ACI Asia-Pacific Green Airports Recognition 2020

Water Management

ACI ASIA-PACIFIC
GREEN AIRPORTS
RECOGNITION

Disclaimer

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May 2020

ACI Asia-Pacific

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INTRODUCTION AND ACKNOWLEDGEMENTS

The Green Airports Recognition (GAR) was established by ACI Asia-Pacific with the support of the ACI Asia-Pacific Regional Environment Committee (REC). The Recognition's objective is to promote environmental best practices to minimize aviation's impacts on the environment and to recognize ACI Asia-Pacific's airport members who have outstanding accomplishments in their environmental projects. Understanding that different airports have a variety of environmental priorities, a specific environmental aspect is chosen as the recognition theme each year. The theme for this year's recognition is Water Management to showcase projects that aim to foster water conservation and prevention of water pollution.

New data from the World Resources Institute (WRI) in 2019 warned that almost a quarter of the world's population, many living in Asia-Pacific and the Middle East, among them Bahrain, India, Jordan, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates, will be facing serious shortages in fresh water supply. The theme for this year's recognition was selected in part in response to this critical warning.

Secure and reliable water resources are essential to the operation of any airport. Water is needed to maintain food and hospitality concessions within the airport complex, operating cooling towers and basic amenities within the terminal area, cleaning and maintaining aircraft and maintaining grassed areas and landscapes. The substantial growth of aviation, especially in the Asia-Pacific region, has led to a significant increase in water usage by airports. Airports also generate large volumes of wastewater that may include contaminants. Hence, understanding sustainable water management practices is essential to the aviation industry.

The Airports Council International's (ACI) Policy Handbook provides directions on how airports should protect the scarce water resources by minimizing usage and reducing the negative impacts from wastewater. The handbook states that "airports should work to minimize the use of portable water, to process wastewater (de-icing and sewage) in the most efficient way possible, reuse of treated water and to manage the quantity and quality of storm water run-off."

The ACI Asia-Pacific Environmental Survey 2019 results show that water management continues to be one of the top three priorities. Water and wastewater management systems and measures such as reducing the flow setting of taps at the airports, water meters and leak detection system are implemented to save scarce water resources at airports in the region. Our airport members' efforts are consistent with the United Nations, who in 2015 established 17 Sustainable Development Goals (SDGs) to promote more sustainable development around the world. Goal 6 of the SDGs calls for action by all countries to ensure availability and sustainable management of water and sanitation for all.

Sixteen eligible submissions were received from member airports, representing 16% of the total passenger traffic in Asia-Pacific and the Middle East region. This year's submissions showcase innovative best practices for wastewater treatment, water harvesting, water recycling and water reduction. Apart from the efforts in water management, a number of member airports also demonstrated their efforts in reducing the environmental impact and creating positive benefits through other environmental management initiatives such as implementing Green Airport Infrastructure, Waste Minimization and Energy Management, which were demonstrated in previous Green Airports Recognition.

The submissions were reviewed by a panel of judges comprising:

- Mr. Christopher Surgenor, Editor/Publisher, GreenAir Online
- Dr. Panagiotis Karamanos, Aviation Environmental Consultant
- Mr. Christopher Paling, Senior Lecturer in Environmental Management, Manchester Metropolitan University
- Ms. Juliana Scavuzzi, Senior Manager, Environment, ACI World
- Mr. Stefano Baronci, Director General, ACI Asia-Pacific

We would like thank all judges for their expertise and valuable time.

After collective assessment with eight relevant criteria, the panel of judges recognised the following airports:

Over 35 million passengers per annum:

- Platinum – Taoyuan International Airport
- Gold – Indira Gandhi International Airport
- Silver – Chhatrapati Shivaji Maharaj International Airport

Between 15 to 35 million passengers per annum:

- Platinum – Rajiv Gandhi International Airport
- Gold – Muscat International Airport
- Silver – Kempegowda International Airport

Less than 15 million passengers per annum:

- Platinum – Kaohsiung International Airport
- Gold – Adelaide Airport
- Silver – Sharjah Airport

The outstanding work of the above nine airports plus other submissions are summarized in this publication to promote best practice sharing.

It should be emphasized that all airports in this publication deserve to be recognized because of their commitment to Water Management and willingness to share their stories with the airport community, fully reflecting the objective of this Recognition.

ACKNOWLEDGEMENT OF ALL PARTICIPATING AIRPORTS

Adelaide Airport

BRISBANE AIRPORT CORPORATION

Chhatrapati Shivaji International Airport Mumbai

GVK

Christchurch Airport bringing the world South

香港國際機場 Hong Kong International Airport

Delhi Indira Gandhi International Airport | GMR

高雄國際航空站 Kaohsiung International Airport

Kempegowda International Airport Bengaluru

Malaysia Airports

Muscat International Airport Gateway To Beauty & Opportunity

ITAMI Osaka International Airport

AOT / Phuket International Airport

Hyderabad Rajiv Gandhi International Airport | GMR

مطار الشارقة Sharjah Airport

SYD Sydney's Airport

桃園國際機場 Taoyuan International Airport

WASTEWATER TREATMENT

Kuala Lumpur International Airport

Effluent Water Quality Standard at Sewerage Treatment Plant KLIA

A joint venture project between Mitsui Fudosan and Malaysia Airports Holding Berhad (MAHB) to build a Mitsui Outlet Park (MOP) Kuala Lumpur International Airport (KLIA) Sepang shopping mall. The mall's KLIA Sewerage Treat Plant (STP) is one of the inclusive developments under MAHB. This plant is designed as Sequential Batch Reactor (SBR) System with treatment capacity of 5000 Population Equivalent (PE). The effluent will be discharge at Sungai Labu, Sepang, Selangor. This facility is managed under Utilities & Environmental (U&E) Unit, Malaysia Airports (Sepang) Sdn Bhd. The scope of civil and structural airside facilities within the purview of the Utilities & Environmental Unit covering area of KLIA 10km by 10km perimeter are Water Reticulation, Sewerage, Solid Waste Management and Pest Control Management.

The performance monitoring activities of STP KLIA are conducted daily through in-situ sampling analysis. Through the monitoring yield with improvement possibility and in line with recommended range of Environmental Quality Act (EQA) 1974 requirement**.** U&E unit recognized the potential improvement towards the STP system which improve the quality of discharge water, aquatic life and flora fauna. Rectification of aeration process at SBR tank is an innovative approach brings improvement strategy of performance and its impacts in terms of generate financial saving, cost avoidance, defect reduction, efficiency reboots, stakeholder engagement and environmental sustainability. A total of 99.9% cost saving that translate to USD 574K per year had been achieved which contribute efficiency of maintenance clogging activity at SBR with 100% improvement. It also can contribute to 9,015kgCo2/year carbon emission reduction as using recycle tube diffuser, logistic and electricity reduction.

This project replication to other MAHB's Airports is vital to ensure the planning the environmental consciousness to continue and contribute to event more cost savings and cleaner water discharge.

Project Graphics

<table>
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<td>Material Sample of tube diffuser from SBR Tank</td>
<td>Process installation of modified tube diffuser</td>
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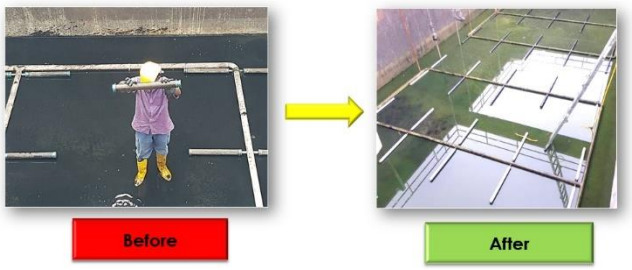
<td> 

Quality in SBR Tank changed, from septic color (black) to normal color (green it proved that aeration process completed in SBR Tank</td>
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<td>Significant water before and after improvement</td>
<td>Significant STP outcome before & after improvement</td>
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WASTEWATER TREATMENT

Sharjah Airport

NEW Sewage Treatment Plant Project at Sharjah Airport

The new Sewage Treatment Plant (STP) at Sharjah Airport with an average capacity of 3,000 m3/day has been constructed by METTITO (the Contractor) under the Design & Build Lump Sum Contract with a total cost of AED: 30 million. The project was started on 18/02/2018 and completed on 1/06/2019.The project was initiated with an objective to meet the future demand for an STP with increased capacity due to Airport expansion and adapt more environment friendly and efficient technology in sewage treatment. STP is designed with two separate streams, each with an average capacity of 1,500 m3/hour. Inlet Headwork's, Drum Screens, Anoxic Tank, Aeration Tank and Membrane Bio-Reactor (MBR) are two streams (2 x 50%), whereas Belt Filter Press, Odor Control Unit is one unit (1x100%). The treatment plant is designed to achieve Treated Sewer Effluent (TSE) standard for unrestricted irrigation as per Sharjah Municipality regulations. The plant technology is based on Membrane Bio-Reactor (MBR).

