

## CURRICULUM VITAE

Name of Firm	:	National Engineering Services Pakistan (Pvt.) Limited
Name of Person	:	<b>MUHAMMAD UMAR FAROOQ</b>
Nationality	:	Pakistani
Profession	:	Water Resources Engineering
Position in Firm	:	Senior Engineer (Water Resources)
Specialization in Firm	:	Hydrological & flood modelling, Reservoir operations and optimizations, Hydropower energy estimation, Sediment modelling, Indo-Pak trans-boundary waters matters, Data analysis and processing,
Year of joining firm	:	2011
Affiliation with Professional Institutions	:	i. Member Pakistan Engineering Council ii. Member Pakistan Engineering Congress iii. International Association for Hydro-Environment Engineering and Research (IAHR), Germany
Contact Email	:	umar.nespak@gmail.com

### **KEY QUALIFICATIONS**

As a team member worked on developing the snow and glacier melt runoff model for Kabul River Basin. Provided assistance to couple the runoff models for Kabul, Indus, Jhelum and Chenab rivers to develop an integrated flow forecasting system. Carried out various reservoir operation studies with a focus to optimize the hydropower energy, irrigation losses and revenue gains. Assisted in flood estimation, flood modelling and suggestion of mitigation measures under various projects. Carried out design evaluation of various India's hydropower projects in accordance with the provisions of Indus Waters Treaty along with other trans-boundary waters issues. Performed sedimentation study and optimization of operational storage at India's Kishenganga and Ratle HEPs. Participating/providing technical assistance for the meetings of Permanent Indus Commission since 2013. Performed sediment/hydraulic modelling for various projects in the Indus Basin. Assisted in optimization of flushing scenario for 840 MW Suki Kinari Hydropower Project on techno-economic basis. Developed various scripts using R-Programming and VBA Excel for modelling and day to day assignments.

**CURRICULUM VITAE****EDUCATION**

<u>Name of Institution</u>	<u>Year</u>	<u>Degree</u>
University of Engineering & Technology, Lahore	2018	M.Sc. Hydraulics & Irrigation Engineering
University College of Engineering & Technology, Bahauddin Zakariya University, Multan	2010	B.Sc. Civil Engineering

**EXPERIENCE**

Employer: National Engineering Services Pakistan (NESPAK)  
Position: Senior Engineer (July 2014 – to date)  
Junior Engineer (July 2011 – June 2014)

**Project: Consultancy Services for Mohmand Dam Project**

Client: Water and Power Development Authority (WAPDA), Ministry of Water Resources, Government of Pakistan

Year: September 2020 – to date

Activities: Developed the reservoir operation model of Mohmand Dam in R language environment and calibrated it with the results produced during the detail design stage. Extended the model with inclusion of Munda Headworks. Analyzed various scenarios of system water demands and reservoir operations to assess the optimum storage provision at re-regulation pond of Munda Headworks while incurring minimum system demand shortages subsequent to peaking operations at dam and loss of hydropower energy/revenue. Implications of future water supplies to Peshawar city from dam were analyzed. The benefits associated with the raising of maximum conservation level to the highest flood level during non-flood season were also assessed.

**Project: Design, Construction, Supervision and Implementation Support for Baluchistan Water Resources Development Sector Project (BWRDSP)**

Client: Irrigation Department, Government of Baluchistan

Year: September 2020 – to date

Activities: Developed a regional relationship between annual inflow volume and sediment load using data of various stations of SWHP WAPDA in vicinity of the project area. The regional relationship was supported by developing similarities of annual rainfall and soil type in the catchments of selected stations. In the absence of any discharge/sediment observation site on Siri Toi River, the developed regional relationship was used to update the annual sediment load at the project location. The estimated annual load was further firmed up by developing the daily suspended sediment rating curves at downstream stations and using the same in a separate analysis to estimate sediment load at Siri Toi dam site. The potential means for the management of sediment influx were also suggested.

