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ENHANCING WATER QALITY BY SALINITY BARRIERS AND ITS IMPACT ON ENVIRONMENT

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Abstract
The Kelani River and its tributaries are the main source of supply of potable and industrial water to Greater Colombo area. The present capacity of Ambatale water treatment plant is around 120MGD representing 65% to 70% of the drinking water supply of the area. With an expected increase of demand up to 175MGD in the year 2020, the ability to extract water from Kelani River is a key issue for Colombo Water Supply. The bed level of Kelani river is below 0 MSL up to about Hanwella and during low flow season, salt water of the sea propagates along the river when there is high tide, reaching Ambatale intake in the worst case, and inducing a limitation in the treated water production experienced almost every year.

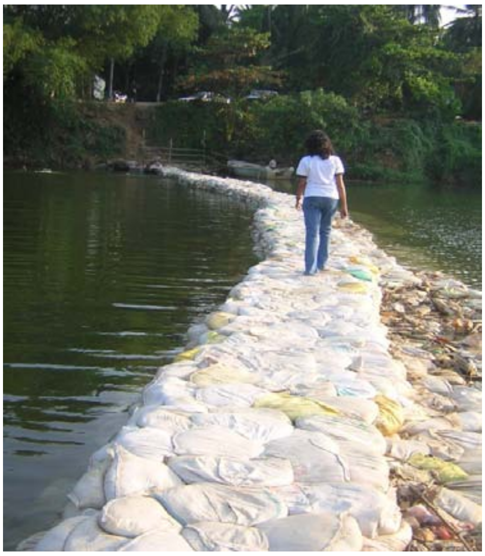
Among the several solutions proposed, the erection of a Salinity Barrier across the Kelani river in the vicinity of Ambatale intake has been found as the most effective solution and now it has come to its construction stage. But the sustainability of this solution is a vital topic. This paper illustrates an overall study carried out to identify the social and environmental impacts that could arise from this solution and possible mitigations.

Keywords: Salinity intrusion, Environment, Mitigation

Introduction:

The proposed salinity barrier is a solution for a long lasted problem in Colombo area for the production of potable water. The salinity problem is now experienced almost annually and this may create scarcity of drinking water in the Greater Colombo area. As a temporary measure a submerged barrier was constructed in 1992 using sand bags across the Kelani River at a place 375m downstream of the Ambatale intake. This has partially solved the problem and repairing of the barrier is required regularly to limit salinity intrusion during dry weather flow. Time has now reached to find a permanent solution to this problem to get the full potential of the Ambatale and Kelani Right Bank Water treatment plants.

Proposed Project: The proposed salinity barrier consists of two parts. The bottom portion is a rigid weir constructed out of concrete and the top portion is a retractable weir crest made out of inflatable membrane(rubber dam)The barrage is proposed to be located 15 to 20m downstream of the old intake at Ambatale. The approximate width of the barrage is about 100m and the bed level at this place is around -5.0m MSL. The top level of the rigid permanent weir is tentatively fixed at -0.5m MSL and the expected top



Temporary sand bag barrier across the river

level of the inflatable weir crest is approximately +1.0m MSL.

Other benefits: This proposal will not only prevent salinity intrusion into the intake area but will also create a pool of water with a high water level thus enhancing the availability of water and efficiency of the nearby intakes, it will allow to extract the actual Kelani discharge according to the requirements and facilitate to flush out any sand deposits in front of the intakes.

Project Alternatives: For the comparison following alternatives were considered at the conceptual stage.

1. No project
2. Salinity control by reservoir release.
3. Salinity control by flow regulation using trans basin diversion
4. Salinity control by a complete ban on sand mining
5. Relocation of the intake further upstream
6. Construction of an additional new intake further upstream
7. Construction of a submerged barrier either permanent or temporary.
8. Construction of a fully raised barrier
9. Construction of the proposed barrier further downstream
10. Desalination of saline water.