Below are the treatment stages:

- **Pretreatment Stage:**

This is primary stage, which includes screening and grit removal from the raw sewer that is fed into the STP as discharge out of the Sharjah Airport expansion;

- **Biological stage:**

This is the second major stage, which consists of Biological treatment for removal of pollutant, i.e. BOD, COD and Nitrification/DE nitrification;

- **Sludge handling and dewatering stage:**

As a final stage, the surplus sludge is removed and dewatered as per Sharjah Municipality standards.

- **Design Flow / Capacity of Plant**

STP is designed for average flow of 3000 m3/d. The process design flow capacity is summarized in Table below.

Table: Process Design Flows to STP:

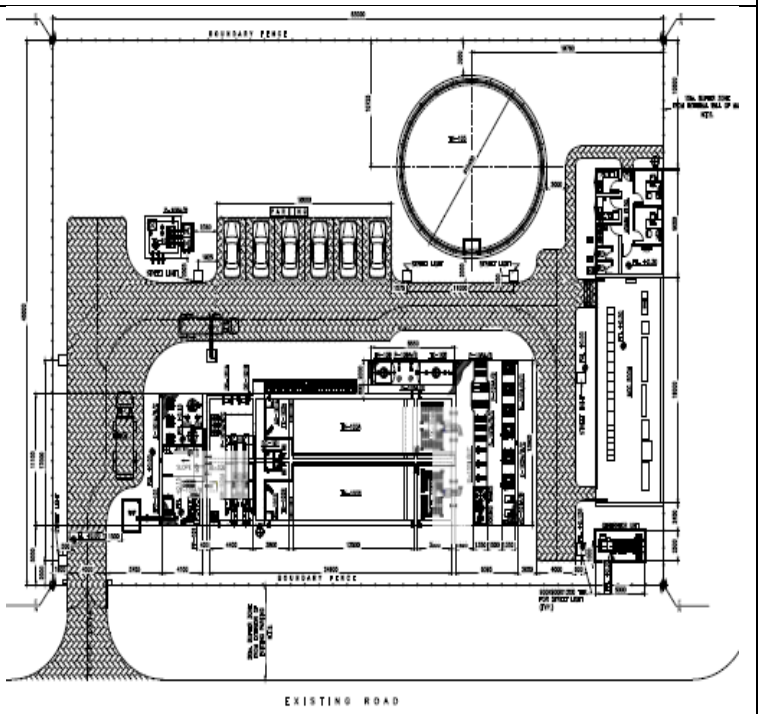
Parameters	**Values**	**Unit**
Average Daily Flow (ADF)	3000	3 m /d
Peak flow factor	1.4	
Average hourly flow (PF)	125	3 m /h
Peak flow (PF)	175	3 m /h
Number of Process stream	2	Nos

Project Graphics

New Sewage Treatment Plant and tank

The Sewage Treatment Plant

Storage tank for treated sewage effluent(TSE)



Project Drawing

WATER HARVESTING

Indira Gandhi International Airport (IGIA)

Evaluation of Watershed and Water Management at IGIA using WATSCAN tool

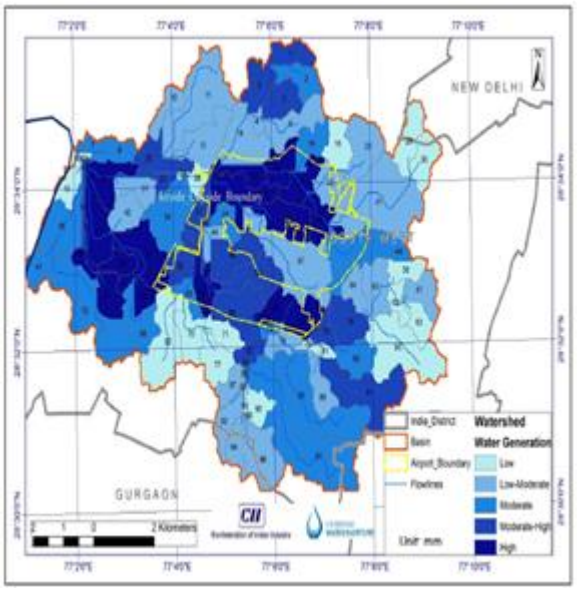
Safeguarding water and ensuring its availability in sufficient quantity and quality is imperative for sustained Airport operation and ensure sustainable management of water for the surrounding communities in its region

DIAL adopted a comprehensive evaluation for the Airport watershed to scientifically assess water resource availability and thereby identifying appropriate strategies that addresses risk and resource challenges. This evaluation was done using Water Planning & Assessment Tool (WATSCAN), which is IT driven, Geographic Information System (GIS) and Remote Sensing based decision support system developed by Confederation of Indian Industry (CII) that links satellite information, on-ground databases and processes information (spatial and temporal) carried in millions of pixels on GIS platform. This has enabled DIAL to-

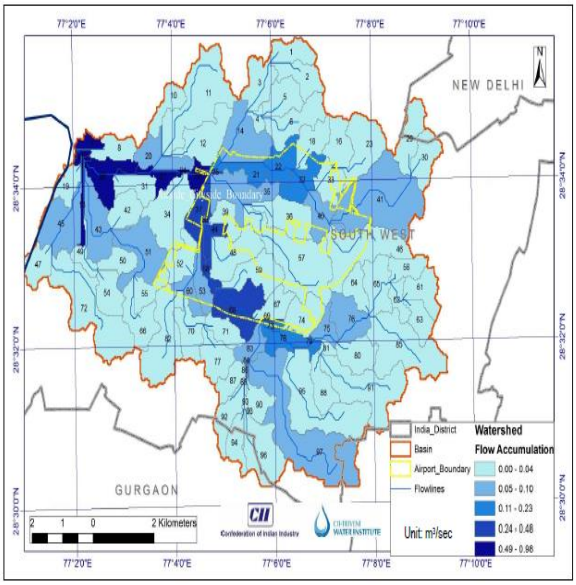
- Assess water resource availability
- Identify water risk and factors that affect water availability
- Prepare climate change adaptations and water security plan
- Adopt water management initiatives
- Community and stakeholder awareness
- Planning with government authorities for better water resource management

The evaluation has further validated the effectiveness of the measures adopted towards water management at IGIA. It also enabled DIAL to plan new initiatives to improve water security for its region. DIAL has installed > 300 rainwater harvesting structures that recharge >65% of DIAL's overall annual water consumption, more structures are being added with an objectives of increasing the recharge potential to 100% and make IGIA water positive. Water efficient fixtures, sensor based drip irrigation, cooling tower water management through improved cycle of concentration, adoption of green infrastructure elements such as open pavers, porous turf etc., 16.6 million litres per day (MLD) sewage treatment plant and reuse of treated water are some the key initiatives implemented. These measures has led to reduction of specific water consumption (L/pax) from 61 in 2010-11 to 30 in 2018-19. The initiative of DIAL was also recognized by CII in Water Management Summit 2019, as DIAL received the "Winner" for its efforts towards water management.

