# BRIEF SUMMARY OF PROJECTS CARRIED OUT BY THE HYDRAULICS RESEARCH INSTITUTE

(RIVER HYDRAULICS & MORPHOLOGY)

**1- Local Scour at the Piers of Imbaba Bridge**

**Consultant** :HRI

**Period** : 1990 – 1991

The hydrographic survey of Cairo bridge sites detected deep scour holes upstream the bridge piers. It was required to find out the reason of these holes and to check their stability from the morphological point of view. The Authority requested a recommendation from HRI of the best protection technique.

The study comprised field investigations, data collection, bathymetric survey, and a hydraulic scale model to check the development of the scour holes. The most suitable solution was suggested, and the scour holes are under yearly investigation.

**2- Local Scour at the Piers of Safaga Bridge**

**Consultant** :HRI

**Period** : 1990 – 1995

The hydrographic survey of safaga bridge detected deep scour holes upstream the bridge piers. It was require to find out the reason of these holes and to check their stability from the morphological point of view. The Authority requested a recommendation from HRI of the best protection technique.

The study comprised field investigations, data collection, bathymeric survey and a 2-D mathematical model to study the flow characteristics. The development of the scour holes was investigated. The most suitable solution was suggested and the scour holes were under intensive monitoring.

**3- Local scour Around Railway Bridge piers**

**Consultant** :HRI

**Period** : 1996-1997

The study objective was to study local scour around eight railway bridges located in the Cairo and the Delta areas.

The study comprised field investigations, data collection, bathymetric surveys and a 2-D mathematical model to study the flow characteristics.

**4- Effect of Filling on Flow Upstream and Downstream Kasr El-Nile Bridge**

**Consultant** : HRI

**Period** : 1997-1998
: 1998 - 1999

The study objective was to study the effect of local scour problem on bridge piers to construct the subway tunnel.

The study comprised field investigations, hydrographic survey, data collection, bathymetric surveys and a 2-D mathematical model to study the flow characteristics. The development of the scour holes was investigated.

**5- Hydraulic Studies and Field Measurements Downstream New Esna Barrage**

**Consultant** : HRI

**Period** : 1997 - 1998

The study objective was to study the effect of new barrage construction on the morphology downstream of the barrage.

The study comprised field measurements to measure the flow velocities at forty-four cross-sections, hydrographic survey of the Nile bed, data collection, and bathymetric surveys. The study showed no significant changes of navigation passage but some changes of scour and sedimentation to the area bed.

**6- Preliminary Hydraulic Study for High Discharges Downstream HAD**

**Consultant** : HRI

**Period** : 1997 - 1998

The study objective was to predict the water levels corresponding to discharges of 270, 300, and 350 $m^3$/day on the Nile.

The study was conducted using 1-D mathematical model (WENDY) by representing the barrages on the Nile and side bays to get water storage upstream each barrage.

**7- Scour Holes Stability Downstream Naga-Hammadi Barrage**

**Consultant** : HRI

**Period** : 1997 - 1998

The study objective was to study effect of scour holes downstream Naga-Hammadi barrage on barrage safety.

The study comprised field measurements, hydrographic survey, and data collection. The study showed that the front inclination of the scour hole within allowable range and the institute recommended the permanent following and monitoring.

**8- New Naga Hamady Barrage and Power Plant**

**Consultant** : Lahmeyer Consulting Engineers.

**Period** : 1995 - 1996

The study objective was to test and modify when necessary the general layout of the proposed structure. The flow pattern has to be estimated for the final design stage.

The study comprised field investigations, data collection, bathymetric surveys and the construction of a 2-D mathematical model to study the flow pattern and to predict if erosion and/or sedimentation are expected.

**9- Design of the western bank facing to Luxor**

**Consultant** : HRI
**Period** : 1997 - 1998

The study objectives were to design the optimal protection of the western bank with 3.5 km long, to prepare the special specifications for this protection and to find the best solutions for executing.