Out of these alternatives no 2, no 3 & no7 are the most promising options other than the proposed project. However these options are high cost solutions and take a longer period to implement in comparison with the proposed salinity barrier which is relatively low cost and straight forward solutions which can be implemented soon.

<u>Findings and Discussions</u>

Existing Environment:

- **Location and Topography**: Kelani River is the second largest river in Sri Lanka. The river originates in the central hill country of the island and flows in a mainly westerly direction until it reaches the sea at the northern limits of the city of Colombo. The river basin, which is located entirely in the wet zone of the country, has an area of 2280sq.km and an annual runoff of 5500 million cubic meters. Kelani river itself is formed by the influence of two similar rivers ,the Kehelgamu oya and Maskeliya oya. Approximately 25km downstream Gurugoda oya joins and Sitawaka River joins further 14km downstream. Again Wak oya joins at Hanwella area. The river loops around the northern limits of Colombo before flowing out to the sea. The river mouth is stabilized by a rock revetment structure on the north side, whilst a sand bar formation is prevalent on the south side.

- **Climate and Hydrology**: The Kelani river basin experiences a hot, humid and rainy climate, which is characteristic of the wet zone of the country in which it is located. The majority of rainfall occurs mainly during the south west monsoon (April to November), and is greater in the mountainous area than the coastal plain around Colombo. Flows in the Kelani river vary widely, according to the season.

- **Floods and flood protection works**: About (2/3) two third of the entire catchment in the upper reaches of the river is in the mountainous region with steep slopes and the lower reaches are in the coastal plain which is very flat. As a result, the heavy precipitation and the quick runoff in the upper catchment cause the river to overflow its banks in the lower flat region. So flood bunds are constructed on both the left (South) and right (north) banks of Kelani River, in the vicinity of Colombo.

- **Land use**: Upper catchment is planted with tea. The land which is not covered with tea is mainly covered with grass and evergreen forest. The middle part of the catchment is predominately covered with rubber, coconut, rice cultivation and forests. The land use in the coastal plain is a mixture of rubber, coconut, paddy, vegetable gardens, towns and villages with home gardens.

- **River users**: The major river transport activities are movement of barges engaged in sand mining activities and log transport in the form of rafts from upstream to downstream. Apart from that river water is consumed by various other users whose industries are located in the vicinity such as Kelani-Thissa Power Station, Kelani Tyres Ltd, Ceylon Petroleum Corporation, Ceylon Steel Corporation etc. There are several industries which discharge waste into Kelani River. Some discharge directly into the river and other dischargers are through small streams or tributaries.

- **Water Quality**: Water quality changes form upstream to downstream. And also the quality level of the river does undergo change when the flow condition of the river change from a medium flow(230m^3/s) to low flow(30m^3/s) or vice-versa.

Violation of standards for BOD and faecal coliform seem to occur in the dry season and at the beginning of wet season. In the dry season the high level of pollutants is probably caused by a low level of dilution. Early in the wet season flushing of accumulated waste water may play a role.

Proposed location for the Salinity Barrier and the existing environment

Environmental Impacts

Impact on Flooding

One of the main concerns in construction of the salinity barrier is whether it will aggravate the flood problems. During wet season the top portion of the barrage which is an inflatable membrane can be deflated and retracted to allow higher discharge over the bottom concrete portion which will act as a submerged weir. The hydraulic simulations carried out indicate that the effect of this submerged weir is not significant. In the immediate upstream of the barrage the water level will be subjected to an increase of about 20mm for flood events up to 100 year return period which is insignificant.

For 1 year and 2 year flood events, the increase in water level is just 10mm to 30mm.Upto about 3year flood event, the water levels are within the protection level provided by the minor flood protection schemes in operation. The water levels obtained from computer simulation for 5 year flood event with and without the weir though exceed the protection level, still contain within the flood bunds located upstream of the barrier. The 10 year flood event just overtops the bund top level. The 25 year, 50 year and 100 year floods will overtop the bund level and submerge larger area and increase of these flood levels by 20mm will not change the extent of flooding and the consequent damages. Therefore, the construction of the salinity barrier will not seriously worsen the flood problem which already exists.

