATHA, KATUBEDDA, MORATUWA, SRI LANKA. TEL : +94 11 2650409 FAX : +94 11 2650470 email : lhi@lhi.lk</p>	<p>DWG. NO. KD/08 - HR/2/1 SCALE As Shown SIZE A3</p>		
			<p>PROJECT DIRECTOR</p>			



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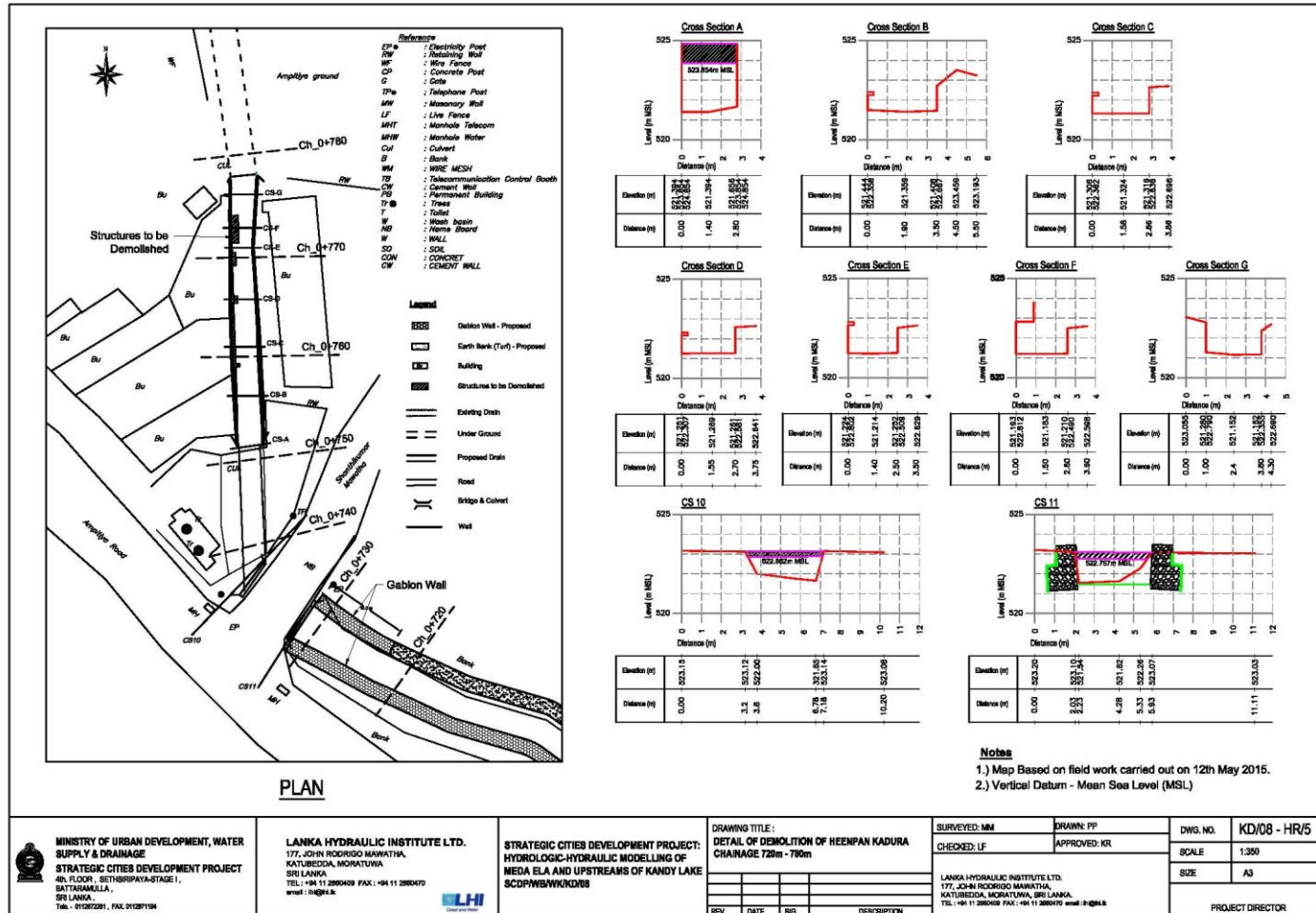
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STRATEGIC CITIES DEVELOPMENT PROJECT:  
HYDROLOGIC-HYDRAULIC MODELLING OF  
MEDA ELA AND UPSTREAMS OF KANDY LAKE  
SCDPWB/WK/KD08

DRAWING TITLE:			
DETAILS OF DRESSED STONE CASCADE SYSTEM			
REV.	DATE	SIG.	DESCRIPTION

DESIGNED: MF  
CHECKED: LF  
DRAWN: PP  
APPROVED: XR  
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DWG. NO.	KD/08 - HR/3/1
SCALE	As Shown
SIZE	A3
PROJECT DIRECTOR	



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STRATEGIC CITIES DEVELOPMENT PROJECT:  
 HYDROLOGIC-HYDRAULIC MODELLING OF  
 MEDA ELA AND UPSTREAMS OF KANDY LAKE  
 SCPDWBWKND8

DRAWING TITLE:  
**DETAIL OF DEMOLITION OF HEENPAN KADURA  
 CHAINAGE 720m - 760m**

REV.	DATE	SIG.	DESCRIPTION

SURVEYED: MM	DRAWN: PP
CHECKED: LF	APPROVED: KR

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DWG. NO.	KD/08 - HR/5
SCALE	1:350
SIZE	A3
PROJECT DIRECTOR	