The study comprised hydrographic survey for reach with 5.5 km long, analyzing of reach bed samples, water velocity distribution measurements, surface current measurements, water surface slope and data collection.

**10- Study of Scour Problem Downstream New Esna Barrage**

**Consultant** : HRI

**Period** : 1997-1998
: 1998-1999
: 1999 - 2000
: 2000 – 2001
: 2001 - 2002

The study objective was to study the scour problem downstream New Esna Barrage and the influence on the barrage safety.

The study comprised hydrographic survey at the problem area and it was recommended following the scour hole downstream the hydropower plant either for solving the problem or

leaving it in case of its stability. The study of 1999 showed stability of local scour downstream both hydropower plant and spillway. Local scour was noticed downstream the barrage at openings 10 and 11 and it was recommended by proper protection and periodical following each six month. The study of (2000 –2001) recommended studying the optimal way for gate opening and closing to overcome scouring problem. The study of (2001 – 2002) reached stability of scour holes at the protection area downstream the stilling basin and recommended the periodical following to find out any changes.

**11- Study of Scour Problem Downstream Kom-Ombo Barrage** on Feterra Drainage

**Consultant** : HRI

**Period** : 1997 – 1998

The study objective was to study the scour problem downstream Feterra Drainage Barrage and to find the optimal solution for the barrage safety.

The study comprised hydrographic survey for problem reach with 2 km long, water velocity distribution measurements, water surface slope measurements, and analyzing of reach bed samples.

**12- Hydrographic Survey Upstream Assiut Power Plant (Walidia)**

**Consultant** : HRI

**Period** : 1997 – 1998
: 2001 - 2001

The main objective of the study was to make hydrographic survey for determining the preliminary dredging upstream the power plant at cooling intake. Hydrographic survey of 1.1 km was carried out and field measurements were executed. The contour mapping of the problem area was drawn and comparing the measured cross-sections with the designed cross-sections and giving the recommendations. The final study of 2000 assured stability of scour holes where there is no scouring or sedimentation can affect safety of hydraulic structures and sheet piles.

**13- Delta Barrage Scour Holes**

**Consultant** : HRI

**Period** : 1997-1998

The study objective was following the scour holes downstream Delta Barrages (Dammietta and Rossetta) and the proper solution if they need.

The study comprised current field surveying and comparing with last surveying, performing hydrographic survey for problem area downstream barrages, and developing contour mapping of scour area.

**14- Scour Holes Monitoring Downstream Tahreer and Imbaba Bridges**

**Consultant** : HRI

**Period** : 1997 - 1998

The study main objective was following the scour holes downstream Tahreer and Imbaba bridges and finding the proper solution if they need.

The study comprised current field surveying and comparing with last surveying, hydrographic survey for problem area downstream bridges for a distance of 700 m long, and contour mapping of scour area. The study showed stability of scour holes and not effecting on bridges and recommended periodical hydrographic survey of problem area to find out any changes of the river bed at problem area.

**15- Effect of Scouring and Sedimentation Upstream Kurimat Power Plant Intake**

**Consultant** : HRI

**Period** : 1997 - 1998

The study objective was to determine reasons of scouring at the power plant intake, which led to non-stability of sheet piling.

The study comprised hydrographic survey for problem area of 2 km upstream the hydropower plant, water velocity distribution measurements, and analyzing of reach bed samples. It was noticed filling part of River section with 60 m wide and establishing of new pavement that resulted in decreasing the cross-section which in turn led to increasing velocity at this area. This high velocity causes degradation in some areas and aggregation in other areas. The study recommended removing the new pavement or translating it to downstream and using the required dredging.

**16- Hydraulic Effects of Increasing Discharge in Rossetta Branch on Kafr-El-Zaiat City, Railway and Bridge**

**Consultant** : HRI

**Period** : 1998 – 1999

The main objective of the study was to prepare technical studies to monitor Kafr El-Zaiat City, Railway and Bridge on the High way to Alexandaria due to passing high discharges that year.