Impact due to Ponding

During dry season when the discharge and water levels of Kelani river are low, the salinity intrusion will propagate along the river and to prevent salt water entering the intake area the rubber membrane will be inflated to a height of about +1m MSL so that, in addition to prevention of salinity intrusion, the efficiency of the intake can be increased storing more water. The probable water level which could be expected is around 1.38m MSL for a low flow of 50m^3/sec which will gradually reduce to the normal water level over a distance of about 29km.Without the salinity barrier, this level would be around 0.85m for high tide level of 0.387m MSL in the sea. The increase in water level by about 0.53m will contain within the minor flood protection bund. However, as some of the flap gates and slice gates are leaking and collapsed certain inundation of the low lands could be expected when water is ponding up at the barrage.

Impact on Sediment Transport and River Morphology

The morphological simulations developed do not indicate any sedimentation due to the presence of the salinity barrier. These simulations show river bed erosion with or without the barrage. However, certain amount of localized sedimentation could be expected just upstream of the barrage once it is constructed due to reduction of flow velocities upstream. When the rubber membrane is deflated and lowered, there would be higher velocities over the concrete barrage which act as a submerged weir and scouring on the downstream side and bank erosion could be expected. Even at the place where the temporary barrier is constructed with sand bags, bank erosion is evident and cross sections taken immediately before and after this barrier indicate deposition and erosion.

This situation may tend to be stabilized after a period of time if siltation is allowed to build up. But, as the barrage is located few meters downstream of the intake, there is concern that the sedimentation may disrupt the functioning of the intake due to clogging. The second location of the barrier under consideration which is about 425m downstream would reduce the problem but will not completely eliminate it.

Impact on Water Quality

The construction of the salinity barrier will improve the quality of potable water by way of preventing salt water intrusion. It will also prevent influx of polluted water from downstream with the high tide during low flows. The present location will also prevent any pollutants coming from Madiwela East Diversion Canal, where the effluent from the Water Treatment Plant at Ambatale is being discharged. If the barrage is located further downstream the Madiwela canal discharge is trapped in the pool created by barrage.

It is possible that the pollutants coming from upstream would be trapped when the barrier is raised up during low flows. Accumulations of heavy metals would also be possible if there are any discharges of heavy metals from upstream. Higher Lead concentrations were reported in the investigations conducted in the recent past for Kelani River.

Effluent discharge at downstream locations: St.Sebestian canal which is heavily polluted mainly due to industrial effluent coming from industries such as BCC, Lankem etc. located on the banks of St.Sebastian canal and Dematagoda canal is a main source of pollution inflow in to Kelani River. Ceylon Leather Corporation tannery at Mattakkuliya also discharges its effluent into Kelani river. Petroleum effluent from the refinery of the Ceylon Petroleum Corporation also finally ends up in Kelani River. All these effluent outfalls are located downstream of Ambatale intake. Madiwela East Diversion Canal is located just downstream of the intake which brings storm water from Madiwela East sub-catchment and from its own drainage catchment on either side of the canal. The effluent from the Ambatale Water Treatment Plant also discharges in to this canal just before it falls in to Kelani River.

Therefore, if the salinity barrier is constructed at the proposed location, pollutants coming from downstream location due to tidal effect can be eliminated. This is a beneficial impact of the proposed project. If it is constructed in the alternative location which is further downstream it will still prevent pollutants coming from the downstream but the discharge from Madiwela East Diversion Canal will then be collected in the pool created by the barrage and any pollution loads coming through the canal will affect the water quality at the intake specially during dry season when the barrier is raised up. However this problem exists even now to a certain degree due to the presence of the temporary submerged salinity barrier constructed with sand bags and the rock outcrop said to exist at the alternative location.