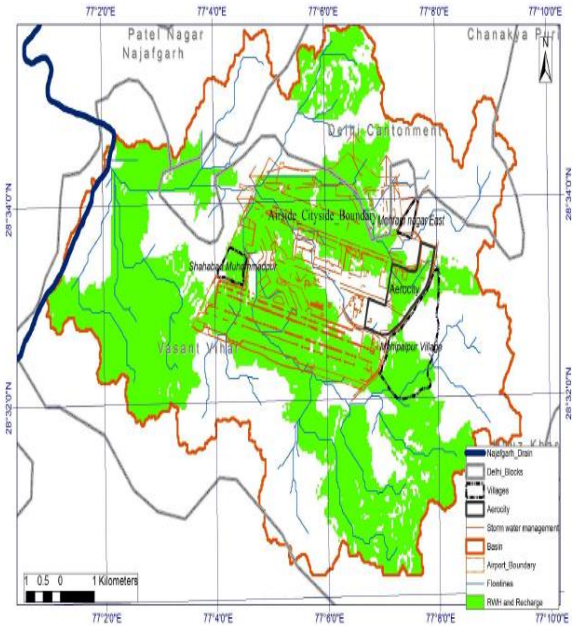
Project Graphics



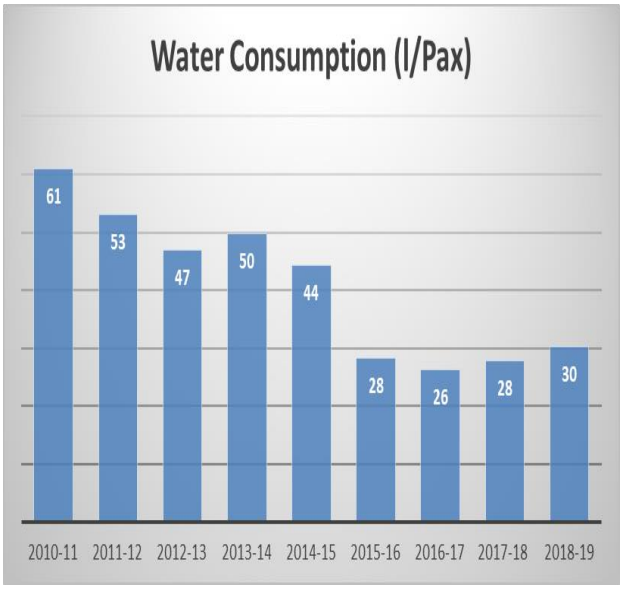
Water Generation in the DIAL Micro Watershed



Water Accumulation in the DIAL Micro Watershed – Normal Rainfall Year



Potential locations for groundwater recharge in the DIAL watershed



Specific water consumption of IGIA (Achieved more than 50% reduction)

WATER HARVESTING

Kempegowda International Airport
Water Conservation Action to Drive Sustainable Water Management

We at Kempegowda International Airport, Bengaluru (KIAB) are sensitive about setting a benchmark in sustainable water management & operations. With our outreach programs, we support various environmental & community initiatives. Considering the high stress on drinking water, high focus is to drive sustainable water management within KIAB & the adjoining region, as a long-term strategic objective, driven using optimization, recycling, capture & reuse.

Airport operations impact water availability in the region as we support 33-35 Mppa, consuming fresh water. Operations at the airport can impact quantity & quality of water due to generated solid waste, liquid waste, emissions, also construction & maintenance activities. Action plans implemented by KIAB will drive strategic goals leading to achieve sustainable water management enhancing access to safe drinking water and safe sanitation.

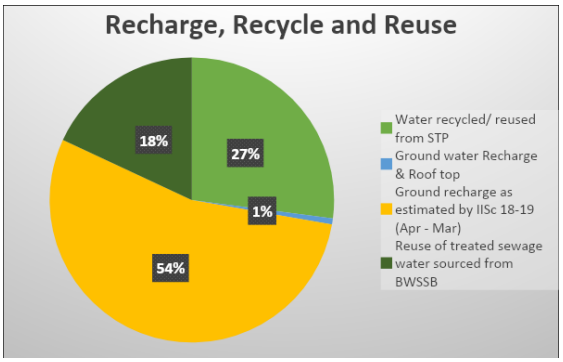
Reduction efforts include adaptation of technology & innovations in water management such as low flow fixtures, pressure-based leakage monitoring, water balance, IEC, training etc.

Sewage treatment plant (activated sludge process) has been upgraded with Sequential Batch Reactor (SBR) of 1.5 million litres per day (MLD) capacity to meet the increased sewage generation of 2.5 MLD. As a part of Phase II expansion of Terminal 3 MLD SBR technology is under implementation with reverse osmosis (RO) and ultrafiltration (UF) for upcycling applications.

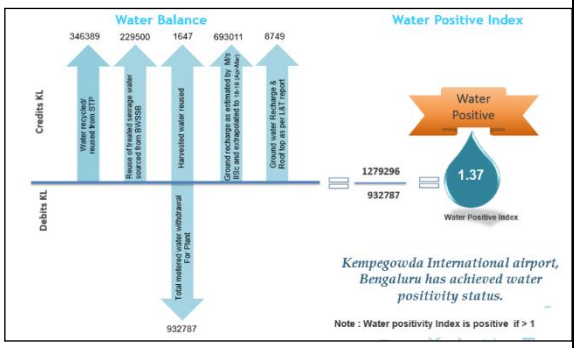
In the 1st phase of the project roof top harvesting, recharge pits and recharge wells (315 no's) were installed. Currently we are developing Rainwater Harvesting Ponds, roof top harvesting, watershed management, which includes Installation & real time monitoring of water quality in the distribution systems, water table depth, surface & groundwater, flood level, weather, storm water level-rainfall, lake water quality.

These efforts helped us achieve water positive status, enhancing own sources of water, increasing water table in the region, preserving water bodies from pollution. Thus, ensuring enhanced water availability and sustained quality of water in water bodies in the region.

Project Graphics

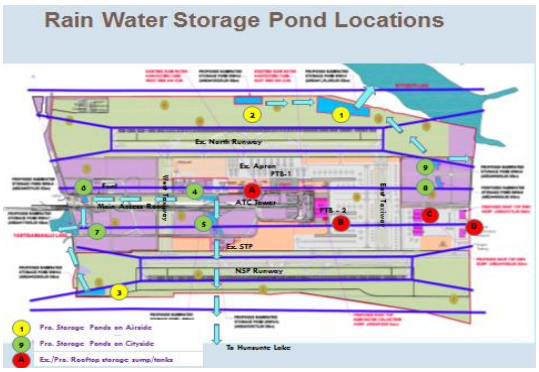


Conserve every drop - Recharge, Recycle, Reuse



BIAL Water positive - Generating more water than its consumption

Capturing every bit - Roof top harvesting the most efficient way



KIAB and its watershed management towards water security

WATER HARVESTING

Osaka International Airport
Resilience of drinking water at Osaka International Airport

Kansai Airports (KAP) objective is to increase its resilience towards disaster proposed in 2018 by diversifying the supply of water. Osaka International Airport is located in a densely populated area at the limit of 3 cities where natural disasters are extremely likely to happen.

The project was carried out by building a water plant of 400 m3/day consisting of 3 main parts:

- The wells
- The purification
- The storage

The wells consist of 2 wells pumping in 200 m deep layer below the airport. The sustainability of the pumping has been studied in detailed to ensure that the pumping will not affect the local environment on the long term.

The purification unit consists of several processes combining reverse osmosis, activated charcoals in order to eliminate the unwanted elements (NH_3, Fe, Mn ,…) to the standard level and at the exit the water is of drinking quality.

The storage consists of 2 tanks totaling more than 1,600 m^3 able to supply the airport over 48 hours.