The study comprised a hydrographic survey at Kafr El-Zaiat City for 3.0 km long, water velocity

distribution, analyzing of bed samples and calculating the sediment transport, water surface velocities, contour mapping for river bed for more than 6000 point, and the water discharges. It was recommended to protect the right bank facing to Kafr El-Zaiat City and the railway.

**17- Scour Holes Downstream Naga-Hammadi Barrage**

**Consultant** : HRI

**Period** : 1998 – 1999

The main objective of the study was making periodical following for scour holes downstream Naga-Hammadi Barrage to decide its case, stability, and treatment way.

The study comprised field measurements covered measuring water depths at scour area by formatting 100 longitudinal sectors with length of 200 m, water velocity distributions, discharges, contour mapping, analyzing bed and suspended samples.

**18- Sedimentation Problem Upstream West Cairo Power Plant Intake**

**Consultant** : HRI

**Period** : 1998 - 1999

The main study objective was to make hydraulic studies and field measurements upstream the power plant intake.

The study comprised comprehensive hydrographic survey upstream the intake for 1.0 km, analyzing bed and suspended samples, plotting contour mapping to bed surface for more than 4000 point, calculating and plotting water velocity distribution upstream each pump.

**19- The Nile Morphology Downstream New Naga-Hammadi Barrage**

**Consultant** : HRI
**Period** : 1998 – 1999

The main study objective was to study the different operation effects on the Nile morphology downstream the barrage.

The study was conducted using a distorted physical model and investigating the different effects which, include operation of power plant and weir and changing the power plant location from the left bank to the right bank. This investigation didn't appear morphology changes but there was local scour for 1.0 km immediately downstream the new barrage, which would be covered on future study.

**20- Study of Scour Problem Downstream Saryakos Regulator on Ismailia Canal**

**Consultant** : HRI

**Period** : 1999 –2000

The study objective was to study the scour problem downstream Saryakos Regulator on Ismailia Canal and required protection for barrage safety.

The study comprised hydrographic survey for problem area with 2.27 km long, water velocity distribution measurements, water surface slope measurements, and analyzing of reach bed samples. The study recommended following the scour hole after time not exceed than four months to study the stability case.

**21- The Scour Problem Upstream Assiut Power Plant (El-Walidia)**

**Consultant** : HRI

**Period** : 1999 –2000

The study main objectives were to study the scour problem upstream Assiut power plant.

The study was conducted using the hydrographic survey of the problem area for 800 m long, velocity distribution at two cross sections, analyzing bed samples, surface current measurement, and developing contour mapping for bed surface covering more than 5000 points. It was recommended inlet perfection and pitching the left bank for 50.0 m after and before inlet.

**22- Sedimentation Problem at El-Nasr Canal Intake**

**Consultant** : HRI

**Period** : 1999 –2000

The study main objectives were to study causes sedimentation at canal intake and improving discharge distribution through barrage openings.

The study comprised hydrographic survey for Nubaria canal with 3.0 km upstream and downstream the canal intake, measuring the water velocity distribution in three cross-sections, analyzing the bed and suspended samples at the same previous cross-sections. According to the field data and measurements, a physical model was constructed, calibrated, and achieved by studying many alternatives. The study recommended constructing a wall with gradual height upstream the bed barrage of the canal intake, in addition to sediment trap upstream the intake, and periodical dredging for trap at intervals six months.

**23- Scour Problem Downstream Delta Barrage (Rossetta Branch)**

**Consultant** : HRI

**Period** : 1999 - 2000

The study main objectives were to determine the stability of scour holes and providing the proper way for protection.

The study was executed by a hydrographic survey for Rossetta branch for a distance of 670 m downstream the barrage and upstream the weir. The study also included measuring the water velocities and corresponding discharges accompanied with analyzing bed samples, preparing 46 longitudinal sections, developing contour mapping for bed surface, and comparisons between the current and last measurements to achieve the best results, conclusions and recommendations.
The main study objective was to study possibility of Assiut Barrage development and adding power plant.