Effluent discharge at upstream locations: The effluent discharge from upstream locations will undergo mixing process by advection and dispersion when transporting down the river. If the concentration of pollutants at the intake due to effluent discharges from upstream is within acceptable limits then there is no cause for alarm. However, the trend must be observed continuously to take appropriate actions in time. During high flows there would not be problems on concentration of industrial effluent but the surface run-off may contain higher level of faecal coliform etc. When the barrier is constructed it will not increase the level of pollution at the intake during high flows which are very turbulent. If there are any bottom gates that would also be opened during high flows which will allow bottom layers also to move forward. However, during low flows in the dry season, the barrier will also be raised up and that may perhaps trap pollutants at the pool created by the barrier. Therefore, the quality of effluent discharged at upstream locations must be monitored regularly during dry season to make sure that it is within acceptable limits.

Impact due to Sea Level Rise

The expected rise in mean sea level due to rise in mean temperature as a result of green house effect is now taken in to consideration in the planning of projects. The expected changes by end of this century could vary from a low figure of 15 cm to a moderate figure of 50 cm to a high value of 95 cm depending on the extent of emission of Greenhouse gases into the atmosphere. These changes could occur gradually and precautionary measures must be taken by providing provisions to adopt for the situation. The barrage is constructed such that the inflatable rubber membrane can be replaced with a larger size one to cater for expected gradual rise in water levels in the Kelani estuary as a result of rise in mean sea level. Construction of the barrier will bring beneficial impacts in consideration of the possible sea level rise which will worsen the salinity intrusion problem.

Impact on Flora and Land Use

Natural vegetation including bamboo plants on the banks of Kelani River is quite susceptible to the change in water levels of the river and hence rise in water levels due to the barrier will not cause adverse impacts. The low land flood plains are either cultivated with paddy and vegetables or used for brick and tile making. If the flood control structures function properly the rise in water level during low flow can be contained within the flood bunds and will not cause adverse impacts.

Impact on Fauna

The main concern in this respect would be the fish population in the river. However fishing is not done on commercial basis in the Kelani River. During low flow when the barrier is raised the fresh water fish may be trapped downstream unless they move to upstream locations with the gradual influx of salty water with high tide when the dry season starts. Brackish water fish deaths could also occur not because of the construction of the barrage but due to pollution inflow from downstream sources. This phenomenon has been observed earlier also. However, impact of the barrier on fauna is not significant.

Impact on Sand Mining

The limited number of barges (about 7 or 8 at present) operates near the intake at Ambatale for sand mining will be affected during dry season when the barrier is raised up. The sand mining is normally done upstream of the intake and the sand barges are unloaded at the landing point on the left bank about 400m downstream of the intake. The people involved in the sand mining requested a slot of about 3 to 4 m wide and at least 1 m deep (at lowest water level) to navigate their barges across the barrage. Subsequently, a discussion was held with all those who are involved in sand mining at this location to get their views if another landing point located upstream of the intake is offered to them in place of the present location to avoid movement of barges across the barrage. Initially, they opposed the idea saying that the landing point is by the side of a main road and security at this place is much better. But finally they agreed for another landing point on the left bank with access facilities from the main road for lorries to come in for transporting sand.

Impact on Transport of Logs and Bamboos

The transport of logs and bamboos in the form of a raft navigated along the river is mostly done during high flows and the frequency of transport is very much reduced during low flow due to difficulty in navigation. The salinity barrier with rubber membrane inflated up will pose problems for transport of logs and bamboos during dry season. When inquired from a navigator of three log rafts coupled together, he requested about 10 m wide opening with 1 to 1.2 m clearance below the water surface during low water flow to navigate the raft across the barrier.

Impact on other Water Intakes

The water intakes located upstream of Ambatale will be benefitted by the salinity barrier but the intakes located downstream of the intake at Ambatale may be affected unless the required minimum discharge is maintained to facilitate intake of water. The intakes located upstream will be benefitted by way of higher water level if the intake is located within the back water region. All the intakes in the upstream will be benefitted due to prevention of salt water intrusion. The main purpose of abstraction of the water at the downstream locations is for cooling of industrial plant. In any case, the low water levels in the river during dry weather flow will reduce the efficiency of pumps at these intakes.