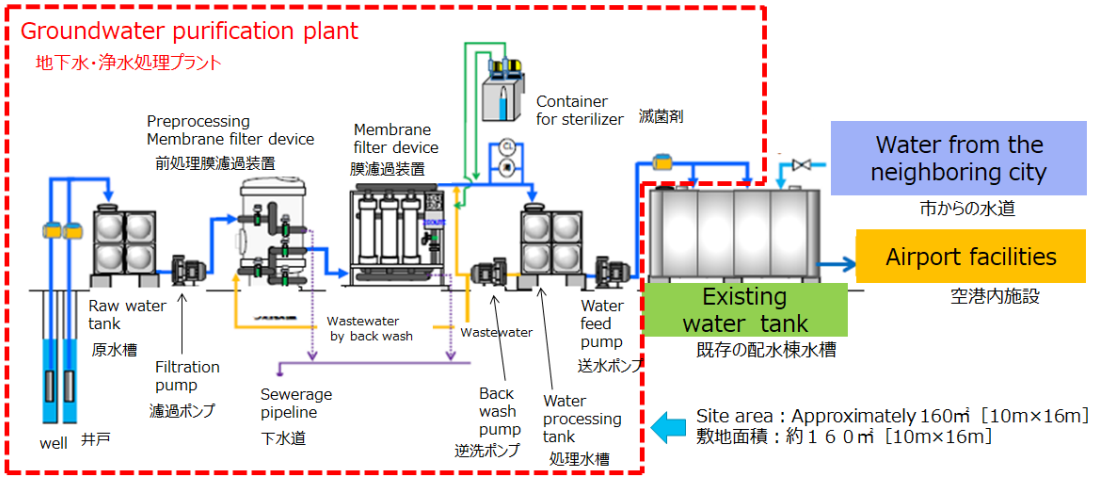
The plant is connected to the airport network and as well can provide water to the local resident, as far as the airport is aware of, it is the first time in Japan that an airport facility will be able to supply drinking water to local communities in case of disaster.

This innovative approach towards the resilience and the collaboration with a municipality is unique in Japan, KAP hopes this is a milestone. As KAP is establishing its resilience plan on all the Kansai airports, this will pave the way for more innovative projects.

Beyond the stakeholder engagement, the project has a side effect, it reduces the CO_2 emission, because the temperature of the water supplied is much cooler than the municipal one, leading to a 50 tons/year reduction of CO_2 emission from the air-conditioning system.

Project Graphics

Osaka International Airport



Groundwater purification plant

Well excavation

Water lifting and quality tests

WATER HARVESTING

Rajiv Gandhi International Airport (RGIA)

Water Sustainability at RGIA through efficient devices, recycling and repl

GMR Hyderabad International Airport Ltd. (GHIAL) considers conserving natural resources as an integral part of business and is committed to operating Rajiv Gandhi International Airport (RGIA) in an environmental friendly and sustainable manner.

Water Sustainability by 4Rs:

GHIAL has an Environmental Policy to conserve water by Reduction, Recycling, Reuse and Replenishment to the nature. Under the Project Water initiative, GHIAL implemented several practices for efficient use of water by partnering with the airport community:

Reduction is achieved through

- Using latest technology devices to optimize the water consumption
- Real-time monitoring of water consumption through Supervisory control and data acquisition (SCADA) based flow meters
- Automation of the airport's landscape irrigation system across the vast 278 hectares
- Sensor based water taps along with aerators in all the terminal buildings and offices

Reuse by recovering the air handling unit (AHU) condensate and improvement of the chiller plant water use efficiency.

Recycling of the airport wastewater through multistage treatment for flushing and irrigation within the airport premises.

Replenishment is achieved through rainwater harvesting by collecting runoff from paved areas, rooftops and open areas within the airport.

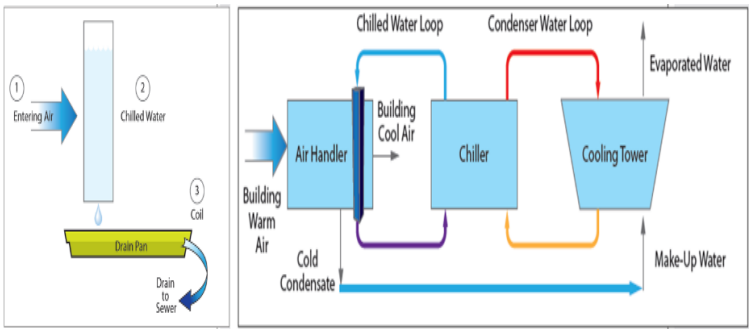
The above stated efforts by adopting 4R strategy has resulted in a significant amount of water savings to the tune of:-

- 30.92% water use efficiency in 2018-19 over 2015-16 in overall consumption.
- Reduction water footprint of 6, 86,414 kiloliters (kl) in the past 3 years
- Significant reduction of domestic water use per passenger brought down from 19.40 to 12.18 liters
- About half of total airport water demand is met from internal resources (4,61,685 kiloliters/year) like treated wastewater and surface water.

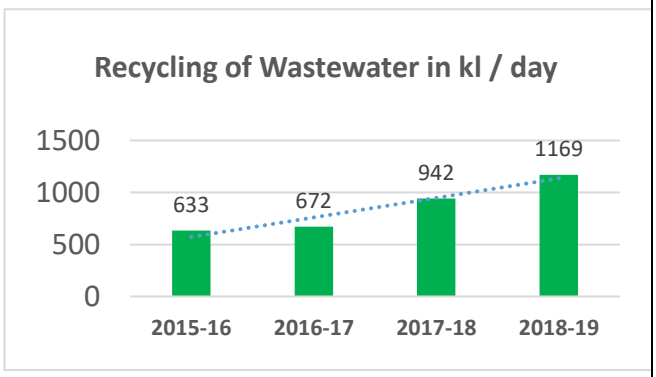
RGIA is a self-sustained airport in terms of water resources management and will continue the water stewardship initiatives further. These initiatives are also aligned to U.N. Sustainable Development Goal 6: Ensure Availability & Sustainable Management of Water and Sanitation for All.

Project Graphics

AHU condensate recovery water tank

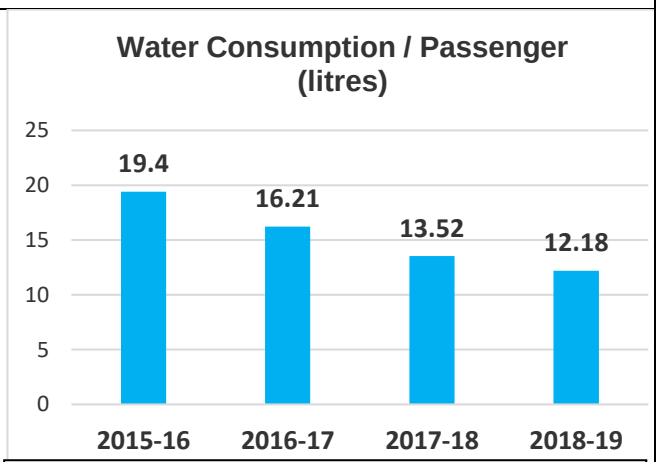


AHU condensate recovery from Chiller plant



Sewage treatment plant

Booster & Sensor for Cloud based central control software irrigation system



Note: The water consumption / pax has been taken for Passenger Terminal Building area.

Water consumption per pax

WATER RECYCLING

Adelaide Airport
Recycled stormwater for terminal cooling towers

Adelaide Airport is set to reduce Terminal 1 potable water consumption by 50% (10 million liters) with connection of cooling towers to the Adelaide Airport Stormwater Scheme (AASS).

Climatic trends, uncertainty with respect to South Australia's long-term water availability, increasing demand linked to airport growth, water security concerns and rising supply costs has led to water resources emerging as a priority for Adelaide Airport.

Building on the solid track record of leadership in water sensitive urban design and water conservation, security of water supply and the smart use of water are key considerations for all developments.

In 2015 a managed aquifer recharge scheme was constructed by local utility provider, SA Water with the support of Adelaide Airport. The Adelaide Airport Stormwater Scheme (AASS) has the capacity to capture, store and distribute up to 270-million liters of treated stormwater each year from Brownhill-Keswick Creek for use on, and around, Adelaide Airport.