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**CURRICULUM VITAE****Project: Hydrological Modelling for Flow Forecasting Study of Kabul River Basin Using GIS/RS Technology**

Client: Water and Power Development Authority (WAPDA), Ministry of Water Resources, Government of Pakistan

Year: November 2018 – April 2020

Activities: Assisted in downloading and processing of remote sensed data (MODIS, GLIMS, NOAA RFE) to develop flow forecasting model of Kabul River at Nowshera. Carried out temperature lapse rate analysis in the region to project ground station data over the whole basin. Validated application of computed temperature lapse rate on the basis of temperature data of specially installed three automatic weather stations. Calculated snow retreat elevation using daily snow product of MODIS. Provided support to replicate SRM+G models of Jhelum, Indus, Chenab and Kabul Rivers in .NET for development of a web-based integrated flow forecasting application. Downloaded and processed MERRA SWE monthly product to validate snow water equivalent in the study area. Analyzed performance of MERRA2-LND and LIS-NOAH products in purview of stand-alone source for flow forecasting. Applied Bayesian Joint Probability (BJP) approach to develop seasonal and short-term forecasts by employing statistical and hybrid scenarios. Developed R-scripts to carry out analysis of remote sensed and ground observed data.

**Project: Dams on Chachar, Vidor, Mithawan and Kaha Hill Torrents in DG Khan and Rajanpur – Feasibility Study**

Client: Irrigation Department, Government of Punjab

Year: December 2017 – October 2018

Activities: Analyzed ground observed and various satellite-based rainfall data sets to be used as representative for the project area. Assisted to estimate the water availability at each of the proposed dam site. Provided assistance to estimate the rainfall generated design flood and optimization of the spillway level for its safe routing. Supported to analyze various options of flood peak attenuation / flood diversion to minimize the associated losses.

**Project: Consultancy Services for Preparation of Pakistan's Case against India's Ratle and Kishenganga HEPs for Presentation before the Permanent Court of Arbitration/Neutral Expert**

Client: Office of Pakistan Commissioner for Indus Waters (PCIW), Ministry of Water Resources, Government of Pakistan

Year: March 2016 – to date

Activities: Participation in Government level negotiation held in India to discuss Pakistan's objections on India's Ratle and Kishenganga HEPs. Carried out reservoir operation for optimization of peak and off-peak energies and subsequent revenue corresponding to various values of active storages of the reservoirs. Developed a tool in Excel VBA for computation of maximum permissible pondage in purview of the Indus Waters Treaty provisions corresponding to hundreds of data sets under various scenarios. Provided technical assistance for development of suspended sediment rating curves and estimation of long term suspended/bed/total annual sediment loads for both the projects. Developed 1-D numerical model using HEC6-KC for sedimentation studies and

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prediction of long-term thalweg profiles, residual capacity and reservoir life at various instances during reservoir operation. Provided support for preparation of various design alternatives of Ratle and Kishenganga HEPs in accordance with the Treaty provisions. Developed tool in Excel VBA to arrange and plot the cross-sectional data extracted from DEM using ArcMap.

**Project: Standing Consultancy Services for the Office of Pakistan Commissioner for Indus Waters (PCIW)**

Client: Office of Pakistan Commissioner for Indus Waters (PCIW), Ministry of Water Resources, Government of Pakistan

Year: January 2012 – to date

Activities: As a member of Consultant's team, providing technical services on standing basis for the Office of Pakistan Commissioner for Indus Waters, Government of Pakistan since 2011 to prepare technical evaluation reports of India's new hydroelectric projects on Western Rivers of the Indus Basin (Indus, Jhelum and Chenab) in accordance with the Treaty. Participated/provided technical assistance in 108th to 114th meetings of Permanent Indus Commission (a total of 7 meetings).

