



# 2019 Seven Year Water Planning Statement (2020-2026)

## Main Report

Rev. 1

Issue Date: 31 Oct 2019

## **Foreword**

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I have the pleasure in releasing the 2019 Seven Year Planning Statement (7YPS) for Water transmission within the Emirate of Abu Dhabi and, where appropriate, our network outside of the authorized area covering the period 2020-2026. In producing this document, we have endeavored to ensure that our system users, both existing and future, are presented with an opportunity to understand the scale and type of transmission network operated by us. We have sought to ensure that customers are able to identify areas of the network where additional investment is proposed in order to increase available capacity or otherwise ensure that network performance continues to attain the targets expected from such a critical infrastructure provider.

This is the Tenth of the 7YPS series that is released in response to Condition 15 of the Transmission and Despatch License that provides detailed short to medium-term plans for the transmission network. The plans included in the 7YPS are linked to the needs and investment requirements and are based on the network development strategy that provides a long-term vision for taking the transmission system forward consistent with Government's 2030 vision.

Feedback on this 7YPS is most welcome in order that TRANSCO can continue to adjust its planning and development strategies to meet the regulatory, customer and stakeholder requirements and expectations.

Copies of the approved 7YPS can be provided on request.

Dr. Bruce Stedall  
Managing Director

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## Acronyms and Definitions

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The following are the definitions of abbreviations used in this document:

7 YPS	:	TRANSCO Seven Year Planning Statement
AADC	:	Al Ain Distribution Company
AAR	:	Al Ain Reception
ADDC	:	Abu Dhabi Distribution Company
ADNOC	:	Abu Dhabi National Oil Company
ADPC	:	Abu Dhabi Power Corporation
ADWEA	:	Abu Dhabi Water and Electricity Authority
EWEC	:	Emirates Water and Electricity Company
AID	:	Asset Information Department
AMPC	:	Al Mirfa Power Company
AMD	:	Asset Management Director/Directorate
CAPEX	:	Capital Expenditure
CS	:	Carbon Steel Pipe
DI	:	Ductile Iron Pipe
DN	:	Diameter
DoE	:	Department of Energy
DISCO	:	Distribution Company, i.e. ADDC and AADC
DPM	:	Department of Urban Planning and Municipalities (formerly UPC)
GENCO	:	Generation & Desalination Companies (Producers)
FEC	:	Fujairah Energy Company
FEWA	:	Federal Electricity and water Authority
FWTS	:	Fujairah Water Transmission System
ICAD	:	Industrial City of Abu Dhabi
IWPP	:	Independent Water and Power Producers
LoS	:	Level of Service
MD	:	Managing Director
MDEC	:	Metering and Data Exchange Code
MIG/MIGD	:	Million Imperial Gallons/Million Imperial Gallons per Day
m/s	:	Meter per Seconds
NE	:	Northern Emirates
NOD	:	Network Operations Director/Directorate
O & M	:	Operation & Maintenance
OPEX	:	Operating Expenditure
OpCos	:	Operating Companies
P&PD	:	Power and Desalination Plant
PD	:	Projects Director/Directorate
PS	:	Pumping Station
RAK	:	Ras Al Khaimah
RO	:	Reverse Osmosis
RSB	:	Regulatory & Supervision Bureau
SEWA	:	Sharjah Electricity and Water Authority
SFCR	:	Statement of Future Capacity Requirements
SWTS	:	Shuweihat Water Transmission System
TO	:	Tap Off/s
TRANSCO	:	Abu Dhabi Transmission and Despatch Company

UAE	:	United Arab Emirates
UAN	:	Umm Al Nar
WASPD	:	Water Asset Strategy and Performance Department
User	:	Term to refer to entities using the TRANSCO Water Trunk Mains Systems
WDF	:	Water Demand Forecast
WLCC	:	Whole Life Cycle Cost
WNPDD	:	Water Network Planning & Development Department
WPD	:	Water Projects Department
WTC	:	Water Transmission Code
WTS	:	Water Transmission System

## **Executive Summary**

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### **ES1 Introduction**

TRANSCO was created under Law (2) in 1998 when the Government of Abu Dhabi passed a Law concerning the regulation of the water and electricity sector. On January 1<sup>st</sup> 1999, the then Abu Dhabi Water and Electricity Authority (ADWEA) was set up as an entity wholly owned by the Government and responsible for making sure that its group of companies were set up and running; prior to that the Water and Electricity Department was the responsible body. ADWEA are responsible for being the focal point between the Government and the group companies, with TRANSCO being the transmission and despatch arm of the sector and the distribution elements then being controlled by Abu Dhabi Distribution Company (ADDC) and Al Ain Distribution Company (AADC).

In his capacity as Ruler of Abu Dhabi, His Highness Sheikh Khalifa bin Zayed Al Nahyan issued Law No. (11) for 2018 establishing the Department of Energy (DoE) which replaced the role and function of the Abu Dhabi Water and Electricity Authority (ADWEA) and the Regulation and Supervision Bureau (RSB).

Lately and in His Highness's capacity, Law No. (3) for 2019 was issued which relates to the Abu Dhabi Power Corporation (ADPC). The law stipulates that the legal status of the corporation is converted to a Public Joint Stock Company, having a full legal, financial and administrative independence and transferring all assets, properties, shares and stocks of DoE and its subsidiary companies to ADPC (Development Holding Company).

ADPC, an entity owned by the government of Abu Dhabi, was set up as an active asset owner that oversees financial and operational performance of Operating Companies (TRANSCO, ADDC, AADC, EWEC, AMPC) without direct involvement in OpCos operations, ensuring empowerment of its subsidiaries. ADPC are responsible of ensuring efficient, reliable and subsidy-free system that generates value and fit for the future of the energy sector through active asset management of key utilities investments across the UAE.

TRANSCO's Vision, "TRANSCO will be an innovative world class provider of sustainable water and electricity transmission services" is supported by its Mission, "TRANSCO is committed to its stakeholders by transmitting water and electricity safely economically, securely and reliably; whilst embracing innovation and organisational excellence".

Therefore, TRANSCO's developed corporate aims and strategy is based on driving towards the mission and vision of the company and ultimately contributing to ADPC's goals and that of the government.

TRANSCO's core of business is the planning, construction, and operation of the Abu Dhabi water and electricity transmission network whose responsibilities include servicing current demand for water and electricity transmission and building the appropriate infrastructure to service future demand. It has also expanded the scope of its business to include assisting in the planning, development and

operation of water and electricity transmission assets in the Northern geographic area of the United Arab Emirates

TRANSCO as per condition 15 of Transmission License is bound to issue the Seven Year Planning Statement (7 YPS) annually to inform the Users of the system of its expansion plans and development strategies covering a successive period of seven years into the future. The main purpose of which is to enable the prospective Users to identify and evaluate the opportunities available when planning to connect and make use of the system. It provides an overview of the existing water transmission system and its capabilities as well as to the proposed transmission development plans to meet the forecasted demand growth and planned new generation capacity that will be of benefit to other stakeholders.

Since 2014 the 7YPS document, upon DoE's recommendations and identification of the possible areas of improvement, was restructured. Based on the new structure approved by the DoE, the following are the main topics consisting of corporate and technical information such as:

- TRANSCO's Background. Its Core Business, Vision, Mission, Corporate Values, Business Strategies and Key Achievements.
- Asset Management Strategy, Plans, Policies.
- Water Demand Forecast and Production Expansion Plan for the coming seven Years.
- Water Transmission System Planning Processes & Criteria.
- TRANSCO existing Water Transmission Systems and its planned System Expansion for the coming 7 Years.
- Business Opportunities for End Users.

## ES2 Demand Forecast and Production Overview

In November 2018, the Emirates Water And Electricity Company (EWEC) became the new subsidiary company of the Abu Dhabi Power Corporation (ADPC) which replaces the Abu Dhabi Water and Electricity Company (ADWEC) as the single buyer and seller of water and electricity in the Emirates of Abu Dhabi.

EWEC, as per Article 30 of Law No. 2, retains its duty "to ensure that there is provided sufficient production capacity to ensure that, at all times, all reasonable demands for water and electricity in the Emirate are satisfied"

Article 32 of the Law No. 2 requires EWEC to determine annually in respect of each year and the next five years, the requirement for the provision of new or additional water desalination capacity and new or additional electricity generation capacity. Condition 18 of EWEC's License essentially extends Law Number 2's requirement to seven years, but with more detailed requirements for the first five years. Generally, EWEC prepares annually the water demand forecast for the following main purposes;

- a. Planning the water production installations.



- b. Calculation of Fuel Requirements
- c. Calculation of BST (Bulk Supply Tariff)

In order to meet the above legal requirements EWEC prepares the followings annually:

- a. A long Term Electricity & Water Demand Forecast
- b. A Statement of Future Capacity Requirements

Similarly, in accordance with provisions of the Water Transmission Code (WTC), EWEC is designated to prepare and submit to TRANSCO and all Users a coordinated long term demand forecasts which TRANSCO shall utilize for its planning purposes.

According to the WTC “Data Submission Timeline Requirements” on Figure ES2.1 below, to enable TRANSCO to start its planning phase, TRANSCO must receive the long term demand forecast prepared by EWEC by Week 7 and the EWEC’s “Generation/Production Expansion Plan” on Week 17 of the current year as specified in the WTC. The timely provision of these planning and analysis data is essential in the delivery of the TRANSCO 7 YPS as per its obligation to DoE.

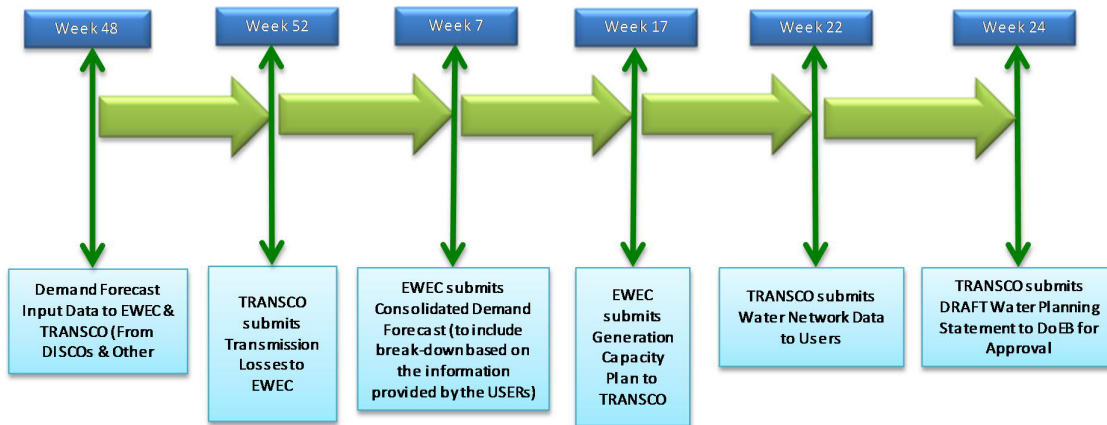


Figure ES2.1: Data Submission Time Line Requirements

### ES2.1 Water Demand Forecast

The Regional summary of the detailed breakdown of the EWEC Winter 2017/2018 Demand Forecast of the Most Likely Diversified Demand Scenarios as received by TRANSCO is depicted in the Figures ES2.2 below inclusive of the Auxiliaries demand. The demand projections contains the area-wise detailed breakdown of the existing normal growth and mega developments demands in line with the Plan Capital 2030 Update undertaken by the Department of Urban Planning and Municipalities based on the original Abu Dhabi Plan. The demands are arranged by regions spread throughout the Abu Dhabi Emirates containing the residential, commercial and industrial development demands in particular ADNOC and the requirements of the Northern Emirates.

Based on these forecast, TRANSCO utilized the Most Likely Diversified WDF for water balance analysis while the Most Likely Un-Diversified WDF was used for TRANSCO’s capacity planning and/or analysis of its transmission facilities.

The illustrated Figure ES5.2 below represents the EWEC’s provided data of the diversified regional peak water demand forecast for 2019 - 2030 for the most likely demand scenario covering the entire Abu Dhabi Emirates network including the exports to the Northern Emirates. In global terms, the forecast shows an annual growth rate of 0.95% from 2019-2030 or an at an annual rate of 0.89% for the current planning horizon of 2019-2026.

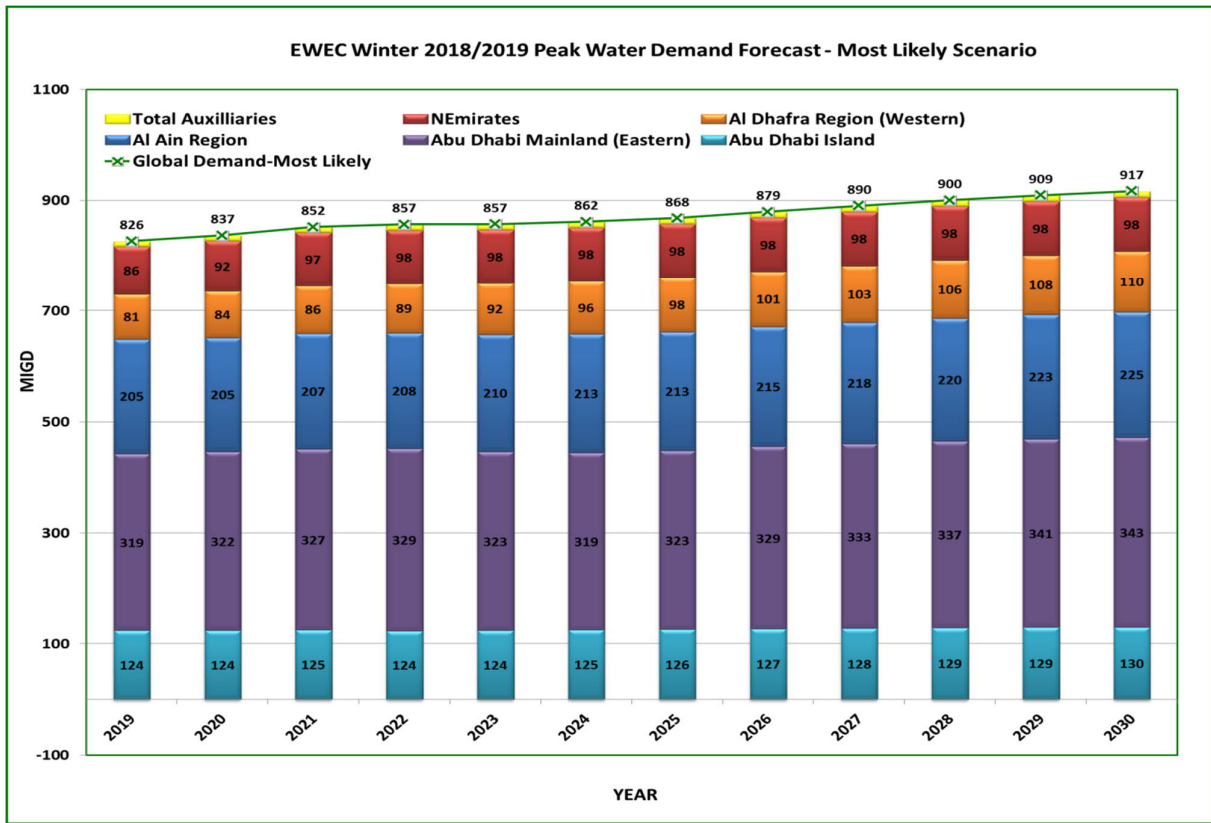


Figure ES2.2: EWEC Water Demand Forecast 2019-2030- Most Likely Scenario (Diversified) by Region- Including Auxiliaries

The Figure ES2.3 below of the comparative analysis of the “most likely demand scenario of water demand forecast” data and information provided by EWEC used by TRANSCO for the respective planning horizon of year’s 2016, 2017, 2018 and 2019 planning statements clearly illustrates the declining trend of EWEC’s demand projections. By comparing the forecast between Years 2019 and Year 2018 data, the demand from year 2019 up to 2026 there is an average drop of -12 MIGD or an average decline of about -11 MIGD for the 2019 to 2030 period. While in considering the Years 2018 and 2017 comparison of the same durations, there is an average similar difference of about -62 MIGD respectively. The declining difference as notified by EWEC is attributed mainly to the mega projects where numerous uncertainty factors are expected to influence their projected requirements such as construction completion, changes in phasing, occupancy rates, delays in implementation, relocation factor, market conditions and government policies among others. Most

interesting to note is the imposition of the tariff increase and in the introduction of the Value Added Tax (VAT) that have influence the pattern and manner of usage on the part of the consumers.