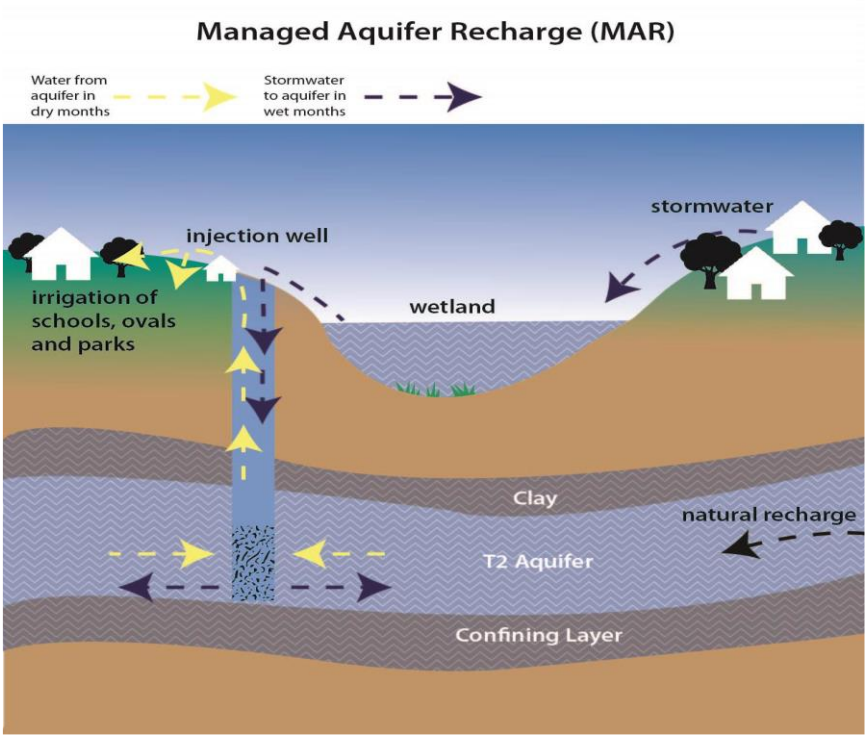
With irrigation and toilet flushing already connected to the recycled water network, the Terminal 1 cooling towers represented a key opportunity to reduce potable water use.

In April 2019 AAL completed a project to supply the Terminal 1 cooling towers with recycled stormwater from the AASS. The Terminal 1 cooling towers are connected to the AASS via a recycled stormwater pipeline from the AASS on the southern boundary of the airport to the multilevel carpark underground stormwater tank within the Terminal precinct and connection of this tank to the Terminal 1 cooling towers.

The use of recycled stormwater from the AASS within the Terminal 1 cooling towers will reduce the terminal potable water use by 10ML annually representing a reduction of approximately 50% of the total mains water used within the terminal.

Project Graphics

Plan showing recycled water pipeline from aquifer recharge supply point to MLC underground tank and then to T1 cooling towers



Schematic showing Managed Aquifer Recharge

WATER RECYCLING

Brisbane International Airport

New Recycled Water Pipeline

The Recycled Water Pipeline project, a 12 month project completed in June 2018 as part of Brisbane Airport's New Parallel Runway (NPR) project, provides recycled water needed for the construction of the NPR including, 160,000m3 of concrete, 500,000m3 of fine crushed rock production, and 360ha of airfield landscaping irrigation.

The pipeline, travelling 4.5km from the local wastewater treatment plant to the airport runway site, provides an estimated 4.5ML of recycled water daily. The installation of the pipeline, in collaboration with Queensland Urban Utilities (QUU) the wastewater treatment provider, reduces the need to use local drinking water for construction purposes by 1.25 billion litres by the end of the project – equivalent to 500 Olympic swimming pools.

The pipeline route included a large 800m underbore beneath runway 14/32 and a smaller underbore. Recycled water is delivered from the QUU wastewater facility where wastewater is treated through microfiltration and reverse osmosis prior to being pumped through a 350mm diameter main to the NPR Airfield Site. The 800m underbore was a challenge for the project as this was a significant distance from the wastewater facility, as well as traversing an operational runway.

Three key defined benefits.

Cost Savings

Nine options were provided during the planning phase which saw this pipeline option as the preferred option with an almost AUD$1 million in savings compared to the next cheapest option.

Environmental Benefit

By using recycled water, BAC did not draw on valuable potable (drinking quality) water. Over 1.25 billion liters of water was saved from the local water supply, reducing our consumption of regional water.

Legacy

While the main reason for the pipeline was to provide water for the runway project, it will also provide an opportunity to extend the pipeline for use across Brisbane Airport. This water has various uses across the airport.

Project Graphics

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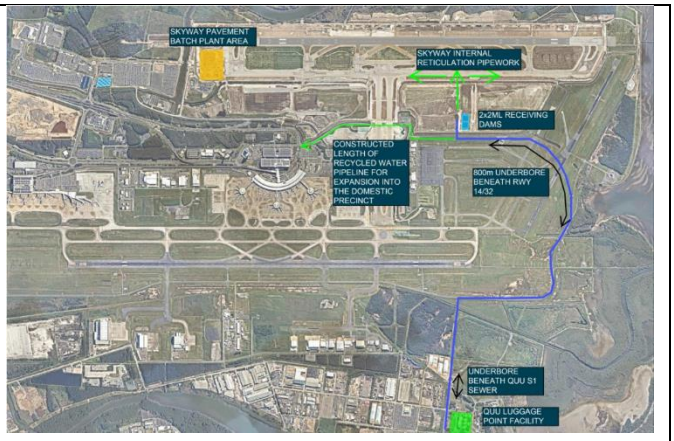
<tr><td>  </td><td> 
</td></tr>
<tr><td>Piped recycled water into storage dams</td><td>Location of pipeline and points of interest.</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Wastewater Treatment Plant</td><td>Irrigation of new airfield using recycled water</td></tr>
</table>

WATER RECYCLING

Muscat International Airport
Gateway To Beauty & Opportunity

Muscat International Airport
Water management project for sustainable environment development

Muscat International Airport is committed to environmental sustainability and currently has 3 projects focused on making better use of available water.

Project 1

The condensate drainage system has been adapted to recover and re-use water from the heating, ventilation and air conditioning (HVAC) system. This has involved the installation of a series of pumps and a reservoir to collect condensate from air handling units (AHU), fan coil units (FCU) and direct expansion (DX) air conditioning units. We have also installed condensate removal pumps in places where it is not possible to drain the condensate water with a normal gravity drainage system. We then re-use this water in the chiller plant.

The system covers 3,250 individual pieces of HVAC equipment, 29km of piping and 51 sump pumps and has a maximum flow of 32.4 cubic meter per hour. Its introduction has already saved us an average of 5,800 cubic meters of potable water per month.

Project 2

Blow down water utilization has been introduced to utilize the water from the chiller plant bleed/washout and overflow from the firefighting and potable water tanks. This water is collected in bleed chambers from where it is then pumped to our irrigation tanks that support the Airport's landscaping.

The installation of 2 submersible pumps in each bleed chamber ensures all overflow is put to good use. This project has saved an average of 7,000 cubic meters of treated water per month.

Project 3

Underground water utilization for cooling towers will soon be achieved through the drilling of wells to capitalize on the plentiful ground water in the vicinity of the Airport. This water will be processed through the reverse osmosis (RO) plant before being used in the chiller plant cooling towers.

This project has the anticipated potential saving of 997,000 USD per annum.