The study comprised comprehensive hydrographic survey included cross-sections every 50.0 m covering 1.5 km upstream the barrage and 4.0 km downstream it and 1.0 km downstream Ibrahimia Regulator. The study also included measuring water velocity distribution, analyzing bed samples, measuring water surface velocity and current in the problem area in the Nile and Ibrahimia Canal.

**24- The Detailed Studies for Final Design of New Naga-Hammadi Barrage**

**Consultant** : HRI

**Period** : 1999-2000

The study main objective was to revise and check the preliminary studies and select the optimal location for project components including the power plant, the spillway, and navigation lock. The study also aimed at studying the water velocities upstream and downstream the lock and studying the water velocity upstream both the power plant and spillway.

The study included studying the water velocity distribution through converting channel, studying the bed protection stability upstream and downstream spillway and plant, and finally selecting the optimal design for stilling basin downstream the spillway.

The study covered the following:
1. Selecting the final location of the project components
2. Studying the water velocity distribution through navigation lock and consequently modifying the Nile right bank beside the lock and also modifying the bed level.
3. Modifying the power plant intake to overcome vortices upstream the plant.
4. Modifying the shape of converting channel specially downstream the axis of barrage to reach optimal distribution and also following the bed protection of converting channel right bank that was found to be stable.
5. Modifying the protection layer downstream both spillway and power plant where found to be stable at maximum discharges.
6. Modifying shape of stilling basin downstream the spillway to overcome the current high velocities which caused moving rip-rap protection layer.

**25- Hydraulic Studies of Local Scour Downstream Esna Spillway Gates**

**Consultant** : Sogria
**Period** : 2001 –2002

The study main objective was to follow the local scour downstream the spillway gates in the protection area.

The study was executed using field survey and measurements to find out reasons of scour holes in the protection area downstream the spillway. A physical model was constructed where the spillway and problem area was represented at different operation cases and different discharges. The study conducted efficiency of suggested design at different operation circumstances and recommended representing the barrage and spillway on physical model to reach the causes that led to the problem and to get the optimal usage of gate operation.

**26- Intake of Red Sea Drinking Water Plant**

**Consultant** : HRI

**Period** : 1996- 1997

The study objective was to find a solution to the sedimentation problem in front of the intake of Qena and Red Sea Municipal Water Treatment Plants at Qena City.
The study comprised field investigation, data collection, bathymetric surveys, and desk work.

**27- Extension of Naga Hammady Berthing**

**Consultant** :HRI

**Period** : 1987 - 1988

The study objective was to protect the River berthing area from erosion and / or sedimentation under different River flow conditions.

The study comprised field investigation, data collection, bathymetric surveys, and desk work to choose the required hydraulic structure to fulfill the berthing navigational requirements.

**28- Cairo Bridges**

**Consultant** : HRI

**Period** : 1987 - 1989

The study objective was to measure and predict the evolution of the local scour arround the piers. The study covered all bridges constructed on the Nile River in the Cairo area.
The study comprised field investigations, data collection, bathymetric surveys, and desk work to analyze and record the state of each scour hole.

**29- The Super Phosphate Factory Berthing at Mankabad ( Assuit )**

**Consultant** :HRI

**Period** : 1993-1994

The study objective was to select the suitable berthing location for the factory which should be stable from the morphological point of view. Both erosion and sedimentation had to be checked to ensure safe vessel maneuvering.

The study comprised field investigations, data collection, and bathymetric survey of a river reach of length 4 km, and desk work, to compare different locations.

**30- Study of the Effects of Increasing the Discharge of Rossetta Branch at Kafr Zaiat City**

**Consultant** : HRI

**Period** : 1999- 2000

The study objective was to conduct the technical procedures to monitor the river bank stability at Kafr-Zaiat City and the Kornish road. Also, to find the required distance between the country road bridge and the railway bridge and to give the necessary solutions for passing large discharge without effecting their stability.

**31- Increasing the Capacity of Toshky Spillway to Pass Flood Discharges**

**Consultant** :HRI

**Period** : 1999- 2000

The study objective was to study how to increase the capacity of the Toshky Spillway so that it can pass maximum flood flows.