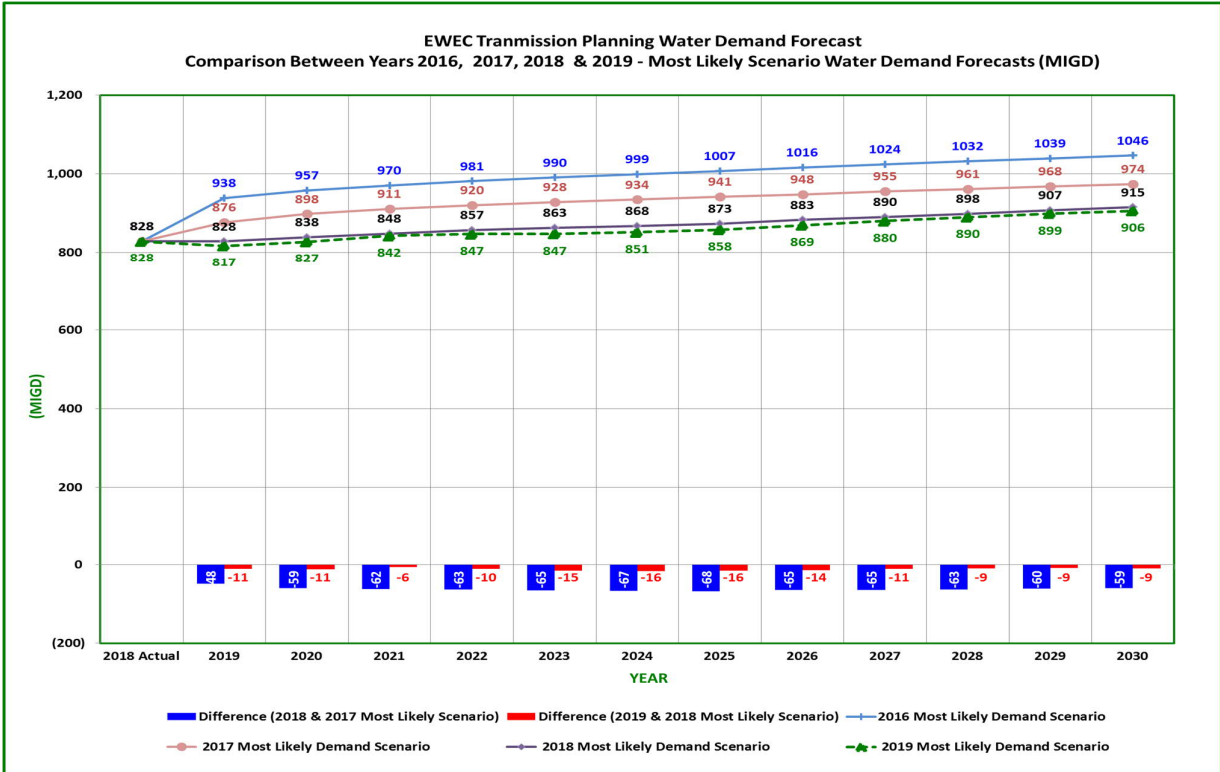


Figure ES2.3: Comparison of EWEC'S 2016, 2017, 2018 and 2019 Water Demand Forecast Data of the "Most Likely Demand Scenario" used in the 7YPS (Excluding Auxiliary)

## ES2.2 Production Expansion Plan

EWEC determine the Generation and Desalination Plants expansions in relation to the location and capacity requirement as per its license. The generation planning coordination activities are well established between EWEC and TRANSCO .

Table ES2.1: Details of EWEC Existing Production Capacities

Plant Name	IWPP Owner	Region	Plant Type / Gross Cap. [MIGD]			Contract Expiry
			RO	MSF	MED	
Umm Al Nar West	Umm Al Nar / Sas Al Nakhl (Arabian Power Company)	Abu Dhabi Island				2019 (EWEC Early Retirement- 28 MIGD)
Umm Al Nar East		Abu Dhabi Island				2019 (EWEC Early Retirement- 22 MIGD)
Umm Al Nar B (SAN)		Abu Dhabi Island		88	7	2027
Taweelah A1	Taweelah A1 (Gulf Total Tractebel Power Company)	East		32	53	2029
Taweelah A2	Taweelah A2 (Emirates CMS Power Company)	East		51		2022

Plant Name	IWPP Owner	Region	Plant Type / Gross Cap. [MIGD]			Contract Expiry
			RO	MSF	MED	
Taweelah B	Taweelah B (Taweelah Asia Power Company)	East		70		2028
Taweelah B2		East		23		2028
Taweelah New B		East		68		2028
Shuweihat S1	Shuweihat 1 (Shuweihat CMS Power Company)	West		101		2025
Shuweihat S2	Shuweihat S2 (Ruwais Power Company)	West		101		2036
New Al Mirfa	Mirfa Independent Power and Water Company)	West	30	23		2042
Fujairah F1	Fujairah F1 (Emirates SembCorp Water &Power Company)	Northern Emirates	67	64		2029
Fujairah F2	Fujairah F2 (Fujairah Asia Power Company)	Northern Emirates	30		102	2031
SUBTOTAL			127	621	162	
TOTAL			910			

The Table ES2.2 below represents the production plants that are considered retired within the current planning horizon. Throughout this statement, UAN E and West was retired earlier than expected in accordance with EWEC Letters EWEC-PCD/CEO/UAN-TRANSCO/L-008/04.19 dated 01-04-2019 and EWEC-PCD/CEO/UAN-APC/L-192/04.19rev dated 21-04-2019. Taweelah A2 is assumed to be retired by 2022. All other Plants whose PWPA's will expire after year 2025 are assumed extended in all succeeding Tables related to production capacities in view of EWEC's on-going study and negotiations with individual IWPP's bearing in mind the feasibility and economics of the plan.

Table ES2.2: Retirement Plans

Year	Retirement Plans	
	Site	Capacities (MIGD)
2019 April (EWEC Early Retirement)	UAN E	22 MIGD
2019 April (EWEC Early Retirement)	UAN W	28 MIGD
2021 (End)	TAW A2	51 MIGD

Likewise, Table ES2.3 below represents the new committed plant capacities based on confirmed information and assumptions from EWEC's Draft 2019 SFCR as covered within this year's planning horizon. It should be noted that the EWEC's SFCR, as in previous versions of the statement, does not contain the exact location and timing of the future RO Plant after the 200 MIGD Taweelah RO Plant in 2022 as well as the dispatch schedules of the Production Plants that are required in the detailed analysis of transmission network upgrade or developments. Purely, the recommended production capacity investments are according to the licensed and contractual commitments that EWEC had already entered into, that is at the moment the Taweelah RO Plant.

Table ES2.3: EWEC New Production Committed Capacities

Year	New Committed Capacities	
	Site	Capacities (MIGD)
2022	New RO at Taweelah	2x100 MIGD
(2023)	New RO (No Location)	150 MIGD

Referring to Tables ES2.4 and ES2.5 beneath, it is evident that the added production expansion is for the decoupling and other purposes only as it is more than the demand by 190.00 MIGD by the planned year 2026. It is worth to mention that even in the year 2030, there is a surplus of approximately 154.00 MIGD. Transco will engage with EWEC to define and optimize the Water Production Plants location in terms of transmission system.

Table ES2.4: Total Installed Production Capacity Including Retirement & New Committed Capacities

Plant Site	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Umm Al Nar B / Sas Al Nakhl	95	95	95	95	95	95	95	95	95	95	95	95
Taweelah A1	85	85	85	85	85	85	85	85	85	85	85	85
Taweelah A2	51	51	51									
Taweelah B	162	162	162	162	162	162	162	162	162	162	162	162
Shuweihat 1	101	101	101	101	101	101	101	101	101	101	101	101
Shuweihat S2	101	101	101	101	101	101	101	101	101	101	101	101
New Al Mirfa	53	53	53	53	53	53	53	53	53	53	53	53
Fujairah F1	101	101	101	101	101	101	101	101	101	101	101	101
Fujairah F1 Extension	30	30	30	30	30	30	30	30	30	30	30	30
Fujairah F2	132	132	132	132	132	132	132	132	132	132	132	132
Available Capacity (MIGD)	910	9910	910	860	860	860	860	860	860	860	860	860
Taweelah (RO)				200	200	200	200	200	200	200	200	200
Total Additional Capacity (MIGD)				200	200	200	200	200	200	200	200	200
Total Installed Capacity	910	910	910	1060	1060	1060	1060	1060	1060	1060	1060	1060

Table ES2.5: Additional Production vs. EWEC's Diversified Most Likely Demand Forecast

Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Total Avail. Production (MIGD)	910	910	910	860	860	860	860	860	860	860	860	860
Global TOTAL Most Likely WDF Scenario (MGD)- Excl. Auxiliaries	817	827	842	847	847	851	858	869	880	890	899	906
Surplus\Shortfall (MIGD)	93	83	68	13	12	8	2	-10	-20	-30	-39	-46
Additional Capacity (MIGD)				200	200	200	200	200	200	200	200	200
Surplus\Shortfall (MIGD)	93	83	68	213	212	208	202	190	180	170	161	154

### ES2.3 Approach and Results of the Analysis of Production Expansion

Given some of the uncertainties in the future production to inform secure operation and any potential future requirements, TRANSCO have formulated seven (7) scenarios which are described below:

Scenario 1: Based on the data acquired from the Consultant Ms. Tractebel for the optimization of desalination plant with the arrival of Taweelah 200.00 MIGD and the Nuclear Power Plant at the Al Dhafra Region. Here the capacity of the Taweelah Plant Complex is

approximately 331.95 MIGD at maximum. This is more than the capacity of the existing pumping station and transmission lines at Taweelah.

Scenario 2: Based on the maximum system capacity of the transmission line from Taweelah to Unit III and to Ajban PS. This is to eliminate any transmission facilities required with the addition of Taweelah 200.00 MIGD. This is limiting Taweelah to Unit III at 152.00 MIGD utilizing twin DN1200 (Line 1 and Line 3) and DN1600 (Line 4).

Scenario 3: The scenario is based on the assumption that the 200.00 MIGD is just a replacement of the existing desalination plant at Taweelah. The additional 200.00 MIGD RO will only replace the thermal units for economic dispatch. Existing plant is at 297.40 MIGD, future capacity will also be at 200.00 MIGD.

Scenario 4, 5, 6 and 7: The following Scenarios are based on the Ms. Tractebel output which is representative of the commissioning of the 200.00 MIGD RO plant. It has been divided into four (4) scenario which represents the annual cycle of water utilization of which is winter peak, winter off-peak, summer peak and summer off-peak.

The following scenarios were simulated and the demand forecast were adjusted to production supplies for water balance purposes. Moreover, for Scenario 1, 4, 5, 6 and 7, FEWA demand were readjusted as per the recent discussion and revised requirement of FEWA. Scenario 2 and 3 utilized the full requirement of FEWA of which will be supplied fully by the Fujairah system. Full details of the analysis can be found in the Volume 1 - "Comprehensive Analysis of Abu Dhabi Water Transmission Network - Water Balance Analysis" accompanying this statement.

The criticality of production profile plays an important input on the water balance. The capacity of flow evacuated from Taweelah with the inclusion of the 200.00 MIGD Reverse Osmosis plant and Fujairah dictates the transmission facilities required in the Taweelah system which also includes areas supplied by the Taweelah system (Mainland and Al Ain Region).

With the absence of a firm production expansion, TRANSCO have utilized any available data based from Consultant's previous study to formulate scenarios.

Additional scenarios were generated by including the system capacity of the existing transmission lines and the option of a complete replacement at Taweelah. This is to provide the management of the required flow that can be added to Taweelah for evacuation without disturbing the system which would results to minimal investment until such time that EWEC production expansion have been finalized.

Based on the scenarios analyzed considering all the assumptions as stipulated above especially on TRANSCO's understanding from the EWEC's SFCR 2019 that the new 200 MIGD in Taweelah will be a replacement of the existing thermal units in Taweelah, there will be an investment involve only for Scenario 1 and Scenario 4 which includes transmission facilities from Taweelah to Unit III and Unit III pump station. However, it has to be noted that these investment comes ONLY when the production of Taweelah is above the 297.40 MIGD which is the existing production capacity.

In view of the above investment, which is large and very sensitive due to the uncertainty of the Taweelah output profile in addition to the unavailability of EWEC final production plan which has

great influence on the above assumption, it is then recommended to proceed with “Scenario 3” which is a complete replacement of thermal units in Taweelah for the additional 200.00 MIGD. No investment is required and the majority of proposed transmission facilities proposed in the last 7YPS will still be required except for Taweelah to Unit III and Taweelah to Ajban water transmission system which are dependent on the Taweelah profile. The existing system and the proposed as per last year Planning statement can accommodate Scenario 2, 5 and 7.

In summary of the analysis, it can be concluded that:

- There is no impact on the system with the retirement of UAN as early as 2019. Surplus of water is around 88.00 MIGD within the year.
- Even with the retirement of Taweelah A2 (50 MIGD) by 2022, it has no major impact on the system even without the 200.00 MIGD as demand is approximately equal to production.
- The additional 200.00 MIGD can provide the requirements of Abu Dhabi up to year 2030 and further, however the strategy on efficient dispatch will dictate the future operation of Taweelah and any other plants that are planned to be built in Abu Dhabi.
- Any production that is planned at Al Dhafra Region should be used for decoupling purpose for economic reasons due to the location of Shuweihat and Mirfa to Abu Dhabi city. Relocating the replaced capacity to a different site would result to additional investment which can only be justified through WLCC analysis.
- With the unavailability of EWEC production plan at the time of the preparation of this report, all investments are likely to change as transmission lines are planned not only on demand but also on production. As for this year planning statement, major transmission lines (Production to Intermediate Stations) are based on production driven analysis due to surplus of production.
- Lastly, the 7YPS is developed without the input of SFCR 19, the 7YPS will be updated once we clear the uncertainty in the production profile.

Therefore, as the additional 200.00 MIGD will be used to replace the existing MED and MSF plants at Taweelah and utilizing the available transmission capacity of the system, there is no requirements for transmission facilities for the whole Abu Dhabi region including Northern Emirates.

As discussed above, majority of the proposed transmission line proposed in the last year planning statement is adequate to evacuate the supply to demand areas up to planning year 2026; except the Taweelah water transmission schemes (Taw to Unit III and Taw to Ajban) since it will be dependent on EWEC’s recommended flow profile output of the plant which shall be the basis in the design of the transmission facilities, if any, that will be revisited by TRANSCO once available.