Project Graphics

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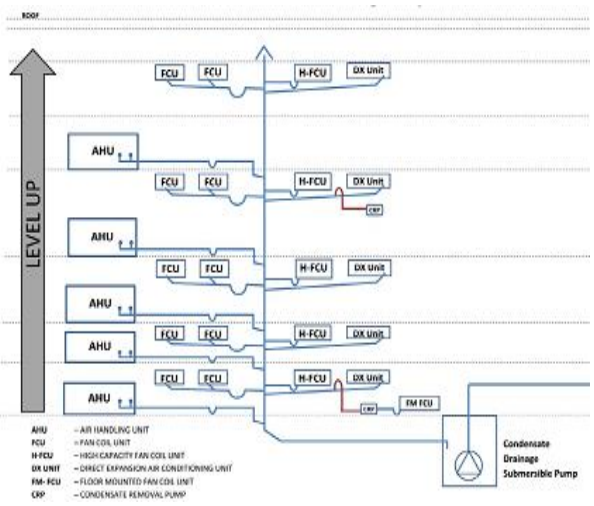
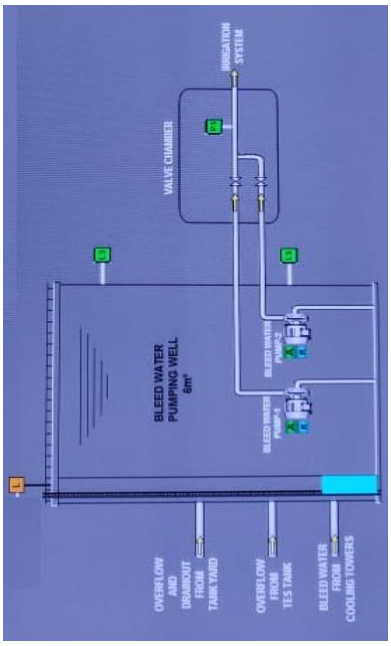
<tr><td> 
</td><td> 
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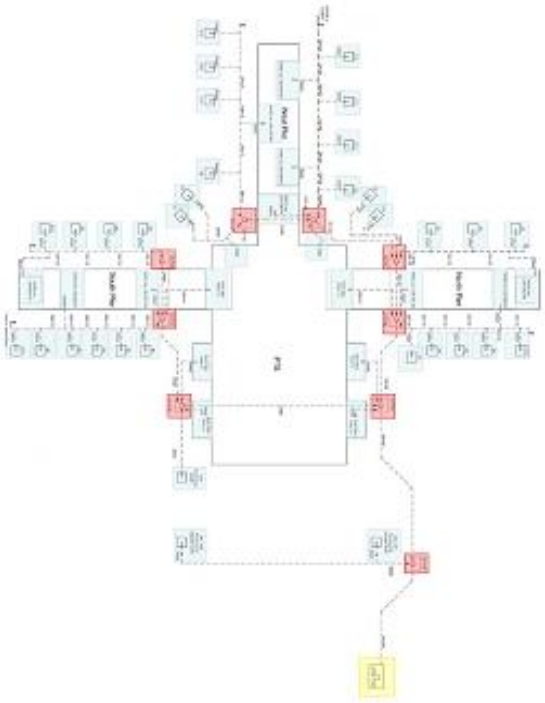
<tr><td>Condensate water collection – Airport Terminal</td><td>Bleed water collection system- Utility plant</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Condensate water Network</td><td>Condensate system at HVAC equipment</td></tr>
</table>

WATER RECYCLING

Phuket International Airport

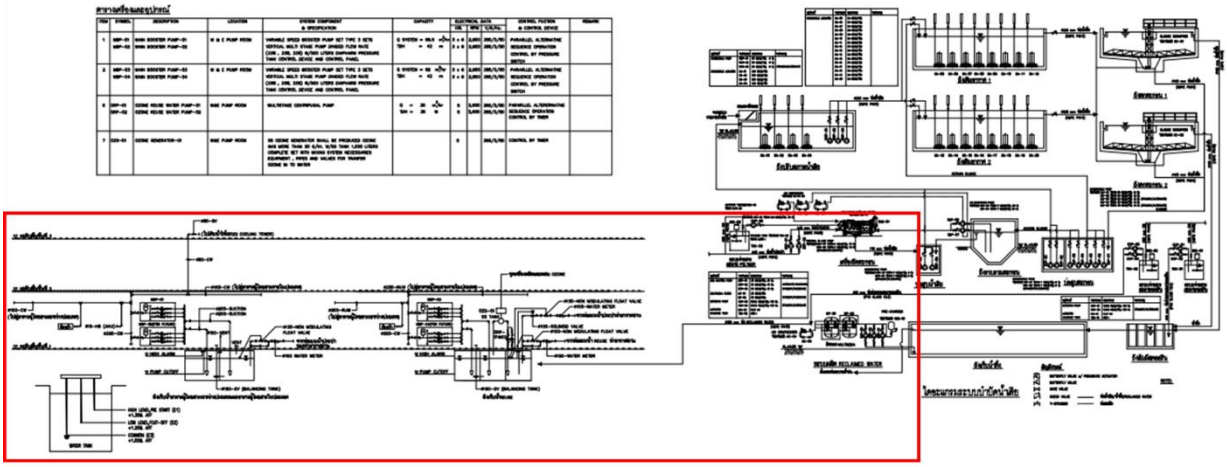
Recycling of water at Phuket International Airport

Phuket International Airport (HKT) is located in Phuket province which is an island of 543 km^2 situated in the Andaman Sea. Being an island and a tourist destination, Phuket has limited supply of freshwater while the demand is very high. HKT concerns about the consumption of resources and environmental impact from the increasing numbers of passengers. Therefore, HKT included improvement of wastewater treatment system as part of the expansion project. Extended activated sludge is used with the capacity of 2,300 m^3. Influent from terminal building, office building and staff residence go into the system. The quality of effluent from the system passes the standard to be discharged to natural waterways. However, HKT has installed the third treatment system, namely Reclaimed Water System, to further treat water for recycling purpose. The system consists of 3 centrifugal pumps, 2 multimedia filters, chlorine feeder, ozone sanitizer and air compressor. The multimedia filters have 3 layers: 1.4-1.6 mm of Anthracite in the upper layer (the height of 0.70 m), 0.9-1.0 mm of sand in the middle layer (the height of 0.30 m) and 2-38 mm of sand (the height of 0.30 m) in the lower layer. The filters are used alternatively with an automatic backwash system. The backwash system is triggered when the filters have been running for 12 hours or when the difference of water pressure between in and out of the filter is greater than 1 bar. On average, the system could recycle over 2,011 m^3/month which equals to 4.3% of total water consumption and 9% of total wastewater. This reflects in the cost reduction for water supply of over 72,000 Baht per month. The implementation of this system has generated environmental benefits as it helps reducing consumption of water from natural resources in the area where freshwater is limited.

Project Graphics

Multimedia filters

Ozone sanitizer



Layout of reclaimed water system (red rectangle)

WATER RECYCLING

Sydney Airport
Water Treatment Plant Upgrade

In 2009 Sydney Airport, in conjunction with the NSW government installed a wastewater treatment facility (WWTF) at the International Terminal to reduce reliance potable water. The WWTF had a capacity of 600,000 litres (L) of recycled water per day. The recycled water is used for cooling systems and bathrooms within the international terminal.

The water treatment plant is a key piece of the infrastructure used to achieve Sydney Airport's sustainability goals and reduce potable water consumption within the International Terminal.
As passenger numbers continued to grow, the increased consumption of potable water was highlighted and precipitated an upgrade to the WWTF to allow for the increased demand, particularly in the summer months.

The upgrade project began in late 2106 and required a retrofit of the existing facility to expand the bioreactor and allowed for staged regrowth of the biomass used to treat wastewater. The WWTF now has the capacity to produce up to 960,000 L of water per day. The plant produced 178,141 kilolitres (kL) of recycled water during the last financial year 2018/19, which saw a 18% increase from the previous year. Sydney is proud of this achievement as Sydney and New South Wales (NSW) is currently experiencing one of the worst droughts on record.

Sydney Airport is committed to minimising potable water use by using alternative and recycled water sources and will continue to explore further opportunities as part of Sydney Airport's Environment Strategy 2019-2024.

Project Graphics

Water treatment facility location

WATER REDUCTION

Chhatrapati Shivaji Maharaj International Airport

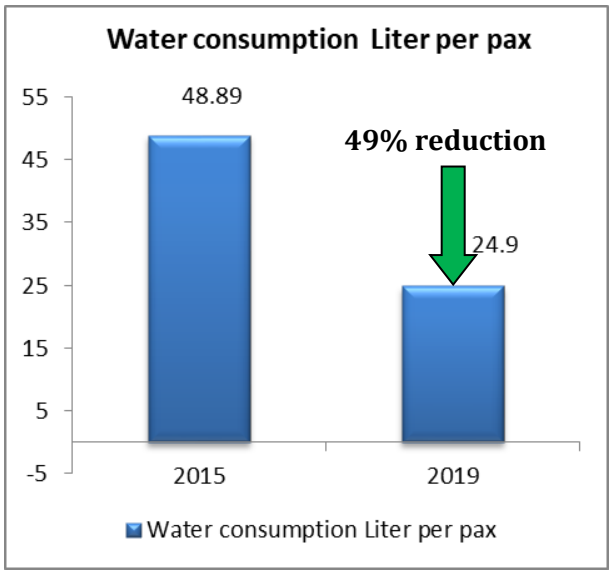
Waterless Urinals – A unique water Conservation project at CSMIA

Chhatrapati Shivaji Maharaj International Airport (CSMIA) operated by Mumbai International Airport Limited (MIAL) is an iconic structure providing best in class experience to the passengers. MIAL is committed to implement best environmental and sustainable practices to maintain its high operational standards in the aviation industry. The initiatives in the areas of waste management, carbon management, energy efficiency, water management, etc. have been incorporated with most updated technologies and applications to achieve the excellence in Sustainable performance. As the CSMIA is more than 75 yrs old airport & also India's one of the busiest airport, earlier our water foot print was on higher side. Hence water conservation always remains prime focus area for us. The present source of freshwater is from Municipal Corporation. No groundwater extraction is carried out for any water usage.