Provided technical support for evaluation of 48 MW Lower Kalnai, 120 MW Miyar, 850 MW Ratle and 1,000 MW Pakal Dul hydroelectric projects. Technically assisted for various day to day queries of PCIW Office pertaining to trans-boundary waters issues. Involved in preparation of Treaty compliant design alternatives of India's hydroelectric projects on Western Rivers of Indus Basin. Provided technical assistance to present Pakistan's stance at various national and international forums on trans-boundary waters.

**Project: Tarbela Tunnel 5 Project**

Client: Ministry of Water Resources, Government of Pakistan

Year: August 2017 – June 2018

Activities: Technically Assisted the Enquiry Committee constituted by the Ministry of Water Resources, to conduct the review of power and energy studies carried out by T5 Consultants. Involved in development of Tarbela dam's reservoir operation model for re-evaluation of power and energy benefits associated with Tunnel 5 project both for 'Tarbela Alone' and 'Tarbela with Basha' scenarios. Applied Brune's curve following the findings of Tarbela reservoir sedimentation report of 2014 by Dr. Gregory Morris. It was found that historic depletion trend of Tarbela reservoir was in close proximity of the forecasted residual storage values by Brune's curve.

**Project: Feasibility Study and Detail Engineering Design of Torcamp Godubar Hydropower Project District Lower Chitral Khyber Pakhtunkhwa**

Client: Pakhtunkhwa Energy Development Organization (PEDO), Government of Khyber Pakhtunkhwa

Year: March 2018

Activities: Developed reservoir operation model to compute power and energy for various design proposals of the project. Carried out the optimization of peak and off-peak energies was also carried out for maximization of revenue.

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- Project:** **Hydel Power Station at Qadirabad-Balloki Link Canal RD 304+985**  
**Client:** Punjab Power Management Unit, Energy Department, Government of Punjab  
**Year:** February 2018  
**Activities:** Estimated the discharge series from 2010 to 2016 at the project site in view of data unavailability after year 2009. Updated power and energy model for the complete range of canal discharges to provide support for selection of optimum design discharge and turbine sizing.
- Project:** **330 MW Kishenganga Hydroelectric Plant; India's Proposed Project on Kishenganga/Neelum River**  
**Client:** Office of Pakistan Commissioner for Indus Waters (PCIW), Ministry of Water and Power, Government of Pakistan  
**Year:** January 2012 – December 2017  
**Activities:** Worked as a technical team member to prepare Pakistan's case against India's proposed 330 MW Kishenganga Hydroelectric Plant (KHEP) on Kishenganga/Neelum River in Indian Administered Kashmir and its presentation before the Court of Arbitration. Assisted in various project activities i.e. determination of water availability at different sites in Kishenganga/Neelum River catchment, effect of reduction in flows due to diversions at KHEP on various potential and under construction hydropower projects in Pakistan's territory, and determination of the impact of KHEP and various downstream discharge release scenarios on the regime of channel using HEC6-KC model. Developed reservoir operational model to optimize the peaking hours at KHEP.
- Project:** **Hill Torrents Management Study in Dera Ghazi Khan Division**  
**Client:** Water and Power Development Authority (WAPDA), Ministry of Water and Power, Government of Pakistan  
**Year:** September 2015 – February 2016  
**Activities:** Involved in estimation of annual sediment load at 15 potential dam sites proposed for flood management in the hill torrents of Dera Ghazi Khan Division. In view of unavailability of discharge and sediment observations in the project area, developed a relationship between stream catchment area and specific sediment yield on the basis of historic data of SWHP stations. Applied the same relationship to estimate the annual sediment load at each potential site by means of relevant catchment area and estimated annual inflow.
- Project:** **Development of Water Resources Management Information System (WRMIS) and Decision Support System (DSS) for Efficient Irrigation Water Management in Punjab**  
**Client:** Project Management Office (PMO), Punjab Barrages Rehabilitation and Modernization Projects, Irrigation Department, Government of Punjab  
**Year:** July 2015 – February 2016  
**Activities:** Prepared input data for numerical modelling of various canal systems in HEC-RAS. In Hakra Branch Canal system, analyzed historical rotational plans for evaluation of implementation ratio and computed GINI coefficient/index for estimation of historically prevailed equity. Developed a tool in Excel VBA for identification of errors, typos, gaps in the PMIU's data base and their

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rectification through plotting technique for all 57 canal divisions of Punjab Irrigation Department which comprised 3,151 channels including main, branch, link, disty, minor and sub-minor canals.