When the propagation of the salinity wedge is prevented by the barrier more mixing of the salt water at the bottom with the fresh water in the upper layer will take place and the upper layers will become more brackish. Extraction of water with certain salinity content during any season has been going on at these intakes located in the downstream for the last two or three decades and frequent corrosion of certain parts in the cooling system had been a recurrent problem to them. Further at least 2 to 4m^3/s of water is required to be released from the barrier to fulfill the demand of downstream users.

Impact on Flood Discharge Outlets of other Catchments

Noteworthy flood discharge outlets are the Sebastian Canal which is a storm water drainage outlet of Colombo North area which falls on to Kelani river at the North lock at Nagalagam street and the Madiwela East Diversion Canal which divert storm water from Madiwla East area a sub catchment of the main Colombo catchment.

If the salinity barrier is constructed in the proposed location them it will not affect the flood discharge outlets of other catchments like Madiwela East Diversion Canal. However if the barrier is constructed at the alternative location downstream of the outfall of Madiwela East Diversion Canal then the ponding up of water at the barrier may affect the flood discharge in an event when there is a flash flood in Colombo catchment with very low flow conditions in Kelani River which is a rare occurrence. During dry season, when the salinity barrier is fully raised at the alternative location and ponding up of water occurs, there would be Kelani water spreading along the upstream direction of Madiwela East Diversion Canal thus reducing the higher water level intended to be achieved and allowing to divert precious Kelani water to an unwanted direction. This could be avoided to a greater degree by closing the flood gates of Madiwela East Diversion Canal which is now been constructed little upstream of the present location of the flap gates. But it will then cause inundation of lowlands in the vicinity of the gated structure and pose a different problem.

Mitigatory Measures

Mitigation of Flood Problem

As explained above that the flood events up to 10 year return period will contain within the flood bunds and the construction of the salinity barrier will not worsen the flood problems which already exist. However, repairing of the flood control structures (Flap gates, Sluice gates etc.) which is the responsibility of the Irrigation Department will further reduce the flood problems. If the collapsed flood control structures are replaced with a new structure, the lowlands which are now inundated in the area can be saved from minor floods. If the paddy cultivation is already abandoned and if there is no public pressure for reconstruction of these structures, the Irrigation Department may not take it up in the near future. If the recommendations of the Kelani River flood protection study are implemented, then there will be enhanced flood protection for areas which are inundated now.

Mitigation of inundation problems due to ponding up of water during low flow.

As explained above, during low flow in the dry season, when the rubber membrane is inflated to a height of about +1m MSL, there will be ponding up of water to a level of about 1.38m MSL which will gradually reduce to the normal water level over a distance of about 29 km. The maximum increase in water level is about 0.53m near the barrage. Repairs to flap gates and sluice gates from Ambatale to few kilometers beyond Hanwella and reconstruction of the collapsed flood control structures will prevent any adverse impact due to inundation of lowlands due to increase in water level. Anyway it is proposed to operate the rubber dam, during the critical phase-low flow high tide with an automatic control system that will keep a constant difference of +20cm between the upstream water level and the downstream level. In that case the maximum increase of water level will be reached and maintained only a very few hours during a day, like presently during the high tide.

Mitigation of Sedimentation Problems

Problems due to any sedimentation at the proposed location very near the intake can be reduced by incorporating gates at the bottom to flush any sediment deposits from time to time. However proper arrangements must be made to prevent deposition of sediments near the banks which may cause problems to the water intake. A special channel is provided on the left bank in the design of the barrage to maintain high velocities due to water level difference which is expected to flush any sediments deposition in the intake area. Scouring of the bed on the downstream side of the barrage and any piping problems could be prevented by providing an apron and cutoff walls with impermeable material. Bank erosion which could be expected on either side of the barrage could be prevented by providing bank protection work using gabions etc.