**32- Following the scour Holes Downstream of Naga-Hammadi Barrage**

**Consultant** : HRI

**Period** : 1999-2000

The study objective was to conduct periodical monitoring of the scour holes downstream Naga-Hammadi Barrage to determine their stability and whether a remedy is needed.

**33- Scour Problem Downstream of the New Esna Barrage**

**Consultant** : HRI

**Period** : 1999-2000

The study objective was to conduct the investigations on the Nile downstream the New Esna Barrage and to estimate the protection ways after passing the discharge.

**33- Monitoring the Scour Holes Downstream the Rossetta Barrage**

**Consultant** : HRI

**Period** : 1999-2000

The study objective was to monitor the downstream of the Rossetta Barrage to determine its stability and safety.

**34- River Training Using Submerged Vanes**

**Consultant** : Delft Hydraulics

**Period** : 1993 – 1994

The study objective was to determine the optimum design for a matrix scheme of submerged vanes which can be placed in the river to produce a transverse near bed velocity.

The performance of the vanes was measured in terms of the strength of vane induced circulation in the flow downstream from the vanes and the rate of decay of the circulation. In determining the optimum vane angle, flow separation at the vane was a key factor.

**35- Rod El-Farrag Water Treatment Plant**

**Consultant** : Nasr Company for Civil Works, Egypt.

**Period** : 1996-1997

The study objective was to check the stability of the River right bank due to the flow which is caused by the Treatment Plant Intake.

The study comprised field investigations, data collection, bathymetric survey of 4 km long, and a desk study.

**36 – Monitoring of Scour Holes Downstream Zefta Barrage**

**Consultant** : HRI

**Period** : 2002 – 2003

The study objective was to check the stability of scour holes downstream Zefta Barrage in the context of monitoring the status of main barrages on the River Nile upon the end of the

flooding season.

The study comprised field investigations, data collection, and bathymetric survey using high technology instruments, such as DGPS, Complete Total Station, and Range Finder. The hydrographic survey covered a distance of 500 m, starting from the centerline of the Barrage intake towards the downstream direction.

It was found that some scour holes were originated downstream the Barrage with a slope of 5H:1V and at a distance of 20 m from the riprap end. Moreover, some stones were discovered downstream the originated scour holes. It was recommended to perform a periodic follow-up of the originated scour holes after the period of maximum supply.

**37 – Scour Assessment Downstream Delta Barrage, Damietta Branch**

**Consultant** : HRI

**Period** : 2002 – 2003

The study objective was to test out the stability of scour holes downstream the Delta Barrage in the context of monitoring the status of main barrages on the River Nile upon the end of the flooding season.

The study encompassed field investigations, data collection, and bathymetric survey using high technology instruments, such as DGPS, Complete Total Station, and Range Finder. The hydrographic survey covered a distance of 500 m, starting from the centerline of the Barrage gate openings towards the downstream direction.

It was found that some scour holes were originated downstream the Barrage. It was suggested to perform a periodic follow-up of the originated scour holes after the period of maximum supply.

**38 – Scrutinizing of Scour Holes Downstream Assyut Barrage**

**Consultant** : HRI

**Period** : 2002 – 2003
2003 – 2004
2004 – 2005

The study objective was to check the stability of scour holes downstream Assyut Barrage in the context of monitoring the status of main barrages on the River Nile upon the end of the flooding season.

The study comprised field investigations, data collection, and bathymetric survey using high technology instruments, such as DGPS, Complete Total Station, and Range Finder. The hydrographic survey covered a distance of 300 m, starting from the Barrage gate openings towards the downstream direction.

The hydrographic survey revealed that a complete scour was produced downstream the Barrage riprap with a slope of 4H:1V and a depth of 0.5 m to 5 m. It was recommended to monitor the status of the originated scour holes before the winter closure period.

the Sea.