### ES3 Network Development Plans and Business Opportunities

To meet its objective in catering both the forecasted demands and the planned additional production capacity from the existing, under construction and future desalination plants, TRANSCO Water Transmission system is undergoing expansion activities. The below Projects represents the potential opportunities for Users or any entity seeking the use of the transmission system to identify



and evaluate the opportunities available for their required connections. These opportunities are associated with production driven Projects, security of supply projects and asset replacement projects.

According to the results of the analysis of Abu Dhabi Water Transmission Network covering the period of 2020-2026 based on the above assumptions and boundary conditions, the following projects are required in the transmission system:

Table ES3.1: List of Planned Projects for Water Transmission System Development

Serial No.	Region	Project ID	Contract Title	Current Expected Finish Date	Classification	Initiative Name\Drivers
A	PLANNED PROJECTS RELATED TO NETWORK EXPANSION (Committed)					
1	AM (ER)	N-16302 / N-W-18-0008-MA-Work1	Replacement of DN1000 mm pipeline from Unit V to Shobaishi pump station	Apr-23	Non-load	Asset Replacement
2	AM (ER)	N-W-21-0001-MA (N-W-20-0001-MA)	Upgrading Lot D Pumping Station at Mussafah	Aug-24	Load	Demand Growth
3	DR (WR)	N-W-21-0002-MA (N-W-20-0002-MA)	New Storage Tanks at New Muzairah Pumping Station	Dec-24	Load	Compliance to Security Standards
4	AM (ER)	N-W-22-0002-MA (N-W-18-0008-MA)	Replacement of DN1000 mm pipeline from Shobaishi to Ramah pump station	May-25	Load	Compliance to Security Standards
5	AM (ER)	N-W-24-0001-MA (N-W-19-0002-MA)	New Pumping Station at Mussafah	May-27	Load	Demand Growth

#### A. Committed Projects both for Production Expansion and to meet the increased in Demand in all the five (5) Supply Zones.

Table 7.1 found under Section 7.1 shows the list of all the existing and committed network developments enumerated and grouped by Region of influence and are further detailed in each Regional Topology Scheme. These sort of details contains the relevant information of these plans and proposals such as the investment driver; the strategy and justification; their associated scope of works and expected key dates of implementation among others, are briefly discussed and described in details with respect to their planned inception to the water transmission network. The Region-wise topology of Drawing Nos. 5 (Sets) found under Appendix A-Drawings illustrates a better view and understanding of each respective development schemes and proposals including an overall view of only the Planned Projects conceived under this planning horizon 2020-2026.

#### B. Water Transmission Replacement Plans:

Although some Projects are already considered and/or initiated based on the previous year's planning statement, new asset replacement Projects are continuously being studied and identified based on WASPD's extensive assessment of the conditions of the existing facilities. For this planning horizon 2020-2026, Table 7.4 under Section 7.3 of this statement present a list of the major Project



identified of this nature as submitted thru WASPD's "7 Years Asset Replacement Plans 2020-2026" for consideration in this year's 7 YPS along with a brief justifications of each proposals. The implementations of these planned asset replacements will be based on the respective "Business Case \ Need Statements" to substantiate and justify the conditions of these assets and to guarantee their eventual removal from the system subject to common consensus of all the TRANSCO stakeholders.

### C. De-commissioning Plans:

Similarly considered under this Statement are TRANSCO's planned de-commissioning of some pumping stations based on the successful implementation of various Project schemes whose key objective is to facilitate their by-passing operations that would eventually render their decommissioning. De-commissioning enables cost savings on both OPEX and CAPEX. Table 7.5 of Section 7.4 details the plans according to the proposed year they will be out from the transmission network indicating the necessary project or schemes to facilitate the implementation of the plan.

Likewise, the strategy for the utilization and de-commissioning of some existing water transmission pipelines especially the GRP pipelines within the transmission networks located in Al Ain Region are discussed under Section 7.4.

Details of the other associated pipelines and reservoirs that are planned to be de-commissioned brought about by the change in the strategy of supplying the Al Ain distribution network are also elaborated under Section 7.4. However, the option of Asset transfer to AADC is also being considered for these affected existing assets including the Al Ain Municipality or DPM (UPC) for incorporation in their Regional Master Plans.

## ES4 Capital Investment and Implementation Plans

All the development works\projects identified under this 7 YPS and all previous Statements as detailed under Section 7.1 are classified and quantified according to their investment type whether they are load or no-load related. Load related are those projects driven by production expansion, demand growth, government initiatives and compliance to security standards while the Non-load related are those replacement/refurbishment/reinforcement and system improvement projects.

The overall summary all the running, committed and planned Projects as categorized above are demonstrated in Figures ES4.1 and ES4.2 hereunder:

Figure ES4.1: Summary of Running and Committed Projects Classified According to Drivers

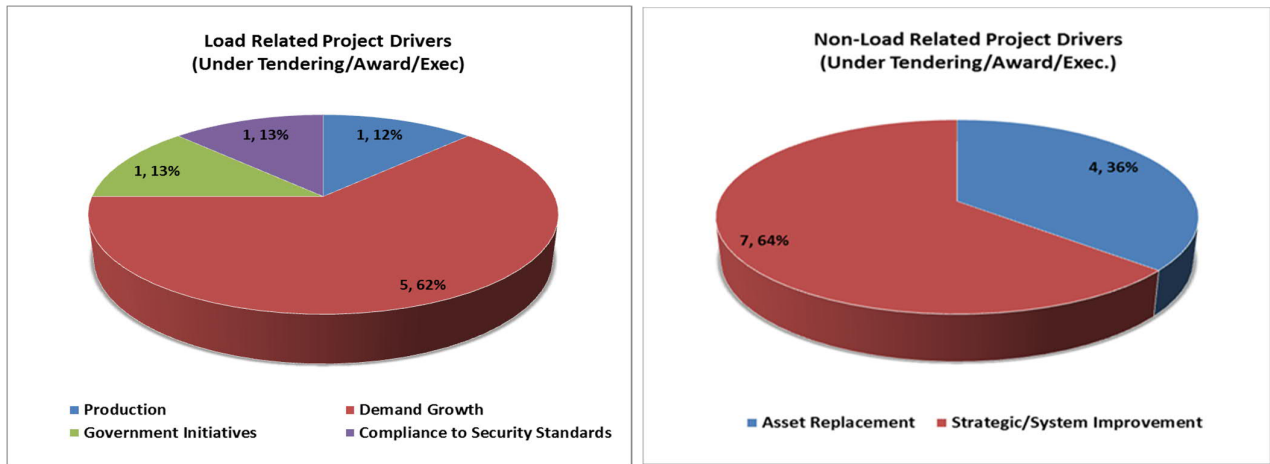
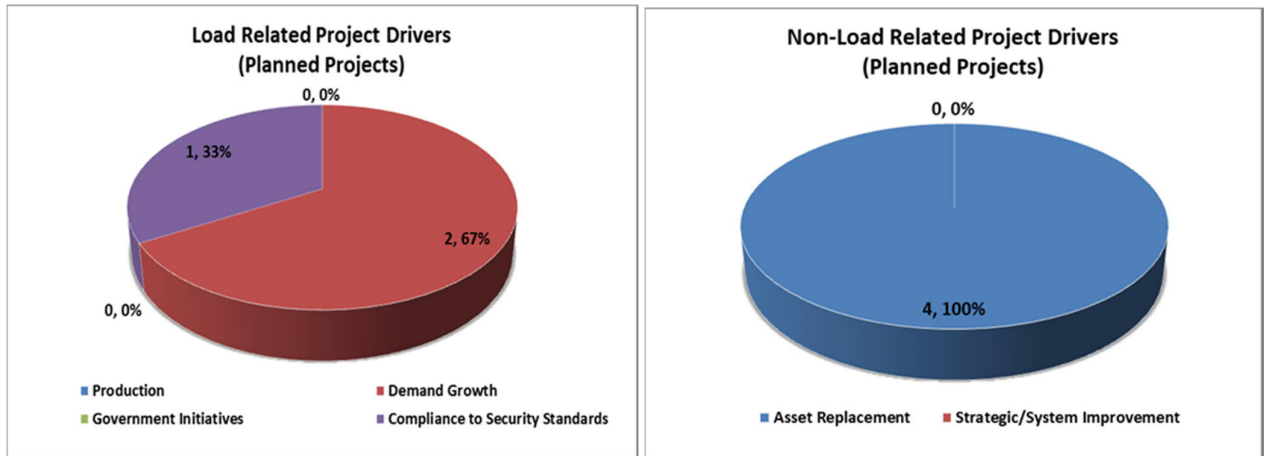


Figure ES4.2: Summary of Planned Projects Classified According to Drivers



With regards to the delivery and implementation of these conceptualized development works, TRANSCO would like to reiterate its strategy on project implementation in view of the uncertainty in the materialization of the various development requirements and demand; some project proposals and schemes are evaluated and TRANSCO has already delayed or deferred or in the process of cancelling some projects. Hence, there is a likelihood of potential deviations of some project proposals and schemes included in this 7YPS.

The financial details of the capital investments plans are deemed to be of confidential in nature therefore are removed as part of this publicly available Statement.

The capital expenditure forecast of all on-going and planned water projects generated under this year's 7 YPS are being reported to DoE in a separate submittal. The delivery of this tasked is under the supplementary document termed as the "7 YPS – Financial Annexure".

## 1. Introduction

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### 1.1 Purpose of the Statement

The Abu Dhabi Transmission & Dispatch Company (TRANSCO) issues the Seven Year Planning Statement (7 YPS) annually pursuant to condition 15 of Transmission License primarily to inform the Users of the system of its expansion plans and development strategies covering a successive period of seven years into the future. The main purpose of which is to enable the prospective Users to identify and evaluate the opportunities available when planning to connect and make use of the system. Moreover, it provides an overview of the existing water transmission system and its capabilities as well as to the proposed transmission development plans to meet the forecasted demand growth in accordance with the planned new Production capacity of Emirates Water and Electricity Company (EWEC) and to dispatch and operate transmission assets efficiently that will be of benefit to other stakeholders and promotes the sustainable growth of Abu Dhabi Emirate and the UAE..

This document is updated annually based on the latest EWEC's Demand Forecast and its Production Expansion Planning scenarios as well as incorporating all the comments from the previous issues received from DoE and other Users. Moreover, it is updated based on major developments in the Abu Dhabi Emirates in relation to the Abu Dhabi 2030 Plan which has caused a major impact in the transmission system expansion strategies. In addition, the recently issued UAE Water Security Strategy 2036 was considered in TRANSCO's transmission infrastructure expansion plans. All the above have impacted the development plans of the foreseeable future.

Since 2014 the 7YPS document, upon DoE's recommendations and identification of the possible areas of improvement, was restructured. Based on the new structure approved by the DoE, the following are the main topics consisting of corporate and technical information such as:

- TRANSCO's Background. Its Core Business, Vision, Mission, Corporate Values, Business Strategies and Key Achievements.
- Asset Management Strategy, Plans, Policies.
- Water Demand Forecast and Production Expansion Plan for the coming seven Years.
- Water Transmission System Planning Processes & Criteria.
- TRANSCO existing Water Transmission Systems and its planned System Expansion for the coming 7 Years.
- Business Opportunities for End Users.

TRANSCO 7 YPS shall be circulated to all Abu Dhabi Power Corporation Companies and shall also be made available to any entity requesting a copy of it.

Some details that are deemed to be of confidential in nature have been highlighted to the DoE and with their consent removed from this publicly available document.

## 1.2 Who We Are & What We Do

### 1.2.1 Creation of TRANSCO

In 1998 Law (2) was passed by the Government of Abu Dhabi concerning the regulation of the water and electricity sector. On January 1<sup>st</sup> 1999, the then Abu Dhabi Water and Electricity Authority (ADWEA) was set up as an entity wholly owned by the Government and responsible for making sure that its group of companies were set up and running; prior to that the Water and Electricity Department was the responsible body. ADWEA are responsible for being the focal point between the Government and the group companies, with TRANSCO being the transmission and despatch arm of the sector and the distribution elements then being controlled by Abu Dhabi Distribution Company (ADDC) and Al Ain Distribution Company (AADC).

In his capacity as Ruler of Abu Dhabi, His Highness Sheikh Khalifa bin Zayed Al Nahyan issued Law No. (11) for 2018 establishing the Department of Energy (DoE) which replaced the roles and functions of the Abu Dhabi Water and Electricity Authority (ADWEA) and the Regulation and Supervision Bureau (RSB).

Lately and in His Highness's capacity, Law No. (3) for 2019 was issued which relates to the Abu Dhabi Power Corporation (ADPC). The law stipulates that the legal status of the corporation is converted to a Public Joint Stock Company, having a full legal, financial and administrative independence and transferring all assets, properties, shares and stocks of DoE and its subsidiary companies to ADPC (Development Holding Company).

ADPC, an entity owned by the government of Abu Dhabi, was set up as an active asset owner that oversees financial and operational performance of Operating Companies (TRANSCO, ADDC, AADC, EWEC, AMPC) without direct involvement in OpCos operations, ensuring empowerment of its subsidiaries. ADPC are responsible of ensuring efficient, reliable and subsidy-free system that generates value and fit for the future of the energy sector through active asset management of key utilities investments across the UAE

As such, DoE responsibility is defined as the energy sector regulator which outlines regulatory framework and policies. DoE's relationship with TRANSCO is defined by such framework and licensing processes. ADPC relationship with DoE revolves on cooperating with DoE through common shareholder and sector processes and is also responsible for improving decision making through outcome driven execution and strengthening regulatory compliance by streamlined DoE/OpCos interface.

Being one of ADPC OpCos, TRANSCO's operating responsibility is then defined as the "transmission, despatch and settlement of electricity and water from production/generation companies to distribution companies as required."

### 1.2.2 TRANSCO's Business Overview

TRANSCO's core business is the planning, construction and operation of a safe, reliable and efficient water and electricity transmission network within Abu Dhabi and, where required, the UAE. TRANSCO's responsibilities include servicing current demand for water and electricity transmission and building the appropriate infrastructure to service future demand. TRANSCO is also responsible for electricity and water production despatch.

## Servicing Current Demand

TRANSCO's responsibility is to provide a safe, reliable and secure transmission network to transmit water and electricity from the water and electricity producers (IWPPs) to the distribution networks operated by Abu Dhabi Distribution Company (ADDC) and Al Ain Distribution Company (AADC).

To execute this responsibility efficiently and effectively, TRANSCO maintains and operates the network of transmission assets, and management of planned and unplanned maintenance activities on the assets.

## Servicing Future Demand

TRANSCO's core business is the planning, construction, and operation of the Abu Dhabi water and electricity transmission network. TRANSCO's responsibilities include servicing current demand for water and electricity transmission and building the appropriate infrastructure to service future demand.

EWEC, a separate operating company owned by ADPC, is responsible for developing water and electricity demand forecasts – TRANSCO's role is to translate these forecasts into transmission network development plans and then to manage the set of development projects required to meet the plan.

## Services Outside of Abu Dhabi Emirate

TRANSCO has also expanded to include assisting in the planning, development and operation of water and electricity transmission assets in some of the northern area of the United Arab Emirates and TRANSCO's authorized areas in Abu Dhabi. TRANSCO is open for any initiative pertaining to the planning and development of interconnections with other Gulf States wherever required.

## 1.3 Vision, Mission & Corporate Values

### 1.3.1 Vision

"TRANSCO will be an innovative world class provider of sustainable water and electricity transmission services".

#### Time Horizon - "Transco 24"

TRANSCO intends to achieve its vision by its 25th birthday – in 2024. It is a period of significant change both within the power and water sector in Abu Dhabi and the UAE. TRANSCO seeks to capitalize on the changes in the sector and ensure that it effectively delivers on its stakeholders' expectations.