MIAL has taken various initiatives for water conservation such as rainwater harvesting, drip irrigation, wastewater treatment & recycling, water efficiency projects etc. with an aim to reduce the fresh water consumption. Amongst many initiatives, one of the initiatives taken by MIAL was waterless urinals program at CSMIA. The program is first of its kind to be implemented at any Indian airports. This included an innovative method employed to cut down on the usage of water in washrooms and cleaning of floors reportedly saving one lakh (1,00,000) liters of water every day. Waterless urinals are retrofitting technology and is an innovation for the modern world where scarcity of water is noticed in recent times.

Wastewaters generated at CSMIA is being treated in state-of-the-art Sewage Treatment Plants with Sequential Batch Reactor (SBR) technology followed by ultrafiltration (UF) & reverse osmosis (RO) having collective capacity of 15 million litres per day (MLD). Treated wastewater at Sewerage Treat Plant (STP) is recycled back for landscaping, toilet flushing and cooling system in heating, ventilation and air conditioning (HVAC). Reuse of treated water at terminal buildings drastically reduced freshwater consumption.

Project Graphics



Reduction in fresh water consumption

Meet green bacteria, airport's eco-friendly toilet cleaners

They Save Big On Water, Have Zero Side-Effects

ManjuV@timesgroup.com

Mumbai: Not that they were desperately seeking employment, but certain groups of bacteria and other microorganisms have found jobs at Mumbai airport. The microscopic lot was recruited two months ago after it was found to be better qualified to clean urinals, toilets, floors and other surfaces throughout Terminal 2. Unlike acids and alcohol reagents used in conventional chemicals, which release asthmagens, carcinogens and ozone-depleting compounds into the atmosphere, these new recruits are environment-friendly and save around one lakh litres of water per day.

In a first of its kind initiative for any airport in the country, all the cleaning jobs at T2 are now being carried out with "green chemicals."

"We started working on the project last July. Our prime concern was whether the green chemicals would be effective given the scale of the job at hand and the large number of passengers that the airport handles," said a Mumbai International Airport Pvt Ltd (MIAL) spokesperson. Currently, green chemicals—the ones in use at the Mumbai airport are essentially a mixture of enzymes and bacteria—are used to clean 200 toilets and 41akh square metres of surface area in T2, he added.

While even those with sensitive olfactory nerves might not be able to figure out that the indoor air quality is better, that's not the case with the toilets, especially the ones designated for men. Passengers who used the urinals in the past two months would have noticed that the auto-sensor flush "doesn't work". They no longer dispense water, they dispense the green chemical instead. Water is used only when the urinals are cleaned manually. "Cleaning compounds that contain ammonia-feeding bacillus spores are instead used in toilets. Lab tests have confirmed that the toilets are cleaner now," the official said.

For, unlike conventional chemicals that clean only when used, green chemicals employ bacteria that are at work 24/7. The green solution is poured at regular intervals in the urinals, it's spritzed in the air, which is why the toilets, used by both male and female passengers have no odour. "We don't use lemongrass or lavender or other such essential oils to mask the smells. The bacteria convert the ammonia generated due to uric acid accumulation to nitrogen, as soon as the toilet is used," he said.

The decision to switch to green chemicals was in fact taken because of the "sloppy way" some Indians used toilets. "We found that the urinals and commodes aren't used the way they are supposed to be. It leaves them dirty and frequent cleaning wasn't the solution," the MIAL official added.

The biggest gain though is the water saved in the urinals in the loos. About 90,000 men, including passengers and airport staff included, arrive and depart at T2 daily. It's not known how many of these use toilets, but with 1.2 litres of water dispensed per flush in the urinals, the savings are huge.

NON-TOXIC, NON-IRRITATING, BIO-DEGRADABLE

What are green chemicals

- These are green seal-GS 37 certified chemicals or products that pass through 37 different types of tests to ensure that these are non-toxic and non-irritating to skin and eyes
- The bio-degradable compounds, with no harmful side-effects, improve indoor air quality, making it a healthier environment for passengers
- Self-sustainable methods are used for their manufacture and transportation to keep the carbon footprint to the minimum
- These products cannot be formulated with harmful chemicals, including heavy metals, phthalates, formaldehyde donors, carcinogens, mutagens, among such others
- The content of volatile organic compounds is limited to prevent ground level ozone air pollution

News in Times of India on 1st March 2017

Waterless urinals with green bacterial coating

Drip irrigation in terminal / Sewage treatment plant

WATER REDUCTION

Christchurch International Airport Limited

Water Infrastructure Upgrades

Over the last 24 months, Christchurch International Airport Limited (CIAL) has been on a journey to upgrade our potable water wells and water networks into a world class asset.

Following the contamination of potable water infrastructure in Havelock North (August 2016) the New Zealand (NZ) government launched an inquiry to determine the cause of the contamination and provide recommendations. Prior to March 2018, most of the Potable water supply in Christchurch was untreated as it was sourced from deep artesian aquifers. Following the inquiry, the New Zealand government adopted the recommendations for all potable water suppliers to increase the security of well heads and networks and to begin chlorination of potable supplies.

Concurrent to this enquiry, CIAL had commissioned a Utilities and Asset management strategy which identified several opportunities to improve the management of our potable water assets. Typically, these opportunities were associated with improving aging asset conditions and providing better infrastructure to measure, model and record water use across our campus.

CIAL saw the opportunity to not only upgrade our infrastructure to meet the government recommendations, but to also go beyond basic compliance and upgrade our network to allow real time tracking and modelling to meet our development, environmental compliance, maintenance and sustainability objectives.

To achieve this, we have undertaken a collaborative design and build approach with our consulting (PDP) and water treatment (Water Pro) advisors along with our civil works contractors (Fulton Hogan/Citycare) to ensure we remove vulnerability and risk to deliver a world class asset

These upgrades include:

- Raising potable well heads aboveground
- Implementing UV and Chlorine (gas) treatment system
- PIP telemetry water meters
- Live usage dashboards for all users

To deliver this we undertook a collaborative design, build and operate approach with a view to minimize risk and reduce operating costs

Project Graphics

	
Original Well head chamber	Upgraded well head and secure facility
	
UV treatment system	PIP telemetry installed on existing ABB meter

WATER REDUCTION

Hong Kong International Airport
Implementation of Aircraft Dry Wash

Hong Kong International Airport (HKIA) adopts a “triple water system” to improve the efficiency of its three major water sources: freshwater, seawater and treated wastewater. Seawater is used for flushing toilets and as the cooling medium in the air-conditioning systems of major airport buildings, significantly reducing the demand for both portable water and grey water. Potable water is still being used in several key aircraft and airport operations processes, including aircraft washing.

In 2017, Hong Kong Aircraft Engineering Company Limited (HAECO), an aircraft maintenance service provider at HKIA, initiated an aircraft dry wash programme. Since then, HAECO has worked closely with various departments of Airport Authority Hong Kong (AAHK), the airport operator of HKIA, to evaluate the potential operational and environmental impacts of dry wash, develop the Dry Wash Procedures, and ensure compliance with existing wastewater discharge license requirements. In June 2019, AAHK approved aircraft dry wash for 29 pre-designated parking bays in addition to the 10 designated parking bays for wet wash.