Mitigation of Water Quality Problems

Beneficial and adverse impacts on the water quality due to construction of the barrier have been discussed earlier. Beneficial impacts are prevention of salinity intrusion and pollutant inflow from downstream. The adverse impacts are the possibility of pollutants coming from upstream getting trapped at the barrier, especially when it is fully raised during low flows. Deposition and accumulation of heavy metals on the river bed at the barrier is a matter for concern. The best possible mitigation is to improve the quality of water flowing down from upstream areas. Proper catchment management is essential to achieve this end. Regular monitoring and strict control over the quality and quantity of effluent discharged by various industries must be maintained to improve the quality of Kelani River water coming from upstream of Ambatale. Flushing of any pollutants trapped at the barrier form time to time by opening the bottom gates will also help to improve the situation. But there should be sufficient flow for flushing to be effective. During dry season when the river flows are restricted, flushing could be done during low tide taking advantage of the head difference at the pool created by the barrier.

Mitigation of Impact due to Sea Level Rise

The construction of barrier itself is a mitigatory measure against the possible sea level rise which will cause intrusion of more salt water. However to cater for predicted gradual rise in mean sea water level, the barrage is constructed in such a manner that the inflatable rubber flexi dam can be replaced with a larger size one when actual replacement is required either after its useful life time or whenever needed.

Mitigation of Impact on Flora and Land Use

Any adverse impact on the vegetation or land use in the lowland flood plains due to ponding up of the river at the barrier during dry season can be minimized by rehabilitating the flood control structures from Ambatale to Hanwella. Only minor repairs are needed at most of the places. The

Irrigation Department who is responsible for implementation of these repairs may require funds for this purpose.

Mitigation of Impacts on Fauna

As discussed earlier mitigatory measures may not be required as the impact of the barrier on fauna, mainly the fish population is not very significant.

Mitigation of Impacts on Sand Mining

During low flows, movements of barges across the barrage will have to be completely stopped when the barrier is fully raised. If an opening is provided to allow navigation, the effectiveness of the barrier for prevention of salinity intrusion will somewhat be reduced and chances for receiving damages to the rubber membrane will be more. The slot could be kept open during a limited time period only but it will suppress their activities. Discussions with the barge operators revealed that provision of an alternative landing point on the left bank, upstream of the intake, but not very far from the present location, with access facilities from the main road for lorries to come in and transport sand is acceptable to them.

Mitigation of Impact on Transport of Logs and Bamboos

The impact of the salinity barrier on the transport of the logs and bamboos during dry season could be minimized by providing a 10m wide opening with 1 to 1.2m clearance below the water surface. But this may reduce the effectiveness of the barrier in controlling salinity intrusion. Further it could also cause damages to the rubber membrane and the structure if the rafts are not maneuvered properly through the narrow opening. Bottom scraping could also occur when a bundle of bamboos or different sizes of logs are being transported. In order to face this problem the bottom level of the opening has been designed at -2 MSL and the rubber dam will be protected by a reinforced protection. This part of the rubber dam will be deflected during the dry season only when salinity intrusion conditions will allow it and at the request of the transporters. The frequency of transport is also very much reduced during low flow and therefore even if provision is not provided to allow transport of logs and bamboos when the barrier is fully raised by inflating the rubber dam during the crucial period which may last for few days in the dry season, it will not seriously affect the construction industry. Another option is to ban transport of logs and bamboos during low flows and insist on road transport by lorries from a particular point in the upstream. This point could be at Kaduwela where trade of logs takes place but facilities may have to be organized for removing logs from the river and load on to lorries. This may cause some hardships and extra expenses to the timber merchants but it could only be for a limited number of days or for a short period which they will get accustomed.