#### **Annex 5: List of trees potentially to be removed**

<b>Common Name</b>	<b>Scientific Name</b>	<b>Chainage</b>	<b>DBH</b>
Pare Mara	<i>Albizia saman</i>	0 + 595m	04 Feet
Pare Mara	<i>Albizia saman</i>	0 + 600m	03 Feet

#### **Annex 6: Summary of Procedure to Obtain Mining License for Borrow Pit Operation**

1. Identify the site and verify ownership (land clearing)
2. Obtain letters of consent from the owners (Private / Government)
3. Contractor applies for site clearance from CEA
4. CEA may request an IEE or EIA to be carried out by the contractor
5. CEA gives clearance.
6. Contractor applies for Mining License (IML/A, IML/B or IML/C) from GSMB.
7. GSMB conducts joint inspection with a committee comprising with CEA, DS, and PS.
8. Contractor has to make bank guarantee specified by the GSMB based on the situation of the land, prior to issuing Mining License.
9. Contractor applies for Trade License from PS.

#### **Annex – 7: Summary of Procedure to Obtain Mining License for Quarry Operation**

1. Identify the site and verify ownership (land clearing)
2. Obtain letters of consent from the owners (Private/ Government)
3. Contractor applies for site clearance from CEA
4. CEA may request an IEE or EIA to be carried out by the contractor
5. CEA gives clearance
6. Contractor applies for Mining License (IML/A, IML/B or IML/C) from GSMB.

7. GMSB conducts joint inspection with a committee comprising with CEA, DS, and PS who would decide whether the test blast is needed for IML-A and IML-B which depends on the sensitivity of the site. Test blast will be carried out prior to issuing Mining License
8. Contractor applies for EPL from CEA
9. EPL is issued by CEA
10. GSMB monitors noise and vibrations annually and renews license
11. Contractor applies for explosive license from the Ministry of Defense
12. Contractor applies for Trade license/ Approval from PS

**Annex 8: Waste Management Best Practices**

Waste type	Waste Materials	Trade Contract or Package	BEST PRACTICE			
			Waste Minimisation Opportunities	OnSite Reuse/Recycling/Recovery	OffSite Reuse/Recycling/Recovery	Disposal
Inert	Concrete	Construction	Retention of concrete on site where possible. Only order what is required.	Use as secondary aggregate on site.	Segregate for reprocessing and reuse as recycled secondary aggregate.	Landfill and cover
	Rubble (hardcore)	Construction	Only order what is required.	Opportunity to reuse 'cut' material as 'fill' in proposed noise bund.	Segregate for reprocessing and reuse as recycled secondary aggregate.	Landfill and cover
	Soils/ Greenwaste/ vegetation	Construction		Opportunity to reuse 'cut' material as 'fill' in proposed noise bund.		Landfill and cover
	Mixed waste	Construction	Use of standard sizes. Arrange take back of unused materials with the supplier.	N/A	Segregate materials to maximise potential for recycling.	Landfill/ incineration

	<b>Metal</b>	Construction	Make to measure, Correct ordering, just in time delivery, store correctly. Arrange take back of unused materials with the supplier.		Segregate waste and send to metal recycler.	Landfill
	<b>Timber</b>	Construction	Avoid over-ordering. Provision of suitable storage to avoid damage. Arrange take back of unused materials with the supplier.		Re-use/ Recycle if feasible.	Landfill/incineration
	<b>Plasterboard</b>	Construction	Avoid over-ordering. Provision of suitable storage to avoid damage. Procure to design specifications. Arrange take back of unused materials with the supplier.	Cannot reuse.	Recycle if feasible.	Landfill
	<b>Packaging</b>	Construction	Ask supplier to send product with minimal packaging/ reusable containers, buy bulk not individually wrapped products.	N/A	Segregate materials to maximise potential for recycling.	Landfill/incineration

			Return pallet to supplier or use plastic pallets.			
	<b>Cable &amp; wiring</b>	Construction	Avoid over-ordering. Arrange take back of unused	Reuse on site if appropriate.	Segregate and recycle to reclaim plastics and metals.	Landfill
	<b>General Office waste</b>	Site management	Print double sided, send documents electronically, reusable crockery and cutlery.	Reuse paper, cartridges, plastic cups, tins and cardboard.	Segregate and recycle white paper. Send for composting (food waste only).	Landfill
	<b>Glass</b>	Construction	Avoid over-ordering, appropriate storage to avoid accidents. Arrange take	N/A	Segregate and send for recycling.	Landfill and cover
	<b>WEEE</b>	Construction	N/A	Re-use elsewhere on site.	Send to dedicated recycling facility for recovery and recycling.	Landfill
	<b>Asbestos</b>	Construction	N/A	N/A	N/A	Landfill
	<b>Contaminated land</b>	Construction	Avoid excavation where unnecessary.	Consider on-site treatment methods.	Treatment at contaminated land hubs.	Landfill

	<b>Painttins, line markers, mastic</b>	Construction	Use solvent free paint that are not disposed of as hazardous waste, maximise use of mechanical fitting rather than adhesives. Arrange take back of unused	Use a lockable COSHH container for storage.	N/A	Landfill
	<b>WEEE</b>	Construction	N/A	Re-use elsewhere on site.	Send to dedicated recycling facility for recovery and recycling.	Landfill