The benefits of dry wash are significant and in various aspects. Compared with wet wash, dry wash uses 90% less water and produces less effluent. The reduction of aircraft towing helps reduce the traffic on the apron and fuel consumption by aircraft and ground services equipment (GSE), and hence the airport-wide greenhouse gas emissions. Dry wash also reduces the need for aircraft cleaning to 4-6 times a year, compared to 8-9 times a year for wet wash, which increases aircraft availability for airlines. Moreover, dry wash enables aircraft zonal cleaning, rather than washing the whole aircraft, which is a new cleaning option for airline and saves aircraft grounding time.

The technique of dry wash has become more mature in recent years. It is especially suitable for use in airports located in water-constrained areas.

Project Graphics

Traditional wet wash uses a significant amount of potable water

Demonstration of dry wash conducted by HAECO

Dry wash uses 90% less water

WATER REDUCTION

Kaohsiung International Airport
Water Efficiency Management

Kaohsiung International Airport (KHH) regards water efficiency as one of key sustainability topics and set the target of 2% annual reductions. Since 2015, KHH launched annual Water Efficiency Project and achieved benefits of saving 346,300 tons of water and $56,101 of cost. In 2018, KHH reduced 31,161 tons of water consumption compared to 2015, showing a 7.2% decreased from 432,698 tons to 401,537 tons. Furthermore, the total water consumption per passenger was reduced from 72 L/person to 58 L/person, leading to a reduction of 20.1%.

For a comprehensive management, KHH set the Water Conservation Committee chaired by the deputy director and regularly monitors the status of water consumption. The Committee holds regular meetings twice a year to review the water-saving progress and performance.

The KHH's water efficiency project was implemented via the following four major aspects.

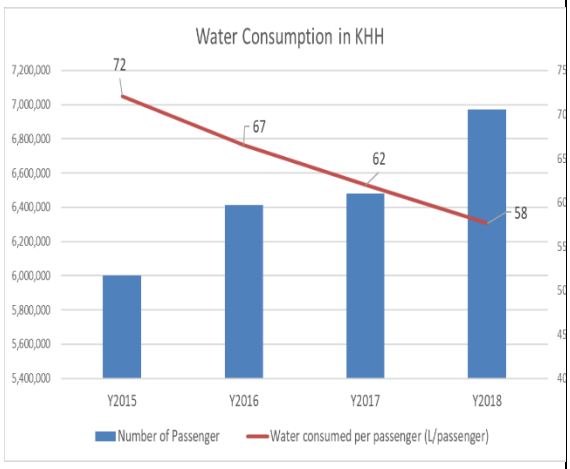
1.Hotspots inspection
Through the water meter setting and monthly record review, KHH identified two critical water hotspots including residential water (including faucets, toilets and air-conditioning equipment) and construction water. In addition, KHH performs pipelines leakage detection and water pumps efficiency evaluation by regular inspection. The replacement with new pipelines and high-efficiency water pumps could save 96,000 tons/year of water.

2.Efficiency improvement
KHH replaced all old toilets and faucets with water-saving toilets and induced faucets (with water-saving gasket), which could save 68,645 tons/year of water. Besides, the replacement with high-efficiency cooling towers could decrease 72,154 tons/year of water consumption.

3.Recycling
The KHH's wastewater treatment plant has the capacity to recycle 109,500 tons/year of water, which could be used for irrigation or road cleaning.

4.Propaganda
The Water Conservation Committee promotes water-saving awareness by inviting employees and tenants to participate in regular water-saving meetings and makes water-saving posters in public area for passengers. KHH also regularly holds environmental training and online courses for staffs.

Project Graphics



Water Consumption Trend in Kaohsiung International Airport

The Four Main Aspects of Water Efficiency Management

	Cost (U.S. dollars)	Water Saving (tons / year)	Cost Saving (U.S. dollars / year)
Pipeline replacing	560	96,000	15,552
Toilet replacing	27,440	53,145	8,609
Faucet replacing	43,768	15,501	2,511
Cooling tower replacing	22,841	72,154	11,689
Wastewater Recycling	0	109,500	17,739
Total	94,609	346,300	56,101
Paybacl period (Cost / Cost Saving)		1.7 years	

The Benefits of Water Efficiency Management


Pipeline Inspection


New Type Cooling Tower Replacing


Wastewater Recycling Equipment


Environmental Training

The Highlights of Water Efficiency Management

WATER REDUCTION

Taoyuan International Airport
Smart water resources management IoT system installation project

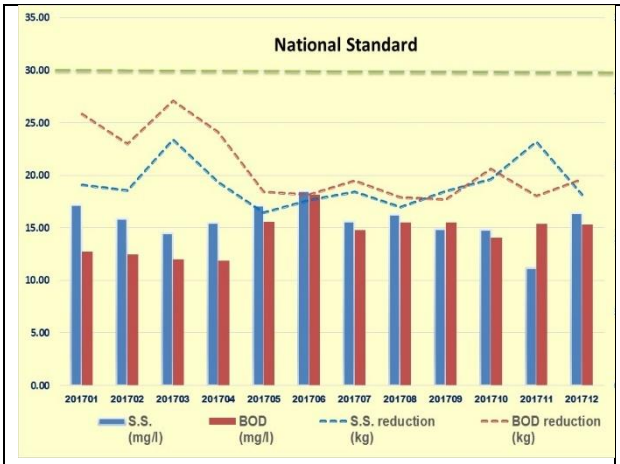
Taoyuan International Airport has established “Utility Supervision Task Force” to plan and promote the “smart water resources management Internet of things (IoT) installation project” under the instruction of the Vice President since 2016. Through the deployment of the cloud electronic patrol system and Standard Operating Procedure (SOP), the initiation of the intelligent management of water supply and drainage and sewage facilities, the effective improvement of the equipment reliability and process efficiency, and by integrating the resources of airport partners, and providing integrated training, three big goals can be achieved:

- The advancement of water facility and equipment maintenance standards.
- The fulfillment of pre-preventive maintenance to replace post-fault repairs.
- The improvement of patrol efficiency.

After conducting the project in 2017, the annual environmental performances included:

- Cooperate tightly with 16 airport partners to reduce 30% labor required for maintenance, decrease water consumption per passenger by 1.3% and suppress water consumption by 29,990 tons.
- Reduce additionally discharged Suspended solids (S.S.) and Biochemnical Oxygen Demand (BOD) by 16,376.1 kg and 17,850.7 kg per year.
- Communicate continuously with passengers to raise water conservation willingness and continue to provide water resource management training courses for airport company staffs and partners. A total of more than 50 training sessions have been conducted, and more than 1,000 people have been trained, the project’s outcomes and effects has been deepen and widen.

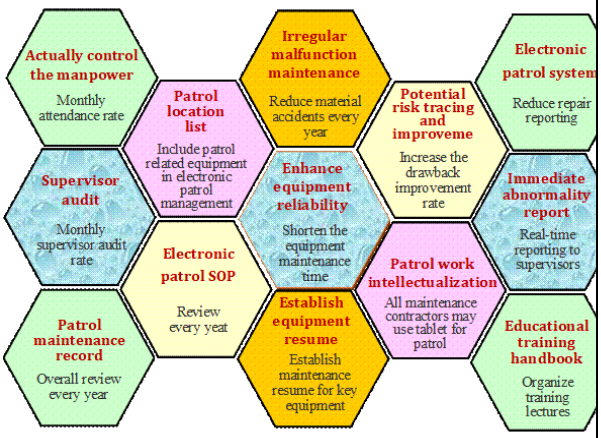
Project Graphics



Reducing discharged water pollutants

On site operation and exercise

Education and training



Project content

About ACI Asia-Pacific

ACI Asia-Pacific, one of the five regions of the Airports Council International (ACI) and incorporated in Canada, is based in Hong Kong and represents over 114 members operating 603 airports in 49 countries/territories in Asia-Pacific and the Middle-East (as of June 2020).

As the only global trade association of the world's airports, ACI represents airports' interests with governments and international organizations, develops standards, policies and recommended practices for airports, and provides information and training opportunities to raise standards around the world. In 2018, ACI Asia-Pacific airports handled 3.65 billion passengers and 57.7 million tonnes of cargo.

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