**39 – River Morphology Assessment at the Kurimat Power Plant: Hydrographic and Hydrometric Survey**

**Consultant** : HRI

**Period** : 2002 – 2003

A large amount of deposits exists in front of the intake units and further upstream at the inlet of the eastern channel. The field measurements, which included bathymetric survey, surface current, local surface slope, riverbed sampling and sediment analysis, were conducted to fulfil the requirements for the numerical and the physical models that are to be built up to get better insight of the sedimentation problem and propose appropriate solutions.

The Differential Geographical Positioning System (DGPS) was used to measure the global coordinate of the site. The bathymetric survey covered a distance of 6.5 km upstream the Power Plant intake and 2.5 km downstream it.

**40– Capacity Assessment of Damietta Branch for Different Discharges**

**Consultant** : HRI

**Period** : 2003 – 2004

The main objective of the study was to assess the capacity of Damietta Branch to discharge the flooding water to the Sea and investigate the different alternatives to increase the Branch capacity.

The study comprised by field investigations, data collection, and bathymetric survey. A mathematical model "SOBEK-1D" that represents the distance from the Delta Barrage up to the Mediterranean Sea was applied to get better insight of the phenomenon under consideration. Several conditions were tested bearing in mind the protection of the Nile banks.

The study revealed that the maximum capacity of the Branch is 80 MCM per day, with all the offtakes opened, including that of El-Salam Canal.

**41- Assessing the Different Methods for Bank Protection against Erosion along the River Nile in front of Kafr Al-Zaiat City**

**Consultant** : HRI

**Period** : 2004 – 2005

The main objective of the study was to determine of the flow condition, scour potential and channel erodibility in front of the city of Kafer Al-Zaiat. Moreover, the study aimed at figuring out a detailed design and cost estimate of the proposed protection works for the local scour and the bank stability of Kafer-Al-Zaiat area.

A two dimensional mathematical model that supports simulations related to flood studies was used. The model was used to simulate the progression of flood water and the depth of flooding in an area along the Nile. In addition, the output of the first model was used as an input to a more sophisticated mathematical model "DELFT-3D" to simulate the velocity of water into the Rosetta Branch with the different discharges aforementioned above. The DELFT-3D model was calibrated and validated using historical data before putting it into operation.

The results revealed that the maximum flood event passing the Rosetta Branch is 440 MCM/day and this produces a relatively high degrading velocity of 2 m/s. The total cost of protection work to weak areas along the Nile depends on the type of the structural work to be used as a protection work. If short retaining wall is to be used then the total cost is about 360 million Egyptian Pounds. The cost of constructing a retaining wall is about 389 million Egyptian Pounds. Diaphragm wall costs 374 million Egyptian Pounds. Sheet piles are the most expensive structural work as it costs about 443 million Egyptian Pounds.

**42– Monitoring of Scour Holes Downstream Assyut Barrage: Hydrographic Survey**

**Consultant** : HRI

**Period** : 2004 – 2005

The study objective was to check the stability of scour holes downstream Assyut Barrage in the context of monitoring the status of main barrages on the River Nile upon the end of the flooding season.

The study comprised field investigations, data collection, and bathymetric survey using high technology instruments, such as DGPS, Complete Total Station, and Range Finder. The hydrographic survey covered a distance of 300 m, starting from the Barrage gate openings towards the downstream direction.

The results revealed that the deepest scour hole to the apron is located at the C.L. of Vent 58 with a level of (37.00 +MSL) and a slope of 3H:1V. The formation of the scour holes are attributed to the unequal gate openings along the Barrage.

**43– Inundation Modeling of the Nile Delta**

**Consultant** : HRI

**Period** : 2004 – 2005

The main objective of the study was to determine the locations where inundation of floodplain is most probable in the Delta branches.

The study comprised field investigations, data collection, and bathymetric survey. A hydrodynamic mathematical model "SOBEK" with its two features; one dimensional and two dimensional was applied. The two dimensional feature of the model was employed to calculate water depths and velocities in the flood area, which is represented by a two-dimensional grid.