**Project: Improvement of Water Resources Management of Indus Basin to Enhance the Capacity of Indus River System Authority**

**Client:** Indus River System Authority (IRSA), Ministry of Water and Power, Government of Pakistan

**Year:** August 2013 – October 2015

**Activities:** As a team member, worked to develop a reliable and transparent flow measurement and distribution systems at 23 selected control structures and associated off-takes on Indus, Jhelum, Chenab, Ravi, Sutlej and Kabul rivers. This task included the formulation of recommendations after review of existing discharge calculation techniques, water distribution, auditing and accounting systems. The main objective of the project was to ensure fair and rightful distribution of river supplies among the provinces in accordance with Water Apportionment Accord of 1991. Assisted in review of the discharge coefficient in-effect at the barrages and head-regulators of off-taking canals. Applied certain checks to assess the quality of flow measurement in rivers and canals. To take all the stakeholders on board, assisted in arrangements of workshops to present adopted techniques/methodologies, subsequent results and the project progress.

**Project: Technical Due Diligence Study of 120 MW Taunsa Hydroelectric Project**

**Client:** Energy Department, Government of Punjab

**Year:** January 2015 – June 2015

**Activities:** Provided technical assistance for estimation of suspended/bed/total sediment inflow at Taunsa Barrage both for pre and post Tarbela Dam scenarios. Developed 1-D numerical model using HEC6-KC to forecast the future sedimentation pattern in the vicinity of barrage and off-taking canals for various operational scenarios (historic and projected) under the impact of proposed 120 MW hydropower project at the right bank. Analyzed the impacts of flow diversion to power channel and subsequent reduction in historic flows through barrage. Provided assistance for formulation of optimum future scenario to avoid the excessive sedimentation of under-sluices and main bays which might be harmful for barrage operation.

**Project: Development of National Flood Protection Plan – IV**

**Client:** Federal Flood Commission, Ministry of Water and Power, Government of Pakistan

**Year:** March 2014 – June 2015

**Activities:** As a member in numerical modeling team, carried out the flood frequency analysis at all the dams and barrages on Indus, Jhelum, Chenab, Ravi and Sutlej rivers. Flood discharges of various return periods at mentioned sites were utilized for hydrodynamic modelling to compute the depth and extent of flood inundation. The purpose of these maps was to provide decision support for future development, design and implementation of flood protection schemes.

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**CURRICULUM VITAE****Project: Consultancy Services for Design and Supervision of Roads and Infrastructure in Town of Duqm (Package-I)**

Client: Ministry of Regional Municipalities and Water Resources, Oman

Year: July 2014 – March 2015

Activities: Assisted in the hydrological analysis of the proposed road alignments. Carried out catchment delineation for significant streams and identified the drainage points using DEM SRTM. Provided support for rainfall frequency analysis using GEV Type-1 and Log Pearson type-III distributions. Assisted in the development of design hyetographs and IDF curves for the project area. Estimated the design flood discharges at the key locations with rational formulae. Adequacy of the proposed cross-drainage structures were assessed using HY8.

**Project: Biodiversity Impact Assessment of Gulpur Hydropower Project on Poonch River**

Client: Hagler Bailly (Pvt.) Limited.

Year: September 2013 – April 2014

Activities: Assisted in estimation of discharge time series at four EFlow sites with/without construction of hydropower project which was then utilized in the DRIFT Model for assessment of environmental flows and impact of release scenarios on river habitat. The discharge available for hydropower generation and environmental purposes was estimated separately for each scenario under consideration.