#### Quantifiable - "World Class"

TRANSCO aims to be ranked amongst the top transmission companies in the world, across all aspects of its organisation and operations. By 'world class', TRANSCO commits itself to the highest levels of organisational excellence across its business and operations.

#### Innovation - "Innovative"

The power and water sector is rapidly changing; stakeholders, stakeholder expectations, and

technology are undergoing significant change. TRANSCO will need to apply innovation to everything that it does, to ensure that it meets stakeholder expectations as a world class water and power transmission company.

#### Sustainability – ‘Sustainable’

Sustainability has quickly become one of the key pillars of the UAE and Abu Dhabi government policy, and is a key driver in the power and utilities industry globally. It is imperative for that TRANSCO commits itself to being a sustainable organisation (financial, environmental, social) going forward.

### 1.3.2 Mission

“TRANSCO is committed to its stakeholders by transmitting water and electricity safely economically, securely and reliably; whilst embracing innovation and organisational excellence”.

#### Stakeholder Focus

TRANSCO is a stakeholder-centric organisation. TRANSCO’s mission acknowledges the importance of its stakeholders, who include the government of Abu Dhabi and the UAE, Department of Energy, the Northern Emirates and their respective electricity and water companies, the ENG and GCCIA; TRANSCO employees; as well TRANSCO suppliers; residents of the UAE who rely on TRANSCO for their electricity and water, as well as the communities impacted by TRANSCO activities.

#### Reason for Being

TRANSCO’s fundamental purpose is the delivery of potable water and the transmission of electricity. It must do this in a safe, economical, secure and reliable manner. This is TRANSCO’s purpose and is the focus of the mission statement

#### Organisational Excellence & Innovation

In order to realize its vision to be a ‘world class’ organisation, TRANSCO must focus on two things. It needs to meet all the criteria for organisational performance excellence, both internally (processes and people) as well as externally (customers and other stakeholders). And in an era of rapid changes in the sector, TRANSCO will need to stay abreast of industry innovations, and adopt new ways of working.

### 1.3.3 Corporate Values

Corporate values should guide the behaviour’s and practices of management and employees. Corporate values that will be utilized within TRANSCO are creativity, accountability, excellence, integrity and teamwork. Examples of behaviours are provided for each value below and these are just a few of the many traits required for a TRANSCO employee to possess.

#### Accountable

“We are accountable to ourselves, our teams and society”

A key value of the sector, the government of Abu Dhabi and the UAE. Accountability also speaks to how TRANSCO seeks to establish relationships with its stakeholders.

## Creative

“We identify creative solutions to our challenges”

The driver in business innovation and value creation is the creativity of an organisation’s people. TRANSCO’s workforce have the ability, and the responsibility, to identify better ways of working and driving the excellence agenda.

## Excellence

“We strive for excellence in everything we do”

Emphasizing the quality in the work that TRANSCO does, as well as the drive towards business excellence across TRANSCO business operations.

## Integrity

“We demonstrate integrity every day”

A key value of the sector and fundamental behaviour of how TRANSCO’s workforce interact with each other and their stakeholders is integrity.

## Teamwork

“Teamwork defines us”

An important value, already part of TRANSCO’s expected behaviours, and should be a benchmark for how the TRANSCO workforce behave with one another and their stakeholders. It was also the most popular value in the survey of TRANSCO staff.

## 1.4 Strategic Goals and Objectives

### 1.4.1 TRANSCO Corporate Strategic Map

TRANSCO’s corporate aims and strategy is based on driving towards the mission and vision of the company and ultimately contributing to DoE’s goals and that of the UAE government.

The new TRANSCO strategy map shown below in Figure 1.1 has been developed as a communication tool to help staff understand their contribution to the overall corporate goals.

### 1.4.2 TRANSCO Strategic Themes and Objectives

According to the developed TRANSCO Strategy Map, by definition this means the following:

Strategic themes: The strategic pillars which underwrite an organization’s vision, mission and corporate strategy.

Strategic objectives: Are specific goals deemed most important to achieving the organization’s strategic goals.

Transco’s strategic objectives which corresponds to the strategic themes are hereunder:

- ✓ “Sustainable Growth” defines the following strategic objectives:



- Efficient and flexible infrastructure planning and expansion.  
This strategic objective revolves on accurate forecasting and expansion planning, being economically focused when planning and expanding the transmission network, balancing between planning accuracy and economic efficiency with managing uncertainty in the transmission sector, considering environmental and social issues when planning and expanding the transmission network.
  - Structured and optimized asset life cycle management.  
This strategic objective revolves on improving capital project lifecycle management considering both long-term OPEX costs when evaluating CAPEX spend, ensuring alignment between both CAPEX and OPEX for Asset Management planning, implementing leading practice technology (digital) and processes (systems) to enhance asset performance and monitoring.
  - Timely and efficient execution of projects.  
This strategic objective revolves on ensuring the timeliness of project delivery according to planned budget, minimising delays to project timelines in line with best practice, delivering high standard of work to meet expectations of the end user and improving and sustainable economic outcomes.
  - Improved and sustainable economic outcomes.  
This strategic objective revolves on meeting requirements of the Price Control Agreement, increasing overall Return on Investment for TRANSCO, securing commercial excellence throughout TRANSCO value chain and efficient organic and inorganic growth.
- ✓ “Stakeholder Focus” defines the following strategic objectives:
- Develop and implement a leading practice stakeholder engagement and communication program.  
This strategic objective revolves on developing and implementing stakeholder engagement strategy (e.g. AA1000), ensuring stakeholders are properly identified, their needs / engagement approach understood, engagement owners across TRANSCO are nominated and the process is effectively managed and strengthening communication capability with stakeholders; ensure engagement is ongoing and is mutually beneficial. Key stakeholders include customers, suppliers, the sector, government, employees, society, and peer networks.
  - Develop and implement a leading practice stakeholder engagement and communication program.  
This strategic objective revolves on the mutually beneficial, long-term relationships for efficiency gains, identification and adoption of sector innovations through better relationships and new methods of procurement and develop and agree on a more flexible procurement framework with DoE to allow for strategic partnerships.
  - Establish improved alignment and integration with regulators.  
This strategic objective revolves on improving alignment with Department of Energy (DOE) objectives for the sector, integrate further regulatory requirements into TRANSCO’s operating plans. DoE are critical stakeholders, and should be prioritized accordingly as part of the stakeholder engagement strategy.

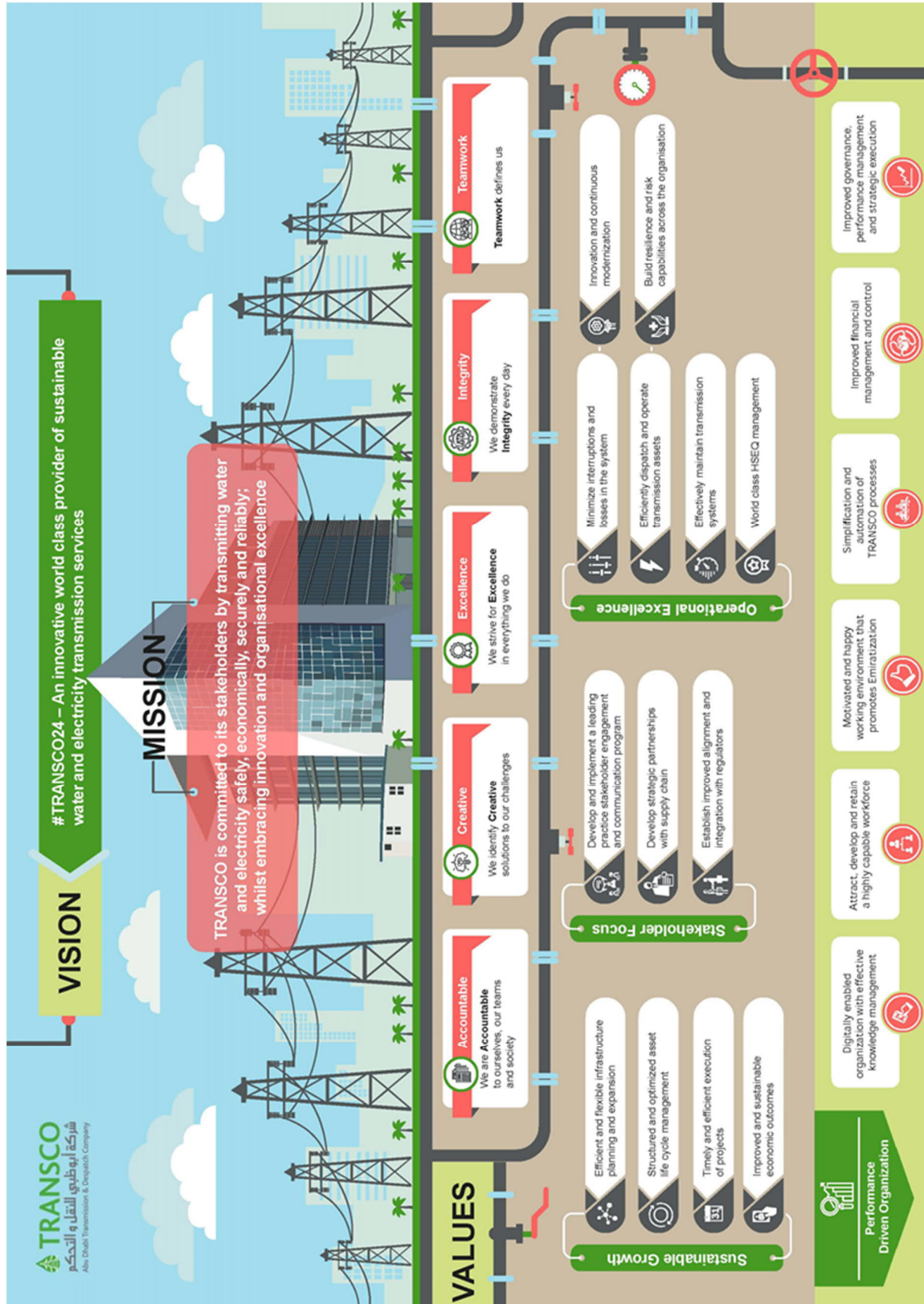


- ✓ “Operational Excellence” defines the following strategic objectives:
  - Minimize interruptions and losses in the system.  
 This strategic objective revolves on minimization of interruptions (unplanned outages) and losses in the electricity transmission system in line with global best practice standards and minimization of leakages in water transmission.
  - Efficiently dispatch and operate transmission assets.  
 This strategic objective revolves on the efficient dispatch and operation of electricity transmission assets and the efficient operation of water delivery assets.
  - Effectively maintain transmission systems.  
 This strategic objective revolves on the implementation of ‘predictive’ analytics to maximize maintenance effectiveness and cost optimization for assets.
  - World class HSEQ management.  
 This strategic objective revolves on developing culture of effective compliance with established HSEQ standards, both with TRANSCO employees and contractors/subcontractors, and building and operate a world class HSEQ management system, with a focus on continuous improvement to ensure best practices and implemented and gaps rectified on an ongoing basis.
  - Innovation and continuous modernization.  
 This strategic objective revolves on identification of strategic initiatives and projects to implement sector innovations, setup of an innovation hub to consider sector innovations, disruption and new technologies, and engaging with stakeholders for the effective implementation of the sector smart grid strategy.
  - Build resilience and risk capabilities across the organisation.  
 This strategic objective revolves on developing a broad-based, holistic approach to resilience for the security and continuity of the water and electricity transmission network (for both physical as well as cyber security) and ensuring risk and resilience culture is established across the business through effective control frameworks and adequate capability development / training.
  
- ✓ “Performance Driven Organisation” defines the following strategic objectives:
  - Digitally enabled organization with effective knowledge management.  
 This strategic objective revolves on identifying and adopting digital solutions for workforce optimization, developing an organisation-wide knowledge management and data management plan, and implementing IT strategy.
  - Attract, develop and retain a highly capable workforce  
 This strategic objective revolves on developing comprehensive training and capability framework to develop capabilities, developing a talent management framework and system covering employee lifecycle, identifying suitable training

(based on the developed competency framework) both business and technical, to develop staff capability and increase specialization across TRANSCO and implementing effective employee performance management framework and system.

- Improved financial management and control  
This strategic objective revolves on building financial acumen capabilities across the organisation by providing training, and instilling a culture of cost awareness.
- Simplification and automation of TRANSCO processes.  
This strategic objective revolves on Identification of internal processes for simplification and automation (where possible) to remove complexity and bottlenecks.
- Motivated and happy working environment that promotes Emiratization.  
This strategic objective revolves on recognizing and rewarding talent, engaging staff to gauge engagement and seek feedback on improving working environment, ensuring that development programs for technical and behavioural competencies are based on developed competency framework for all UAE nationals, and developing attainable career progression tracks for staff, particularly locals.
- Improved governance, performance management and strategic execution.  
This strategic objective revolves on setting the right KPIs, aligned with the corporate strategic objectives, monitoring performance against KPIs on an ongoing basis and periodically reviewing strategic objectives and KPIs and updating as required to move the business forward.

Figure 1.1: TRANSCO Strategic Map



## 1.5 Key Corporate Achievements

TRANSCO endeavours to apply the highest standards throughout the business, adopting a Best Practice approach wherever possible. In recognition of this, TRANSCO has obtained various certificates, in recognition of the organization's on-going achievements. These certificates acknowledge that the Management System in place, meet the various standards set out by the DoE as exemplified in the content of the awards themselves.

- TRANSCO complies with the requirements of the following international standards to effectively manage and control its health, safety, Environment and Quality (HSEQ) obligations:

1. ISO 14001-2015: Environment Management
2. OHSAS 18001-2007: Occupational Health and Safety Management
3. ISO 9001-2015: Quality Management Systems

TRANSCO has been certified by independent certification agency M/s. Bureau Veritas to be in accordance with the requirements of all of the above Standards. Certification was first achieved in 2004 and the same has been subsequently re-certified.

- TRANSCO have been granted the following Awards by the "Royal Society for the Prevention of Accidents" in the aspects of its Occupational Health and Safety levels of achievements. This includes our Consultants, Contractors and Main Sub Contractors working on our behalf:
  1. RoSPA Silver Award 2010
  2. RoSPA Gold Award 2011
  3. RoSPA Gold Award 2012
  4. RoSPA Silver Award 2013
  5. RoSPA Gold Award 2014
  6. RoSPA Gold Award 2015
  7. RoSPA Gold Award 2016
  8. RoSPA Gold Award 2017
- PAS55 – In 2011 TRANSCO has been certified by the Institute of Asset Management (IAM), accredited assessors, to be operating/practising good Asset Management. TRANSCO is the first utility company in the Middle East to have achieved this recognition.
- ISO 55000 – On 24<sup>th</sup> November 2014, TRANSCO receives the International Accreditation of Asset Management (ISO 55000) through Jacobs Engineering Group, an endorsed Assessor by the Institute of Asset Management (IAM). The awarding of the Certificate of International Accreditation for applying Asset Management Standards places TRANSCO in the ranks of global companies that compete in the field of Asset Management with the highest international standards.

## 2. *Asset Management*

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### 2.1 Asset Management Strategy

The Asset Management Strategy sets out the long term strategic approach to the management of physical assets in order to provide direction and guidance to the creation and revision of asset management plans. In particular, the asset management strategy connects TRANSCO's corporate objectives and strategic plans to the activities carried out on the physical assets as described at high level in the Asset Management Policy, enabling these to be quantified as deliverable asset management objectives (targets).

In addition to providing guidance to the creation of asset management plans, the strategy also describes the principal approach and methods to be used. It includes an overview of the improvements proposed by TRANSCO to the processes and organizational capabilities in order to enable the effective and efficient long term management of assets consistent with the organizations overall strategic plans.