The first model (1-D) results indicated that the flooding occur in the Nile Delta when the River discharge exceeds 300 MCM/day at High Aswan Dam (HAD). Whist, the flooded areas range from 1816.66 $km^2$ to 400.43 $km^2$ around Damietta Branch, for a River discharge of 605 to 350 MCM/day at HAD. On the other hand, they range from 1559.702 $km^2$ to 15.656 $km^2$ at Rosetta Branch, at a River discharge of 605 to 300 MCM/day at HAD. Also, it was revealed that maximum water depths at the flooded area near to Farskour Dam vary between 3 m and 3.65 m.

## 44– Investigating the Local Scour Downstream Rosetta Barrage

**Consultant** : HRI

**Period** : 2004 – 2005

The main objective of the study was to assess the expected scour downstream Rosetta Barrage due to the release of high discharge (605 MCM/day downstream HAD), and the required filter and riprap size for protecting this scour.

The study comprised field investigations, data collection, and bathymetric survey. A physical model was constructed as the best tool to have a direct insight of the flow phenomena under consideration. The model has an undistorted scale of 1:32.

The study revealed that the use of graded riprap particles with 300 mm mean diameter size and thickness of 60 cm is very appropriate for the given flow conditions.

## 45 – Protection of the Nile River Right Bank Downstream the New Naga Hammadi Barrage

**Consultant** : HRI

**Period** : 2004 – 2005

The goal of this study was to determine the appropriate protection method for the Nile River right bank downstream the new Naga Hammadi Barrage.

A physical model with a scale of 1:30 was constructed to get more insight of the area under consideration. Different hydraulic conditions were tested, including discharges that vary from 800 $m^3$/s to 2,900 $m^3$/s.

The results revealed that the erosion of the right bank could be alleviated by constructing 8 groins with 20 m width each and 60 m spacing.

**46 – Scrutinizing of Scour Holes Downstream Assyut Barrage**

**Consultant** : HRI

**Period** : 2005-2006

The study objective was to check the stability of scour holes downstream Assyut Barrage in the context of monitoring the status of main barrages on the River Nile upon the end of the flooding season.

The study comprised field investigations, data collection, and bathymetric survey using high technology instruments, such as DGPS, Complete Total Station, and Range Finder. The hydrographic survey covered a distance of 300 m, starting from the Barrage gate openings towards the downstream direction.

The hydrographic survey revealed that a complete scour was produced downstream the Barrage riprap with a slope of 10H:1V. Also, the survey showed that there was a deposition of 1 m beside the navigational lock. It was recommended to monitor the status of the originated scour holes before the winter closure period.

**47 – Protection of the Nile River Right Bank Downstream the New Naga Hammadi Barrage**

**Consultant** : HRI

**Period** : 2005-2006

The study goal was to examine the possible solutions to alleviate the scour problem at the right bank downstream the temporary dam that was used during the construction phase.

A physical model of scale 1:30 was constructed in order to better understand the scour problem and propose the optimum solution. Different scenarios with different hydraulic conditions were investigated.

The hydraulic model results revealed that the proposed groins are sufficient to alleviate the scour problem. However, in case the bank failure may affect the agricultural lands, it was recommended to construct 8 groins with a 20 m length each and a spacing of 60 m.

**48– Monitoring of Scour Holes Downstream New Esna Barrage**

**Consultant** : HRI

**Period** : 2005-2006

The study objective was to check the stability of scour holes downstream New Esna Barrage in the context of monitoring the status of main barrages on the River Nile upon the end of the flooding season.

The study comprised field investigations, data collection, and bathymetric survey using high technology instruments, such as DGPS, Complete Total Station, and Range Finder. The hydrographic survey covered a distance of 500 m, starting from the centerline of the Barrage intake towards the downstream direction.

It was found that there is erosion at the end of the groin located downstream turbine no. 6. Also, it was noticed that the scour hole downstream gate no.11 reached the same level as in year 2000. It was recommended to perform a periodic follow-up of the originated scour holes every 3 months, starting from June. Moreover, it was recommended to modify the the operating system of the gates so that at least 9 gates are opened.