**Project: Design for Storm Water Drainage and Avoiding of Flood Danger for Five Cities of Al-Baha Region**

Client: Ministry of Water and Electricity, Saudi Arabia

Year: February 2013 – December 2013

Activities: Assisted in development of stream network in the project area using DEM. Provided support to estimate the flood peaks of various return periods at significant locations. Engaged in development of an integrated HEC-RAS model for the project area to estimate the inundation extents over the priority zones corresponding to the design floods. Suggested the cross-drainage facilities for safe passage of the flood. Analyzed hydraulic adequacy of existing/proposed cross-drainage structures using HY-8.

**Project: Climate Change Adaptation and Impact Assessment Study for Mohmand Dam, Pakistan**

Client: Delegation of the European Union to Pakistan

Year: August 2013 – November 2013

Activities: Analyzed the data of Surface Water Hydrology Project (SWHP) stream gauging stations for assessment of sediment influx at observation sites in Kabul River Basin. Involved in development of suspended sediment rating curves for estimation of annual load at observation sites of Kabul River (Warsak Dam, Nowshera), Swat River (Kalam, Chakdara, proposed Mohmand Dam site) and Panjkora River (Zulam Bridge). Provided technical support to extend the series of estimated annual sediment load at the project location by correlating short-term data observed at proposed Mohmand Dam site with long-term data of other observation sites in Kabul River Basin.

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**CURRICULUM VITAE****Project: Survey, Feasibility Study and Design for Re-Alignment of Bund from Northern Side of Malir River, Karachi**

Client: Works and Services Department, Government of Sindh

Year: January 2013 – October 2013

Activities: Provided technical support to develop model of Malir River reach in HEC-RAS with the existing alignment of flood protection bunds and proposed re-alignment of Northern bund to reclaim the river floodplain area for urbanization. Calibrated the model with the observed flood marks of 1978 in the city river reach. Selecting 100-year return flood of 410,000 ft<sup>3</sup>/s as design discharge, performed simulations to check the viability of existing height of flood protection bunds after proposed re-alignment. New levels of the flood protection bunds were proposed in view of the increase in water depth after re-alignment. The results of numerical model were also validated through physical modelling carried out at irrigation Research Institute (IRI), Nandipur

**Project: Wullar Barrage – Tulbul Navigation Project**

Client: Office of Pakistan Commissioner for Indus Waters (PCIW), Ministry of Water and Power, Government of Pakistan

Year: January 2013

Activities: Involved in development of HEC-RAS model of Jhelum River downstream of Wullar Lake to Baramula in Indian Administrated Kashmir. The purpose of this numerical model was to estimate the flow which could provide minimum draft of 4.5 ft to meet India's requirement for navigation of barges in this reach. Model calibration was carried out with the help of google image of the said reach. Model was first simulated using the river discharge on the image date and then modelled flow widths at the relevant cross-sections were calibrated using widths as measured from google image.

**Project: Up-gradation of Feasibility Study and Preparation of Tender Documents of 840MW Suki Kinari Hydropower Project**

Client: SK Hydro (Pvt.) Limited

Year: July 2011 – April 2012

Activities: As a team member, assisted in development of suspended sediment rating curve at the proposed dam site on Kunhar River in Naran Valley for estimation of annual sediment load using data of Surface Water Hydrology Project (SWHP). Developed 1-D numerical model of Suki Kinari Hydropower Project using HEC6-KC. Initially simulations were run to determine sedimentation distribution patterns, reservoir life and storage depletion without any sediment management. Then, adopted flushing as sediment management technique to enhance the capacity of reservoir and life of hydro-mechanical equipment subjected to sediment abrasion. Idea was to ensure the availability of required operational storage for peaking in winter season on perpetual basis and minimize the potential ingress of harmful sediment sizes into the power channel for protection of hydro-mechanical equipment. Simulated various flushing scenarios and optimization was carried out on techno-economic basis.