#### 2.1.1 Alignment with Commitments and Obligations

The Asset Management strategy is the basis for delivery of our asset management policy; efficient compliance with our business needs and achievement of corporate goals. Consequently, TRANSCO have developed a strategy that is consistent with the requirements defined in the following:

- Asset Management Policy

This defines the principles of reliability, security and safety on which the company manages its assets. It sets out requirements for carrying out activities throughout the lifecycle of TRANSCO assets for prioritising and optimising cost risk and performance in order to ensure the achievement of the strategic business plan including ASTRO objectives whilst achieving compliance with licence and other requirements, and ensuring long term sustainability of the business.

- Price Control Requirements

This document is issued by the DoE, the regulator and provides the Price control mechanism and the expectation of what TRANSCO is required to deliver over the specified period along with the maximum price the company can charge for its services.

- Regulatory License

All the legal and statutory requirements that TRANSCO must comply with are included in this document issued by the DoE.

- Statement of Future Capacity Requirements

This document issued by EWEC, provides a forecast of the supply and demand requirements for the Emirate, for the next 14 years in outline and 7 years in detail. This provides the capacity details that TRANSCO must provide as part of its license conditions.

- Abu Dhabi Master Plan

This provides the outline plans for what Abu Dhabi will be like in 2030, from this document it is possible to see the aims and aspirations of the government and feeds into the Statement of Future Capacity Requirements. TRANSCO must be able to provide the infrastructure to support these

developments.

- TRANSCO Strategic Plan

Five year plan setting out the businesses strategic priorities, high level strategy and performance measures in line with the Government's strategic planning process.

## 2.2 Asset Management Plan

The Strategic Asset Management Plan describes TRANSCO's long term optimised approach to managing assets and provides a high level action plan for both assets and the asset management system that describes the processes for managing assets. It provides the link between the requirements of the business and the plans which cover investment, maintenance and the development of the business.

Business requirements are set out in license requirements, business objectives targets and other requirements and include those in the corporate business plan described in terms of key performance indicators and other requirements. The Strategic Asset Management Plan ensures that stakeholder requirements including those of the Abu Dhabi Government and the regulator are interpreted as specific objectives to be achieved through planned actions.

The Strategic Asset Management Plan provides the guidance and the asset management objectives required to be delivered through the asset management plan (investment and maintenance plans) and through the asset management improvement plan.

The Strategic Asset Management Plan for TRANSCO is described by the Overall Strategic Asset Management Plan, which incorporates the asset management objectives, supported by the Power Network Development Strategy and the Water Network Strategy. These network development strategies are required by DoE annually. The overall approach is illustrated in Figure 2.1 below.

The below Overview provides direction and alignment to more specific documentation that describes the long term approach to developing principal processes (functional strategies) and the lifecycle management of assets (lifecycle strategies), and the development of networks (network development strategies) consistent with delivering the requirements set out in overall Asset Management Strategy. It provides the basis for prioritisation and optimisation across the Asset Management Plan, and the development of the Asset Management System.

The Strategic Asset Management Plan is:

- Derived from and consistent with the TRANSCO Strategic Plan and the Asset Management Policy
- Consistent with other policies and strategies
- Identifies the requirements of relevant stakeholders
- Considers lifecycle management of assets
- Takes account of asset related risk
- Identifies function performance and condition of existing asset systems and critical assets



- States desired future functions performance and condition of assets consistent with timescales and requirements of the TRANSCO strategic plan and other requirements described above.
- States the long term approach and principal methods for managing assets and asset systems.
- Provides sufficient information and guidance for the production of Asset Management Objectives and Plans
- Provides criteria for optimising and prioritising plans – note this will be consistent with risk management in TRANSCO.



Figure 2.1 – Strategic Asset Management Plan – Overview

(Note: The activity of investment planning is presented as functional strategy only to ease understanding. The activity is addressed through various procedures such as Guidelines for Approval of New DB Projects and Change Management VOR, Capital Assurance Process, Scope and Procedure for Capital Assurance Board Decision Making.)

## 2.3 Risk Analysis

### 2.3.1 Asset Risk Criteria

Where asset related risks or asset management costs are identified, networks and assets will be screened to identify whether their criticality to TRANSCO's business drivers. A critical asset is one

whose function is directly and significantly related to our core priorities of safety, reliability, security, cost control and sustainability. For example, an asset or network may be defined as critical if its failure has a significant likelihood and potential impact on service levels to our customers. Such failure consequences may include any of the following:

- Service Delivery- impact on customers if existing asset fails or new asset is not built.
- Regulatory compliance - impact of not meeting the compliance standard.
- Reputational damage - loss of image if existing asset fails or new asset not built on time.
- Financial - financial losses if asset fails or new asset not built.
- Health & Safety - impact on Health & Safety of TRANSCO staff and/ or general public of asset failure / non implementation of scheme.
- Environmental - it impacts the environment such as causing pollution and /or excessive use of natural resources.

This process and the above categories are aligned with TRANSCO's risk management methodology. To ensure objectivity and consistency in determination of asset criticality, TRANSCO will use a scoring system and risk matrix for failure probabilities and failure consequences.

If during a risk assessment, an identified risk is deemed not to be acceptable, then control or mitigation measures must be identified to reduce, eliminate or transfer the risk. The risk assessment and mitigation actions will be included in the appropriate life cycle strategy and will inform the Asset Management Plan.

Risk and criticality will be used to inform the prioritization and timing of specific projects and activities within the Asset Management Plan.

### 2.3.2 Network Risk Analysis

The risk analysis of the entire Water Transmission System is based on the DoE's Security Standard methodology of risk assessment which is entirely based on probabilistic approach. The performance of the system is analyzed based on the level of Service (Level of Service) which is the agreed and measurable standard of service set by the DoE for all the companies to adopt as guideline.

The methodology assesses the risk of failures causing major loss of supply due to power outages and transmission pipeline failure. The probability used in this assessment for supply interruptions caused by trunk main failure are all based on TRANSCO pipe bursts record.

The trunk main risk assessment study considers the probability of unplanned interruptions of supply to customers. Interruptions to supply considered in this study include pipe bursts, non-availability of emergency links with other systems and storage.

The following criterions were considered in the risk assessment study:

1. Single failure assessment as multiple failure is unlikely to occur on Transmission lines.
2. Series in component, a failure would results to the whole system failing.
3. Parallel Component, a failure would not hamper the other system to operate.
4. Risk of Failure (Collapsible system), alternative sources must be considered.
5. Exclusion of Consumer storage in the analysis.



All segments of TRANSCO network were considered in the risk assessment for supply interruption in order to determine whether the network satisfy the security of supply/level of service. For segments that do not meet the level of service, the risk curve methodology has been used to determine return period of segment based on the actual failure frequency of such segment.

## 2.4 Asset Performance and Condition Assessment

TRANSCO is committed to maintaining and improving asset performance in line with business objectives and targets. This includes monitoring past and current performance and condition in order to forecast future needs and identify improvement opportunities. Asset information systems and key performance indicators are used to manage such performance and condition data for asset selection, design, operations, maintenance, spares requirements and other asset management decision-making, as well as for reporting obligations. The issues identified from asset condition and performance assessments or asset health reviews will be incorporated in the asset lifecycle strategies and used to inform the Asset Plan.

The assessment process considers various performance parameters that are essential input in determining the condition and health of the asset. These parameters and sub-parameters such as the lifecycle (ageing), trend analysis (failure rate, vibration, etc.), running cost (maintenance cost), reliability (availability, manufacturer reputation, design reliability) and environment (environment-indoor/outdoor) among others depending on the type of the asset. The process entails the formulation of Asset Health Indices (AHI), gathering of data and the computation or scoring of such parameters or criteria. The AHI metric is designed to score the condition and health of an asset in a standard and consistent manner. The overall score is a composite score derived from pre-defined condition rating multiplied by the relative weight. The outcome provides an overview snapshot of the asset whether it is Very Good, Good, Fair (Moderate), Poor and Very Poor (about to fail) condition. This ranking shall influence which maintenance strategy is applicable to the asset or shall determine the asset's "end of life" or replacement in conjunction with the probability of failure analysis.

Reference shall be made to the current and/or latest version of the operating procedures related to TRANSCO's activities for the asset performance and condition assessments for the water transmission network.

## 2.5 Asset Replacement

Asset replacement or non-load requirements are identified through Asset Health Review process which is intended to support non-load related investment decisions and asset management strategies in TRANSCO by determining the current condition of the plant, risks and its criticality to the system. The results of the Asset Health Review will be used as inputs for the optimization of Asset Strategies and Life Cycle Strategies which influence the decisions to repair/maintain, run to failure, retire/decommission, refurbish or replace. This will enable a balance between cost, performance and risk when making asset investment related decisions. The criticality and likelihood of failure will be determined for each asset and is mapped on to a risk register.

References shall be made to the current and/or latest versions of the different applicable operating procedures related to the identification of the asset replacement requirements.

### 3. *Network Development Strategy*

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TRANSCO has over the years developed a modern and reliable transmission system making use of best available technology to provide a high degree of network security. TRANSCO aims to continue to develop, operate and maintain a safe, flexible, accessible, robust, reliable, and efficient transmission system that meets the needs of its customers in a manner consistent with its License obligations. This is to be achieved through a structured asset management process that takes cognizance of best practice asset management principles for the development and stewardship of the transmission network and requirements for capital assurance governance.

TRANSCO's Water Network Development Strategy provides a long-term vision for taking the transmission system forward and provides direction to the 7YPS and its associated investment plans. The strategy places much greater emphasis on the trends and drivers which provides a long-term vision for taking the transmission system forward consistent with Government's 2030 vision. The 7YPS describes more detailed short to medium-term plans for the transmission system and is linked to the needs and investment requirements for the period 2020-2026.

#### 3.1 Objectives

The long-term network development strategy aims to provide an optimized vision for taking the transmission system forward that takes into account the government objectives and policies, particularly those associated with the United Arab Emirates (UAE) future social, environmental and economic requirements. The Water Transmission Infrastructure continues to be developed consistent with these policy among others to support the future economic development of the Abu Dhabi Emirate and the Northern Emirates.

The adopted transmission network development strategy along with the application of relevant novel technologies will ensure achieving the following objectives:

- Fulfills the expectations of society.
- Facilitate sufficient energy resources to meet the current and future demand within the Emirate and to allow Abu Dhabi's continued contribution to the water & power requirements of the UAE.
- Secure the domestic water supplies to minimize vulnerabilities associated with unplanned domestic system disruptions, import disruptions, and other crises.
- Provide accessibility in granting connection access to all network users and benefits to customers at the earliest opportunity, particularly for renewable power sources and high efficiency local generation with zero or low carbon emissions.
- Reliable in assuring and improving the security of supply standards, transmission code and quality of supply to accommodate the customer requirements having different technical characteristics.
- Economical by providing the best value through innovation and efficient water management while supporting economic competitiveness and diversification by facilitating supply of reasonably priced water and tariff regulations.

- Facilitate implementation of DoE Demand Side Management (DSM) program. This program presents policies, means and techniques to achieve a scale of possible reduction of water demand keeping high standards of living and customer satisfaction.
- Flexible in fulfilling the customers' needs and broader spectrum of stakeholders whilst responding to the changes and challenges ahead.
- Environmentally friendly, safe & efficient. Protect the environment by facilitating renewable and alternative energy technologies, mitigating the negative effects of traditional energy production, and achieving increased energy efficiency among consumers within the Emirate.
- Reduce uncertainty and risk to investment decisions.
- Ensure end of life renewal of assets for sustainable operation of the Network.

## 3.2 Principal Long-Term Drivers of Network Developments

Among the principal drivers and trends that continue to shape the long-term development of the water transmission system and the investment plans and thereby achieve TRANSCO's strategic objectives with improved transmission performance are:

### 3.2.1 Water Demand Forecast

Water and Power are the critical enabler for the economic and social development of the UAE. Peak water demand (including supplies to Abu Dhabi Emirate and Northern Emirates) is forecast to increase until 2030 according to EWEC's 2019 updated forecast. The principal demand drivers influential with this growth are the vast industrial expansion, the major oil and gas developments, new mega residential and commercial developments, and exported supplies to Northern Emirates. The proportion of industrial demand relative to peak demand is forecasted to increase as the UAE diversifies its economy.

TRANSCO's analysis on this Year's EWEC water demand projections until year 2030 is demonstrated in a more detailed manner in Section 5.3 below and how it influenced the growth in demand in overall emirates-wide perspective and on regional level.

### 3.2.2 Generation Production Location

The production of electricity and the desalinated of water are dominated by large-scale operators using conventional technologies such as gas turbines and thermal desalination (MED and MSF); and the non-thermal (RO) processes. The Table 4.3 and Figure 4.2 in Section 4.5 represent the percentage share of these employed technologies as the major sources of water of the TRANSCO system. Referring to Figures 5.22 and 5.23 in Section 5 below, the comparative analysis of the available production and against the projected demand indicates that there is substantial excess of production capacities that must be managed effectively in order to achieve the efficient and economic dispatch of water to where it is required that entails minimal network investments.

To support the Government objectives of achieving energy sufficiency, energy security, economic diversification, and reduce the negative environmental impact of fossil fuel generation within the Emirate, connection of essential new generation such as nuclear and renewables including the Reverse Osmosis technology are planned which have different technical characteristics to the current generation and production portfolio.

Over the past, the water transmission developments and investments are mainly dominated by the large-scale production related projects to evacuate the new additional production capacities to meet the forecasted future demand and to locations where it is highly required.

Section 5.4 below shows the analyzed production expansion plans which details the existing as well as committed retirements and new production capacities; and the additional future capacity requirements of the system to address not just the shortages in supply but likewise to establish the security of the system according to the DSS (Desalination Security Standards) and the efficient and economic dispatch of water from production to distribution networks.

### 3.2.3 Removal of Transmission Constraints and Risks

The removal of constraints and risks within its transmission system, if there exists, is one of the main aspects and objectives of the 7 YPS in order to meet its envisioned operational excellence that will enhance the level of service to its customers. Please refer to Sections 2.3 and 7.6 of this document which signifies the TRANSCO's detailed strategy or approach to address these essential drivers of the transmission developments.

### 3.2.4 Asset Replacements

The bulk of the infrastructure work presently on-going, and that planned for the near future, is based on water demand growth and water production requirements, however, in the future it is expected that asset replacement works will increase as the asset base ages. Even the majority of the transmission network assets are relatively young, there will be requirements for assets approaching the end of their useful lives to be managed and replaced at an appropriate time.

TRANSCO's strategy of this important and influential network development drivers is explained in Section 2.5 above, while Section 7.3 below indicates the results of the Asset Performance Department's comprehensive evaluation of the transmission assets and facilities that are planned to be replaced according to their conditions.

### 3.2.5 Major Changes in the Strategy for Operating the Transmission System

The water network development strategy considers operational scenarios to come up with an efficient, safe and flexible network.

The following operational scenarios are considered in adopting network designs:

- a. Direct supply connections vs. Pump-Reservoir arrangement.
- b. Gravity supply Vs. Pumped Supply.
- c. High Pressure One-Shot Pumping Scheme vs. Intermediate/Booster Pumping Station Scheme.
- d. Setting up of Transmission Ring-Main System which will serve long term planning with minimum impact from changes in production location: (i.e. Al Ain City Ring Main and Unit III-Unit V-Mussafah-UAN Ring Main).

Al Ain City Ring Main: Al Ain City ring main are designed based on this concept wherein the system will work regardless of where the supply comes either from Fujairah, Taweelah or

even from UAN-Shuweihat-Mirfa. The new Al Ain Reception pump groups are designed to provide supply both ways with Umm Ghaffa tanks as the receiving strategic stations. Umm Ghaffa tanks (Gravity) will be used in case of emergency at Al Ain Reception.