Mitigation of Impacts on other Water Intakes

Water intakes located upstream of Ambatale will be benefitted by the salinity barrier and only the intakes located downstream of the intake at Ambatale may be affected unless the required minimum discharge is maintained. Therefore, maintaining a minimum discharge of 10 m^3/s during dry season when the barrier is fully raised will facilitate them to continue extraction of water.

Mitigation of Impacts on Flood Discharge Outlets of other Catchments.

If the salinity barrier is constructed at the proposed location, it will not affect the flood discharge outlets such as the St.Sebastian Canal outlet at Nagalagam Street and Madiwela East Diversion Canal outlet located just downstream of the intake and therefore no mitigatory measures are required. However if the barrage is decided to be constructed at the alternative location following mitigatory measures are identified as appropriate to reduce the impacts.

- Make sure that the gates of the flood structure located near the outlet of Madiwela East Diversion Canal function properly and well maintained which is a responsibility of SLLR&DC.
- When there is a flash flood situation in Colombo catchment during low flow in Kelani River, lowering of the flexible portion of the barrier must be done immediately to facilitate effective discharge of flood water from Madiwela East sub catchment. Close coordination with SLLR&DC is required to avert adverse impact in this respect.

Monitoring Program

Water quality and morphology problems could be monitored at the detailed design phase itself to get more information on the behavior of the river morphology and to check on the presence of heavy metals. A measurement program must be launched immediately in the region of the temporary sand bags barrier which could be approximate to a prototype model of the barrage to monitor the salinity changes and sedimentation before and after the barrier.

During the construction phase the most important monitoring aspect would be the flood problems which could arise due to partial blockage of the river. Water level and discharge should be monitored constantly to take precautionary measures to avert major floods due to the blockage.

The impacts of the barrier must be monitored after the completion of the project for a further period of about one to two years at least to check whether the mitigatory measures adopted behave in the expected manner and provide the desired results. Special emphasis must be given on salinity levels, sedimentation, morphological changes and flood problems.

Conclusions and Recommendations

The potable water supply to Greater Colombo area mainly depends on the intake of water from Kelani River at Ambatale. A colossal sum of money has already been invested recently on expanding the intake and treatment facilities available there and to construct a new 40MGD water treatment plant at the right bank of Kelani River.

Presently, the salinity intrusion along the river propagates beyond Hanwella during dry weather flow, water abstraction at various places along the river further promotes salinity intrusion.

Therefore, a permanent solution must be found out to prevent intrusion of unacceptable levels of salinity into the intake area during dry weather flow which limits abstraction of fresh water.

Various alternative solutions have been examined so far. Some solutions are long term solutions which will enhance the dry weather flow allowing more abstraction of water. However these solutions are very costly and take considerable time to materialize. These solutions should be investigated for possible implementation in the far future.

The cost wise, more attractive immediate solution to the problem is provided by construction of the salinity barrier with a rubber dam. This could be constructed at the proposed location which is sited immediately downstream of the intake or little further downstream which the rock outcrop is located. It is advantageous to construct the barrier at the proposed location in terms of operational aspects and maintain a higher water head. This location will prevent pollutant entry from Madiwela East Dievrsion Canal also. However, the question is whether it will cause deposition of sediments which will clog the intake. Further the possible deposition of heavy metals is also a problem. These two issues will give less impact if the barrier is located further downstream at the alternative location near the bathing spot where the rock outcrop is located. However, construction of the barrier at this location will trap the pollutant load coming from Madiwela East Diversion Canal. The effluent from Ambatale Water Treatment Plant is also discharged through this canal. Further due to presence of the canal, the high water level which is intended to be maintained to enhance the water abstraction capacity may not be able to achieve as the impounded water will spread along the canal up to the new flood control structure.

The design of the salinity barrier at the proposed location incorporates a specially designed channel on the left bank to flush nay sediment deposition thus providing a sediment free area to abstract water at the intake. Therefore in conclusion it recommends that the construction of the salinity barrier with the rubber dam at the proposed location.

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