GWP Experience in Surface Water Re-Use and Artificial Groundwater Recharge

Reference: CS-22

GWP Consultants has more than 35 years experience in investigating, assessing, designing and supervising construction of rainwater harvesting, surface water run-off management and disposal and groundwater resources development schemes.

GWP experience of integrated water resources control systems, originates in the extractive industry with the design of simple but effective storm water routing and retention basins and silt settlement lagoons used to meet discharge standards, coupled to dry season water demands for process and dust suppression activities. These approaches have evolved with the promotion in Europe of Sustainable urban Drainage Strategies, which include the minimisation of run-off through the maximum use of groundwater infiltration approaches. GWP uses a range of techniques including conventional soakaways, infiltration basins, swales and other structures to achieve these objectives, as well as using permeable pavements and green-engineering to encourage dispersed infiltration.

In recent years GWP have used these approaches to increase groundwater resource augmentation including freshwater lens replenishment in atoll and karstic limestone islands to reduce dry season water scarcity. GWP staff also has experience of catchment wide groundwater recharge approaches using wadi flood retention and recharge dams to increase groundwater resource yields and reduce saline intrusion in the arid Middle East.

Recent Projects:

Drought resilience planning in the atoll state of Tuvalu

The diminutive size of the Tuvalu atolls results in very little fresh groundwater and near complete national reliance upon rainwater harvesting. Drought resilience plans were developed to build on conventional household rainwater harvesting programmes augmenting these through careful targeting of communal structures (churches, schools, government buildings) to provide strategic water reserves for the communities. Areas key to the implementation plan included improved household rainwater harvesting, sizing storage for household demands, maximising roof catchments and infiltration of excess rainwater into household wells and the limited freshwater lenses to increase non-potable groundwater usage.

Water scarcity reduction in the atoll state of the Marshall Islands

A national water scarcity reduction plan was developed to improve dry season water resources availability using household rainwater harvesting programmes in the remote Outer Islands and the densely populated urban areas of Majuro and Ebeye, supported by improvements to the main water sources (rainwater harvesting off the airport runway and co-abstraction of the Laura groundwater lens) such as evaporation reduction and sediment removal measures, and a feasibility study on wastewater management to protect the Laura Lens from pollution.

Post-tsunami island scale water governance strengthening in the Maldives

Rainwater harvesting, hydrogeological, water supply and sanitation infrastructure assessments were carried out with the support and engagement of local communities. The work had a strong focus on rainwater harvesting for potable water supply, groundwater lens usage for non-potable supply and replenishment of groundwater resources using excess rainwater. It was demonstrated that the deliberate recharging of groundwater with rainwater harvesting increased fresh groundwater resources for individual wells, island wide lenses, and on reclaimed land.

Arid zone storm run off retention and recharge dams in Khasab

GWP has considerable technical experience in approaches to capturing flash-flood wadi runoff and routing it into groundwater resources. GWP staff has undertaken detailed studies on the efficiency of recharge dams which capture surface water preventing rapid runoff to the sea or uninhabited desert. The controlled slow release of water to infiltration structures immediately downstream allows removal of sediment loads and maximum groundwater recharge in extreme arid zone environments, increasing groundwater resources, wellfield and aflaja yields and reducing saline intrusion.

Development of a surface water management and disposal master plan for a large urban development in Greater London

Master Plan development required water management schemes for a large mixed use (public, retail and housing) urban development of approximately 20 hectares. To meet planning policy imposed requirements on water neutrality and efficiency and flood risk minimisation a range of appropriate and sustainable techniques for water and wastewater capture, re-use and disposal were proposed, including: rainwater harvesting to provide grey water for toilet flushing, garden irrigation thereby significantly reducing the volume surface runoff and site water demand; and the use of underlying aquifers to allow the development to use SUDS infiltration schemes such as pervious paving, swales, detention ponds, infiltration trenches and soakaways. Where the methods dependent on infiltration could not be used it is necessary to provide detention and attenuation ponds thus limiting discharge to nearby water courses.

Small scale surface water management and infiltration scheme for extension to retail unit and car park, UK

GWP was contracted for the detailed design of a surface water management scheme for a small retail site. The proposed increase to hard standing and rooftop area was predicted to unacceptably increase surface runoff from the site. After on site ground infiltration tests, GWP was able to design appropriate and sustainable small scale water engineering measures to reduce peak runoff from the site. The design included gutters, pervious paving, an infiltration swale, an over-ground attenuation pond, an underground attenuation unit and suitable pipe and drainage network to integrate into the existing drainage infrastructure.

Research project on fluvial flood peak attenuation and groundwater recharge using quarry voids

The primary focus was to produce methods for quantifying the flood alleviation practicable in quarry voids and develop design guides, techniques and tools to implement such schemes. The case study quarries were all hydraulically connected to groundwater and act as large floodwater infiltration basins able to attenuate flooding. When quantifying the available storage, groundwater-surface water interactions were found to be of high importance, and specifically the different timing of responses to flood events. Measures for mitigating the negative impacts on groundwater resources (such as water quality and flooding) were also included in the study. The photograph shows river flood offtake structure connected to quarry void infiltration basin.

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