Unit III-Unit V-Mussafah-UAN Ring Main: The Unit III-Unit V- Mussafah- UAN ring main has been conceptualized and studied to minimize the impact of the proposed location and capacity of future Production plant by considering a ring main that is capable of delivering supply to customer level regardless of where the supply originates. Establishment of a ring main provides the most robust, secured and flexible system in water network design as one station is capable of delivering supply to the other station and vice versa.

Unit III and Mussafah future pump groups shall be designed to supply the proposed transmission ring main covering the areas within the Unit III, UAN, Mussafah and Unit IV axis. If Production Plant comes from the Eastern region via Taweelah, then Unit III will be the main source of supply to the ring main and if production comes from the Al Dhafra Region via Shuweihat or Mirfa, Mussafah will be the main source of supply to the ring main.

- e. Establishment of Emergency Water supply System. This typical operational scenario is further discussed below under Section 3.2.10 (Emergency Supply System) where some of the major projects or will be implemented conceived network developments or schemes are illustrated.

The conceptualization, feasibility and implementation of the above network designs is anticipated to result in huge savings in both CAPEX and OPEX for TRANSCO and DISCOs that includes the proposed bypassing of Unit 1 & Unit 2 Pumping Stations and bypassing of all Pumping Stations in Al Ain Region.

### 3.2.6 Technology Employed for Efficient Monitoring and Cost Reduction

TRANSCO will continue to keep abreast its people and network of new technologies and consider studying new technology as they are available to have an efficient, safe and cost effective, environmentally compliant water transmission network.

### 3.2.7 Economic Uncertainty

TRANSCO's strategic view with regards to this major influential factor of the network development which has directly or indirectly impacted major development projects or works that were already raised and are eventually deferred or cancelled as the result of such economic uncertainty and financial turmoil is indicated in Section 7.3 (Capital Delivery\Implementation and Expenditure Forecast) below.

### 3.2.8 Improvement in Transmission Performance (Water Quality)

One of TRANSCO's main area of concern is to monitor, maintain and further improve the water quality within the Water Transmission Network, particularly the maintenance of Residual Chlorine at the Interface Connection Point with DISCOs and minimizing the formation of Bromate within the network.

TRANSCO through the Project N-7953-Chlorine Decay Modelling will in the future be able to predict the chlorine diffusion in the Water Transmission Network. New Residual Chlorine monitoring instruments will be installed on site to provide on-line monitoring and control to optimize disinfection of supplied water.

A new disinfection process will be tested on a Test Rig with an ultimate objective to minimize bromate formation within the transmission network.

TRANSCO's launching of the Consultancy and Construction project "Implementation of Bromate Control Measures\Study" follows 3 years of investigation by the Bromate Working Group resulting in the pilot testing of effective mitigations measures to reduce Bromate levels in ADPC. Based on the results of the pilot testing, a strategy to control bromate was elaborated. The objective of the project is to implement this strategy by studying in details the location where mitigation measures need to be implemented and carry out the required work. The project is expected to be completed by **December 2021**.

### 3.2.9 Economic Load Dispatching

According to our established planning strategy, the Abu Dhabi and Northern Emirates water transmission network is divided into Five (5) Supply Zones defining the areas currently served by each particular Desalination Plants and Pumping Stations which are named in conjunction with the Regional divisions of the Abu Dhabi Emirates.

The creation of the above five supply zones enables TRANSCO to study and clearly define the surplus or shortfall in water supply within each defined zone as well as to determine the most economical import-export route between each zones, thus dispatching the most economical Desalination Plants to nearby supply zones. From operational point of view, TRANSCO through its Water Network Operations Division and in coordination with EWEC had divided the whole system into "Unit Commitment Zones" which is a more an elaborated detail of the mentioned five supply planning zones but whose main purpose is for economic load dispatch of the available daily production of the system to meet the demand targets of the DISCO's.

With the advent of large scale nuclear power source, TRANSCO is faced with a strong challenge on how to ensure that both electricity and water demand is efficiently met and dispatched based on the available production and generation capacities that will be displaced from the co-generation plants based on this scenario. It is therefore vital for TRANSCO to obtain from EWEC their firm production and generation plans most importantly the "retirement plans and de-coupling strategy" in order to plan properly and adequately as applicable to the transmission system.

### 3.2.10 Emergency Supply System

The establishment of emergency supply system is one of the main aspects of the planning statement and is considered as one of the major drivers for investment with maximum return of benefits focused in maintaining the security of supply and flexibility of operation during unforeseen circumstances. Among the conceptualize and equally important schemes are:

#### Strategic Water Supply Scheme between Fujairah FWTS and Abu Dhabi Water Transmission Network:

The Water Supply Scheme between Fujairah FWTS and Abu Dhabi Water Transmission Network was conceptualized and studied to evacuate surplus of flow from Qidfa for diversion to Abu Dhabi Mainland (Eastern) and Central region as far as Unit III and Unit IV pump station with limited financial outlay as the existing transmissions systems (assets) in between stations to stations are utilized and maximize using bypass systems installed to make the operation works. This emergency scenario was formulated with the assumption of either Taweelah, UAN or Mirfa is out of the system. This strategic emergency supply scheme is expected to deliver 108.0 MIGD from Qidfa of the Fujairah water transmission system in the Northern Emirates to Abu Dhabi Region.



#### Water Storage Tanks in Umm Ghaffa (Contract N6821-D: EPC Works Al Ain Distribution Network - Lot D):

The Water supply scheme at Al Ain with Umm Ghaffa tanks as the strategic reservoir can provide emergency supply inside Al Ain when Fujairah is out of operation. With its strategic location, it can even reach the areas of Unit III and Unit V pump station by utilizing all bypassing works under the above Project (Strategic Water Supply Scheme between Fujairah FWTS and Abu Dhabi Water Transmission Network).

#### Water Supply Scheme for the Aquifer Project (Contract G-4877):

The main purposes of the project are for normal infiltration of 7.0 MIGD into shallow groundwater aquifer and recovery of 40.0 MIGD of chlorinated groundwater for emergency supply to Abu Dhabi. Emergency scenario utilizes all existing transmission assets starting from the scheme location towards the new pump station at Madinat Zayed pump station to transport the 40.00 MIGD to Shuweihat Intermediate Station at Mirfa. It is then further transported to Mussafah via the existing pump station and twin DN1600 transmission lines for eventual supply to consumers where water is planned for distribution during any unforeseen circumstances.

### 3.2.11 Government Objectives and Policies

The Water Network Development Strategy is fully aligned with the Government of Abu-Dhabi's Vision of 2030, and is embarking on the implementation of a best-in-class strategy execution framework throughout the organization to build, develop and utilize a proven strategic framework. This framework will drive the required change needed in order to better achieve the vision 2030.

Now, with TRANSCO under the direct stewardship of ADPC, TRANSCO is wholly bound to abide by the precepts and objectives on the creation of ADPC whose mandate is fully aligned with the Government's vision to transform the Abu Dhabi's power and water into an efficient, reliable and subsidy-free system that generates value and is fit for the future.

### 3.2.12 Interconnection with other Systems/Networks outside the regulated Environment (Regional & International)

To support the Government of Abu Dhabi's initiative to supply particularly the Northern Emirates, and to bolster the domestic water supply security, TRANSCO's water transmission system is increasingly integrating with its neighboring Emirates and possibly in the future with the Gulf Cooperation Council's (GCC) proposed transmission system.

The main objective of the GCC Water Grid is to secure the national water systems in emergency conditions by providing strategic water back up and diversifying seawater and fresh water sources.

Technically, the GCC Water Grid will raise real challenges. However, these challenges can be met thanks to the most recent developments in the fields of pipelines, pumping and electrical equipment and communication technologies.

## 3.3 Security Standards, Planning Criteria & Risk Analysis

### 3.3.1 Planning Process

The complete process and methodology of the water transmission system development as shown in Figure 3.1 below illustrates the overall procedure being adopted and implemented by TRANSCO in the development and planning of its water transmission facilities. This includes the related Network Risk

Analysis (Figure 3.2) detailed approach and the cycle of the Project Initiation and definition process (Figure 3.3). The comprehensive details of whole planning processes can be found in the latest version of the Water Network Development Procedure which is available upon request if required.

TRANSCO is currently using the Consultant's adopted risk analysis approach in addressing the risk of the system, which is widely used in the United Kingdom Water Environment, The methodology utilizes a "workshop based approach" to understand fully the probability and consequences of failure of the critical segments, determine what mitigation measures are available and to define which options offers best value. A two stage approach is implemented with the first assessment using the statistical model using DoE Security Standard Level of Service and critical segments (failures) are then taken forward into the workshops and assessed in more detail to understand their failure mechanisms, the risk associated, the consequences of these risks, which were then developed into a mitigation strategy to ensure the Level of Service within the Standard is maintained on the network. Once the risk assessment is complete, whole life cost analysis (WLCC) analyses were carried out to show which options would give the best financial value.

The Consultant's risk analysis approach focuses on the assessment of individual segment risk data (pipe burst and relevant costs, power outages, repair times) and further build up information on a workshop involving the relevant staff to validate the acquired data.

Recently a Consultant was tasked by TRANSCO to calibrate the existing Security risk graph to adapt to the existing data within the region (TRANSCO, AADC and ADDC data). The result of this project was used in the analysis of Risk in this year's planning statement.

### 3.3.2 Security Standards

TRANSCO in planning the transmission system relies on the guidelines and criteria as stipulated in the Water Transmission Code and Water Security Standard.

The main objective of the Security Standard is to ensure the security of supply of water in the Emirate by developing planning process and to develop appropriate network security standards (Level of Service) for transmission system. Ensuring security of supply is the responsibility of the DoE and all the licensed companies in the Abu Dhabi emirates.

Water Transmission Code specifies the initial criteria for transmission system planning and Water Security Standard providing justification through risk analysis (Level of Service) for the planned transmission system. This is to ensure that any investment of transmission system complies with the Water Transmission Code requirements and with full compliance on securing the supply at an agreed Level of Service.

### 3.3.3 Planning Criteria

TRANSCO shall apply the License Standards, which are set out or referred to Condition (18) of the Transmission License relevant to planning and development of the water trunk main system. The criteria, guidelines and procedures to be applied by TRANSCO for planning and development are specified in the Water Security Standard, as well as in the Water Transmission Code.

The following planning/design criteria were adopted in the Network Capacity planning covering the requirements for storage, pumping and pipeline capacities. These criteria have been reviewed and



updated by Water Transmission Code Panel as an amendment which had been approved by the DoE and is incorporated as part of the Water Transmission Code.

### 3.3.3.1 Reservoir Capacity

#### 3.3.3.1.1 Reservoirs at Water Production Plants

The total storage of the production reserve shall provide 24 hours of water supply at the rated design output of the Water Production Plant. A minimum of two storage tanks or one tank with minimum of two sections or more that can be isolated shall be provided, and the volume of storage so calculated shall be usable and exclusive of any unusable top and bottom storage.

#### 3.3.3.1.2 Reservoirs at Intermediate and Terminal Pumping Stations

Intermediate pumping stations shall be provided with water storage equivalent to 10% of the average daily transfer and 100% of the daily demand of the distribution system.

Terminal pumping stations shall be provided with water storage equivalent to 24 hours' supply at the average daily demand of the distribution system.

All water storage facilities should have a minimum of two tanks, or one storage tank with minimum of two section or more that can be isolated, at each location; and the volume of storage so calculated shall be usable and exclusive of any unusable top or bottom water storage.

The above criteria for storage are guideline figures only and TRANSCO shall undertake risk analyses in accordance with the guidelines given in the Security Standard to determine whether departure from the guidelines is required.

### 3.3.3.2 Criteria for Standby Pumps

All Pumps (variable or fixed speed) must be capable of supplying the output required by the Despatch process at a continuous rate against the head specified in the Connection Agreement. To maintain supplies in case of pump fails or routine maintenance requires to be undertaken, 30% to 40% standby capacity, (depending on the sequence of failure), to be provided at Pumping stations. The number of standby pumps required to meet these criteria is given in the following table:

The criteria in the Table below are for guidance only. TRANSCO shall undertake risk analyses, in accordance with the guidelines given in the Security Standard, to justify the level of standby pump facilities in specific circumstances.

Number of Duty Pumps	Number of Standby Pumps (33%)-normal	Number of Standby Pumps (40%)-critical
1	1	2
2	1	2
3	1	2
4	1	2
5	2	2
6	2	3
7	3	3
8	3	4

Table 3.1: Criteria for Stand-by Pumps

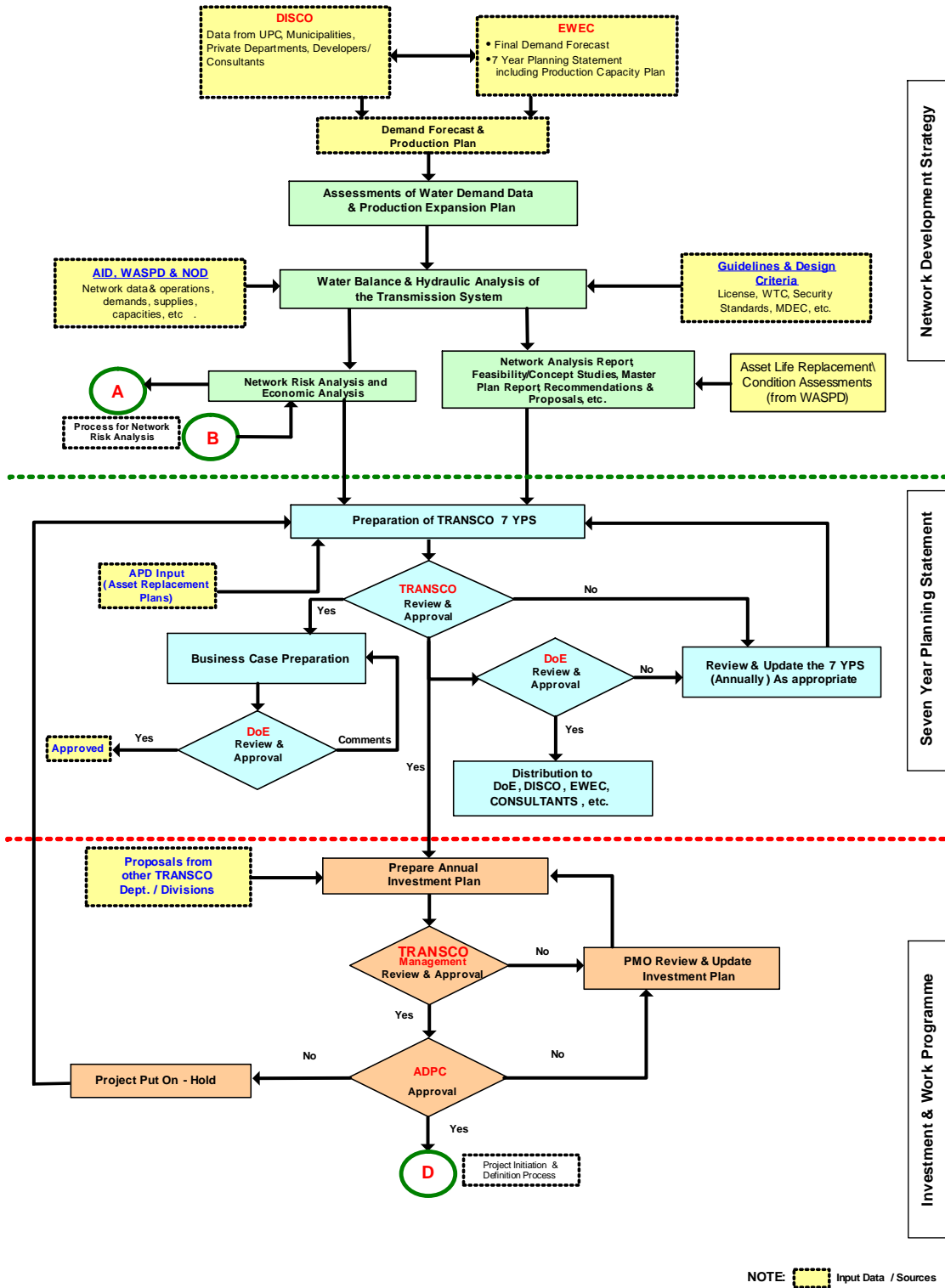


Figure 3.1: Water Network Planning Process Diagram

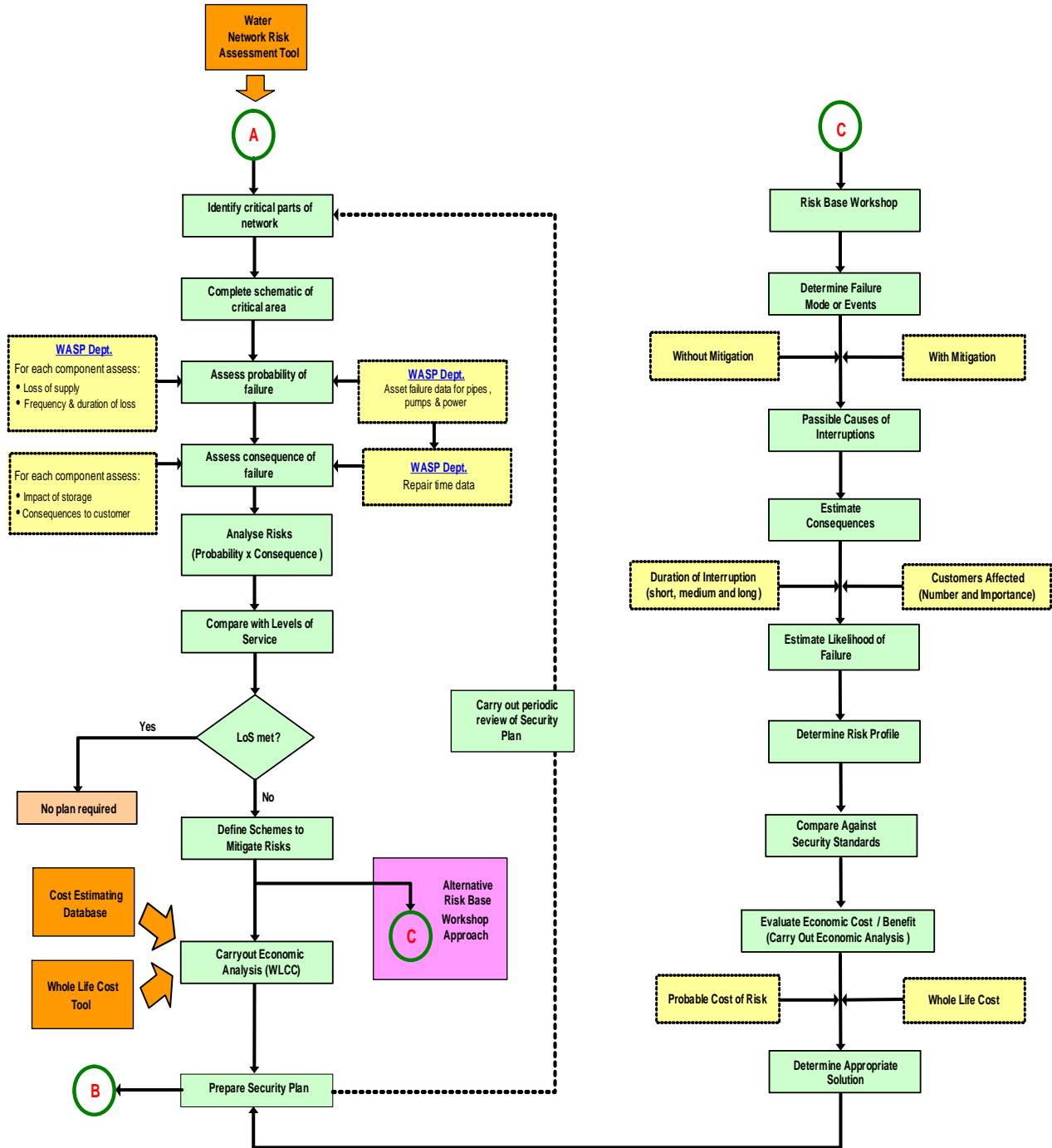


Figure 3.2: Water Network Risk Analysis Process Diagram

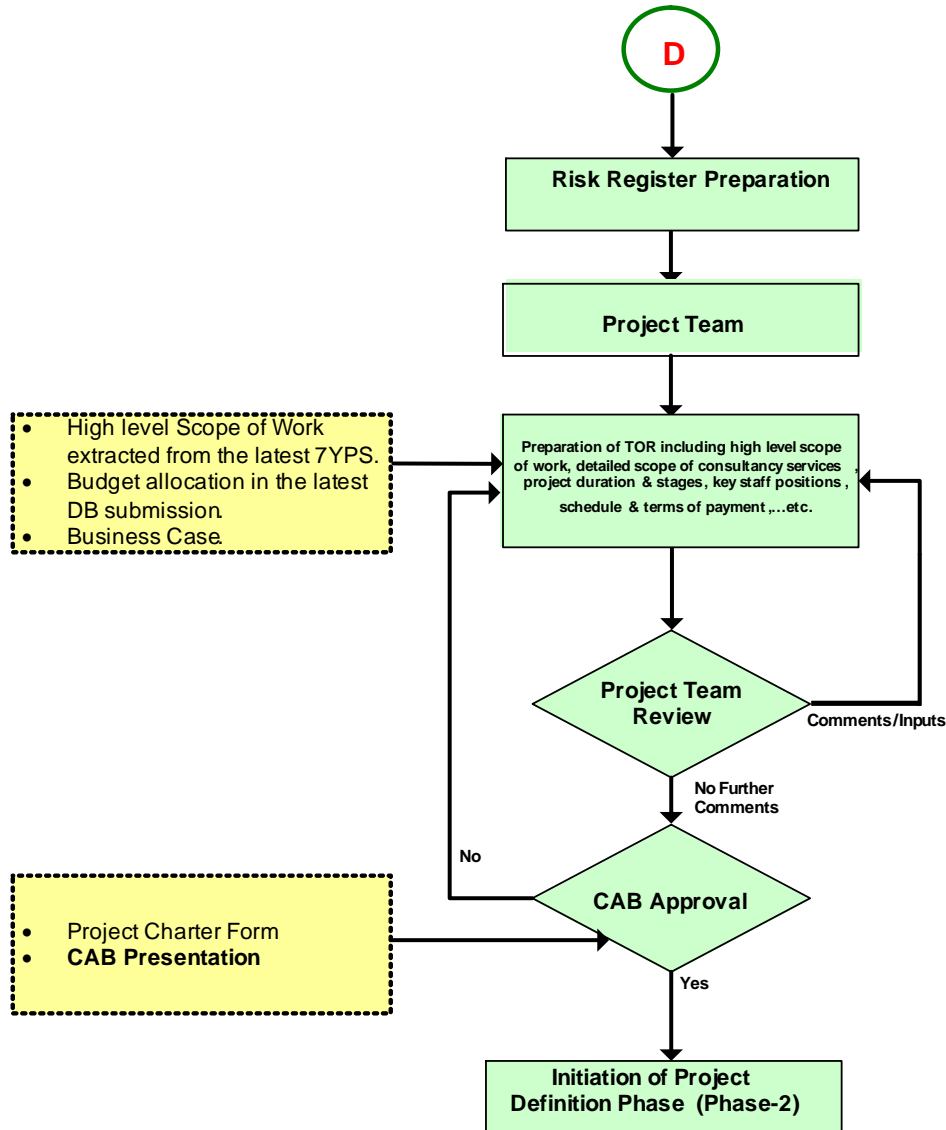


Figure 3.3: Project Initiation and Definition Process Diagram

### 3.3.3.3 Pipeline Facilities

In the design of a pipeline facility, the planning period is decided and accordingly the demand projection that the subject pipeline will handle. The most techno-economical size of the pipeline shall be determined taking into consideration the pipeline costs, energy costs for pumping and the maximum flow velocity within which the pipeline can run safely without reducing the effective life time of the pipe due to erosion which can be a result of velocities exceeding the maximum specified velocity by the WTC.

However, the limitation imposed by the available service corridor greatly affects the ultimate sizing of Transmission Pipeline. Where future addition of pipeline reinforcement within the same service corridor is not feasible or extremely difficult, the pipeline capacity planning shall be based on the maximum demand of the area for the planning period.

As per WTC requirements, Transmission pipelines shall be designed not to exceed maximum velocities of 3.0 m/s. TRANSCO shall undertake technical evaluation to determine the appropriate design velocity for individual circumstance. Slightly higher velocities can be tolerated in emergencies, but only for short periods.

The minimum velocities should not fall below 0.3 m/s to ensure that the age of the water does not become excessive and that loose deposits in the main are not allowed to settle. Water should not be allowed to stagnate under normal operating conditions.

For the purpose of analyzing the capabilities of the existing pipelines within TRANSCO water trunk main system, the design capacity as per hydraulic analysis of that specific water transmission scheme has been considered.

#### 3.3.3.4 Stand-by Generators

Standby generators (either fixed or mobile) shall be provided at sites where no alternative power supply is available (for example, through dual feeds) and where a risk assessment, as per the Security Standard, has shown that service to customers is compromised.

#### 3.3.4 Network Risk Analysis

TRANSCO since 2006 has carried out network risk analysis of the entire Abu Dhabi Water Transmission Network in accordance with the guidelines set out in the Security Standard to determine whether the risk of interruption to supply to customers are acceptable in accordance with the Standard defined by the figure below, which is part of Security Standard.

The completed TRANSCO Contract N-12414 "Consultancy Services for the Calibration of Risk Analysis Model of the Water Security Standard" was implemented to study and define the origin of the standard and to determine the methodology on how it was built. Furthermore, the objective is to calibrate the Water Security Standard Level Of Service (LoS) based on UAE conditions (ADDC, AADC and TRANSCO).

The study has resulted to a new risk curve pattern based on the available data coming from AADC, ADDC and TRANSCO. As the curve has not been approved by DoE as of this time the report has been prepared, TRANSCO in this analysis will include this curve in the performance curve for each segment together with the previous risk curve to compare and test the result.

The Figure 3.5 below presents the relationship between the previous risk graph 2.63 % versus the new risk graph at 2.00 %. Presented also on the graph is the latest risk appetite for UK which is 0.50 %.

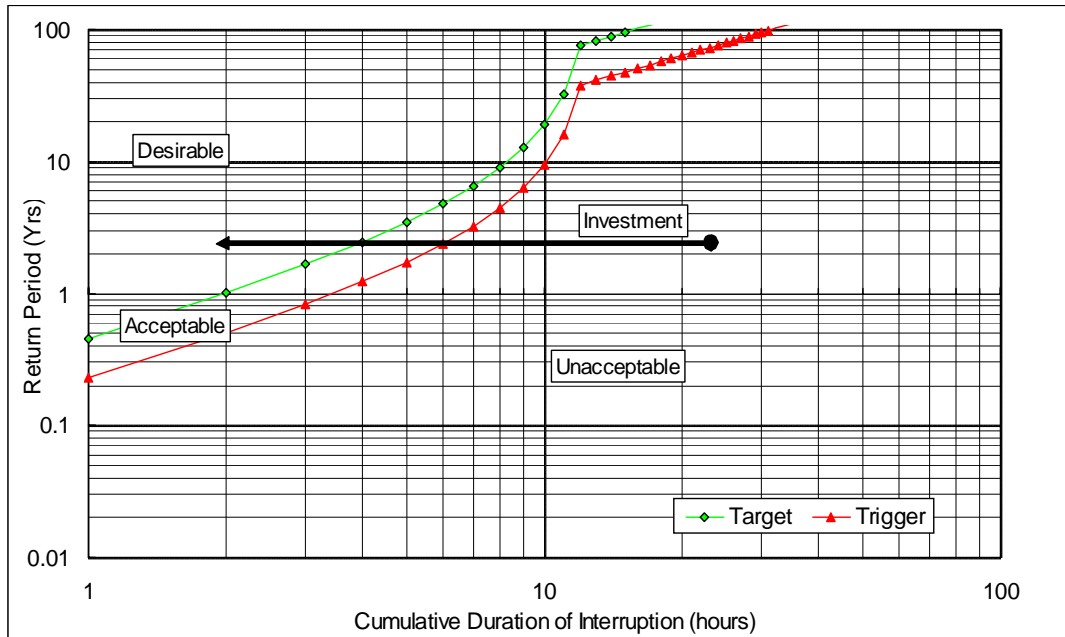


Figure 3.4: Risk Analysis Graph (Level of Service)

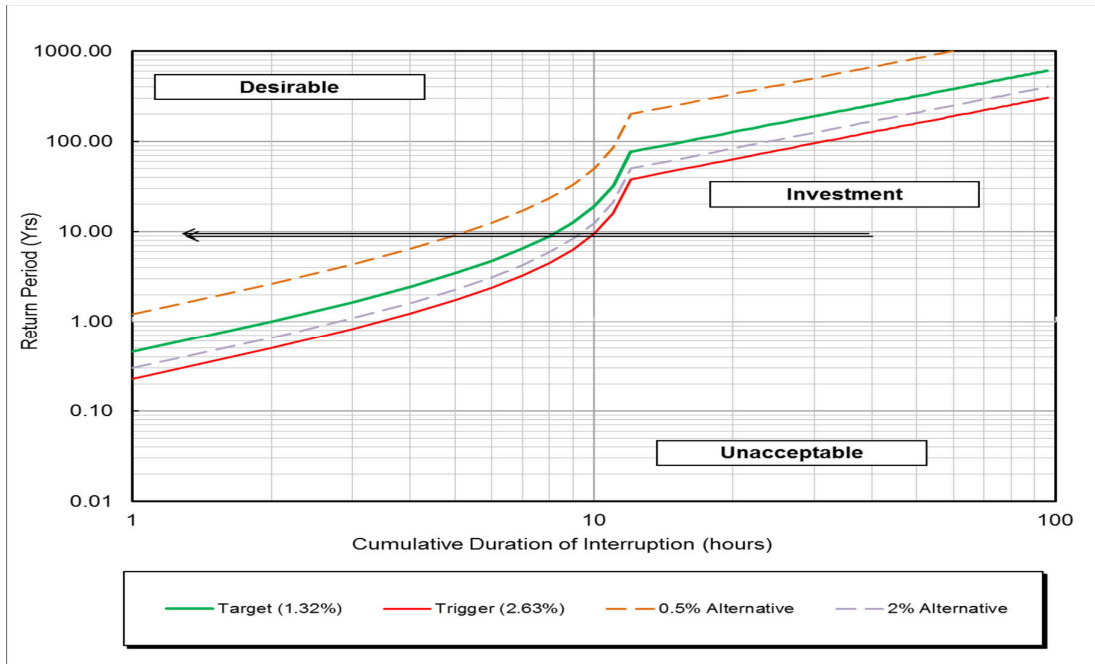


Figure 3.5: New Risk Analysis Graph (Level of Service)

### 3.3.5 Risk Management Policy

The policy defines how the management of risk will be handled throughout TRANSCO. Like all Organizations, the company faces a wide range of risk at all levels of the organization. The Aim of this policy is to communicate why risk management should be undertaken, provide a common risk

management language and a description of the approach that will be adopted by TRANSCO to manage its risk. TRANSCO is committed to manage risk in a proportionate and timely manner compliant with all legal, regulatory, statutory and business obligations.

The Policy forms part of the company's internal control and corporate governance arrangements. It is also recognized that risk management is an integral part of good practice Asset Management.

TRANSCO has identified a number of objectives to support its strategic vision and mission, risk management is a key activity to ensure that all foreseeable events are managed to either minimize the negative impacts, or maximize the positive impacts on the achievement of these objectives should these events occur.

The strategic risk management will be carried by the Risk Management Committee (RMC) on behalf of the Executive Management Team (EMT) and ultimately to ADPC, with the EMT approving the Terms of Reference for the RMC. To support this team a number of Sub Risk Committees have been formed to ensure that the day to day management of risks is carried out and monitored.

Risk Management updates are a standing agenda item on the Monthly Executive Management Meeting and the quarterly Board Meetings, where reports of the top priority risks and associated mitigating actions are discussed.

The risk capacity and appetite will be reviewed on a regular basis to ensure it currently reflects the nature of the industry and the regulatory environment TRANSCO operates, TRANSCO's risk appetite will not exceed its risk capacity.

All risk will be scored using a matrix of probability impact and proximity thus giving a score which enables prioritization of the risks. Where a task is validated with a score of 16 or more for probability and impact, this shall be immediately escalated to the chair of the Risk Management Committee for information and mitigating action approval.

The company risk management policy will be reviewed at least annually to ensure that it reflects any changes in corporate governance, regulatory, legal or other source that impacts on the risk management activities of TRANSCO to ensure that it is fit for purpose.

### 3.3.6 Whole Life Cycle Cost Approach

In considering alternative investment option for network and storage planning, TRANSCO carried out WLCC for all Scenarios and Options considered within the planning period to ensure that its preferred option is the most techno-economical option.

In particular, whole-life costs analysis shall be used to:

- a. Determine planning horizons and the appropriate phasing of development, taking account of growth in demand and changing operating conditions;
- b. Size new transmission mains in conjunction with their associated pumping stations to determine the most economical sizes.
- c. TRANSCO shall use the discount interest rate stipulated by the Bureau for whole-life costing.

The analysis is based on the Net Present Value (NPV) Concept, where the below points were followed:



- a. Capital Investment: The total cost estimate, together with projects cash flows, of the Water Transmission Developments required for each scenario is being calculated, which was based on the formulated cost database of previous of similar projects.
- b. Operation & Maintenance Costs: The expected O&M costs for the required water Transmission Developments was based on the following assumptions.
  - Energy Cost of 0.20 Dhs/KWh
  - Yearly increase of Pump Operational Cost = 1.00% of Operational Cost
  - Pump Maintenance Cost = 1.34% of Construction Cost
  - Yearly increase of Pump Maintenance Cost = 2.50% of Maintenance Cost
  - Pipe Maintenance Cost = 1.34% of Construction Costs
  - Yearly increase of Pipe Maintenance Cost = 2.00% of Maintenance Cost
  - Tank Maintenance Cost = 1.34% of Construction Costs
  - Yearly increase of Tank Maintenance Cost = 2.00% of Maintenance Cost
  - Inflation rate 2018 = 1.96% and 2019 = 3.07%
  - Depreciation period = 40 Years

The above assumption parameters were based on the latest data acquired from DoE.

- c. Revenues: One of the revenues for TRANSCO is the charges from Transmission Use of System, (TUOS) together with the total water expected to be transmitted by the proposed water Transmission Developments. It is not included in the scenario analysis since the yearly revenue is same for all scenarios.
- d. NPV Calculation: Using the data from points a and b above together with a Discount Rate of 4.60%, the NPV of each scenario was calculated.

### 3.4 Network Modelling

TRANSCO uses InfoWater software for system Hydraulic Modelling. Calibration of the model has been completed in 2008 under the Project N4650 "Consultancy Services for Calibration of Water Transmission Hydraulic Model and Implementation of Water Security Standard". For surge analysis and studies, TRANSCO utilizes the Wanda and InfoSurge as its hydraulic modelling and verification tools.

The network models currently used for water transmission planning include the calibrated pipes, updated pumps and reservoirs in operation. The models was constructed, calibrated and updated in accordance with international best practice. The procedures that were used for model construction and field-testing and the criteria applied for determining the adequacy of model calibration is in accordance with the Water Research Centre (WRc), Code of Practice for Network Analysis and the American Water Works Association (AWWA) Manual M32, Distribution Network Analysis for Water Utilities.

TRANSCO under its newly conceptualized Project – “Consultancy Service for Calibration, Study and Optimization of the Water Transmission Network” included the re-calibration of its Hydraulic Model in view of the many changes and system improvements of its transmission network. The calibration scope of the Project considers network flow and pressure monitoring enhancement to ensure that the hydraulic model is a true representation of the actual conditions in the field. In addition, as part of TRANSCO’s concern regarding Water Quality in the transmission network, AMD-WNPDD plans to undertake an OPEX project for Water Quality Calibration which requires, as a pre-requisite, having fully calibrated hydraulic model to be used as the basis for water quality, chlorine dioxide modelling and root cause investigations. This is also in line with the AMD-WNPDD initiative to have a real-time network integrity and operational monitoring.

### 3.5 Level of Service

Water Security Standard defines the Level of Service (LoS) that all licensed companies needs to comply. It sets the measurable standards that will drive the minimum investment that will provide security to the system.

There is only one Level of Service for both TRANSCO and DISCO and the need for updates to this standard for each individual assets of the company are required as it reflects the performance of the individual companies. It should be noted that this Level of Service was entirely based on UK’s data which is technically may or may not be utilized for the emirates as asset conditions for both is entirely different.

TRANSCO completed Project N-12414, Calibration of the Security Standard Level of Service (Level of Service) whose objective is to calibrate the existing Level of Service curve based on available Abu Dhabi Data which includes TRANSCO and DISCO (AADC and ADDC) is now being used by TRANSCO in the risk analysis of its transmission system.

### 3.6 Challenges & Solutions

Over the period until 2030 or even beyond, the development of the transmission system will face many challenges which may generate a major impact on TRANSCO’s core of business, regulatory compliance, and implementation of network development plans among others. The key influential challenges include the following:

#### 3.6.1 Uncertainties In the Realization of Demands

High levels of projected future demand growth along with changing customer and social needs that influence the location and timing of demand development will require greater participation and active engagement with customers.

Moreover, the uncertain market condition which has affected both the private and public sectors in the UAE has resulted in some projects that were either put on-hold or were cancelled. This situation brought planners back to the drawing table to evaluate the demand forecast. Coordination Meetings with Stakeholders were increased to ascertain their plans while on-going developments were revisited and evaluated on site to gauge their actual progress compared to their previously submitted yearly phasing of their developments. This process of re-engineering resulted in cancellation of some water transmission projects and delaying of the implementation of many water

transmission projects to minimize under-utilization of transmission assets due to non-realization of forecasted demand.

As part of the Water Network Development Strategy, TRANSCO-WNDD will continue to engage all Stakeholders through extensive coordination as well as efficient data gathering on site to ensure TRANSCO's water network planning is synchronize with major developments and the government vision.

### 3.6.2 Uncertainties in the Location of Future Generation Plants and Availability of Gas Fuel

One of the biggest challenges which have a huge impact in the development of the Water Transmission Network is the uncertainty of the location of the future Power Generation and Water Production Plants. With the added uncertainty developed from the inception of the nuclear plants and other sustainable power technology, the introduction of RO Plant technology to relieve the expensive co-generation plants, the initiative to conserve the consumption of imported gas among others; are the main influential factors in the formulation of an accurate and firm integrated master plan for both the production and transmission for the Sector.

The uncertainty and absence of a firm Production expansion plan will have an impact on the transmission planning and the timely CAPEX Budget preparation and submissions for its network developments and investments.

To meet its commitments, TRANSCO has now fully involved in assisting EWEC and DoE by proposing future RO plants candidate locations to arrive at a feasible, cost-effective investment portfolio for the Sector.

### 3.6.3 Availability of Transmission Corridors or Right-Of-Way.

Transmission Corridors and Right-of-Way is another challenge which is not under the control of TRANSCO. Though approval for the desired transmission route is already secured from Town Planning, during detailed design stage or even during execution stage of the project, there are instances wherein already approved corridors are rejected which has time and financial impact to the project, not to mention the risk of not meeting the Project timelines and eventually worst the supply to demand areas where the water is required.

Again, TRANSCO will continue to engage Stakeholders most particularly the Department of Urban Planning and Municipalities (DPM) at the early stage of any project (concept & detailed design stage) to minimize this risk and safeguard infrastructure transmission future requirements.

### 3.6.4 Environmental Compliance

TRANSCO, being one of the government entities has always supported endeavours related to protecting the environment. All its projects are fully back-up with environmental compliance studies from well-known consultants in the area. Requirements of other Agencies (i.e. EAD, ESTIDAMA, MASDAR, ENEC, etc.) are all incorporated in the capital governance process within TRANSCO.

TRANSCO in designing the Water Transmission Network will include in its studies and analysis the impact of carbon footprint associated with its design concept. TRANSCO will endeavour to incorporate in the design of its assets considering "green concepts", in aspects as maybe possible and/or applicable, with an overall objective to minimize energy cost thus reducing carbon footprints.

## 4. **Current Transmission Network Characteristics and Operational Philosophy**

### 4.1 Network Characteristics

The TRANSCO water transmission system are typically designed for the evacuation of water from station to station beginning from the source (Production Plant) to intermediate station up to terminal stations, where the water are distributed locally to distribution system. A quite number of Intermediate stations exists wherein transmission and distribution of water are combined and a number of transmission line that functions both as transmission and distribution line, this is where distributions are directly fed from transmission lines.

The characteristic of the system to function both as transmission line and distribution line is now included within TRANSCO supply strategy as more and more distribution system are directly connecting the system. This have resulted to a more complex design of transmission system as it further involves the behaviour of the system in and out of the handover points and the effect of it on the design of pump stations specifically the transient flow (Design of Surge Vessels and Controls). This becomes evident within the last few years with a number of applications from DISCO and from the VIP's. Typical examples of this are DN1600 Shuweihat to Mirfa transmission Line and DN1600 Mirfa to Mussafah transmission line. Both are functioning as transmission with a series of connection supplying the distribution system.

TRANSCO in its network development is now considering the flexibility of pump station to integrate to new pump station design, which is by utilizing the same header with the same head if applicable. This will then have a huge savings in terms of the number of standby pumps and the flexibility of increasing the output of the same in different directions of supply.

Currently the system of TRANSCO is divided into four (4) major types of transmission systems. They are High Pressurized system, Low Pressurized System, Gravity System and the Floating Inline System.

Typically high pressurized systems are from Production to Intermediate Stations, typical example is the transmission line from Qidfa to Summit and Shuweihat to Mirfa IPS wherein a huge quantity of water is evacuated with a requirement of a high head. Low pressurized systems are mostly located on terminal stations where pressure requirement are limited to the requirement of DISCO or as per regulatory standard whichever is higher. Gravity systems are mostly utilized on the areas where terrain is available to provide the minimum required residual pressure and to lessen the operational expenditures (OPEX) of transmission lines. This is evident in Al Ain Region where the slopes are available. Floating in line system was used in Al Ain region at Al Ain Reception Pump Station where Umm Ghaffa tanks are floated to the system to provide flow and pressure at peaking hours; this is in similar manner reducing the operating expenditures of TRANSCO. According to the existing TRANSCO network configurations, typical pressure for High Pressurized system ranges from 16 to 25 bars and Low Pressurized system is from 10.0 bars below and are mainly categorized in terms of its geographical location in the system.

Operational philosophy of transmission system follows the typical dispatch of water from station to station and station to DISCO handover points. Control of the system is either through flow or pressure requirements at each interface points with targets on daily basis coming from DISCO. A number of Transmission facilities are on unmanned operation with manual overrides in cases of an event with communications from pump station to Water Control Centre (WCC). Contingency plans

for each pumping stations are being implemented which documents the hierarchy of reporting, defining steps and fixing of immediate problems that may results to temporary outage of supply to customer.

## 4.2 Key Asset Data and Statistics

### 4.2.1 Water Transmission Facilities

The Detailed data and information of all the existing Water Transmission System and Facilities (i.e. pumps, pipelines and reservoirs) as of 2018 is included in Appendix “C” (Water Systems Data and Capabilities) for information and reference. As gathered from the Asset Information Department (AID), the latest statistics based on the end of 2018 totals, TRANSCO’s water transmission network consists of over 3,601 kms of pipelines ranging in sizes from 500 mm to 1600 mm in diameters. This pipeline is predominantly made of ductile iron and carbon steel; and partly glassfiber reinforced plastic (GRP) interlinked by a combination of 52 nos. regional production, transfer and terminal pumping stations. These collectively have a pumping capacity of almost 3,544 MIGD. The water network is supported by 126 nos. storage reservoirs with a total capacity of over 664 MIG.

### 4.2.2 Water Transmission Network Performance Statistics

The following are the summary statistics of TRANSCO’s business operation based on recorded actual systems data performance and capabilities for the Year 2018 as gathered from the Network Management Department of TRANSCO’s Network Services Directorate.

Table 4.1: Water Transmission Network Performance Statistics

Statistics	2018 Actual Data
Total Quantity of Water Supplied-Production (Gross):	267,419MIG
Total Quantity of Water Transmitted:	257,597 MIG
Total Quantity to ADDC System:	169,216 MIG
Total Quantity to AADC System:	62,965 MIG
Total Quantity to NE Export:	25,295 MIG
Total Quantity to LARS Export:	122 MIG
Water Peak Load, Maximum (1 Day Peak):	805.36 MIGD (10-Sep-2018)
ADDC System	523 MIGD
AADC System	203 MIGD
NE Emirates System	80 MIGD
LARS System	0.31 MIGD
Water Peak Load, Average Weekly: (Week No.)	744.74 MIGD (Week 39)
Water Systems Availability:	95.24 %

Source: BST Data\NOD Water Database Year 2018

## 4.3 Network Configuration

### 4.3.1 Network Topology

A Geographical Map as well as the Schematic Diagram of the overall existing Water Transmission System as of 2019 is enclosed in Appendix A, Drawings. In brief, the water transmission network covers the entire Abu Dhabi Emirates transferring and supplying water to ADDC and AADC areas of

jurisdictions from the five established Productions sites strategically located within the Emirates; at (formerly Al Dhafra Region) from Mirfa and Shuweihat Plants, at Abu Dhabi Mainland Region (formerly Eastern Region) from Taweelah Plants, and at Umm Al Nar Plants for the Abu Dhabi Island Region, all are owned and operated by the respective IWPP's. Outside the Emirates, is the transmission network from Fujairah extending from Qidfa until Al Ain which caters partly the main supply for the Al Ain Region and that of the Northern Emirates through various tap off connections of the FWTS supplied based on quantities as per mutual agreements with the authorities of FEWA, SEWA and in the future DEWA.

### 4.3.2 Transmission System Connections

The Abu Dhabi transmission system is mainly supplied with water transferred from the production facilities located along the coast of Abu Dhabi catering to the demand requirements of its main customers the ADDC (Abu Dhabi Island, Abu Dhabi Mainland and Al Dhafra Regions) and AADC (Al Ain Region). With the construction of an additional water and power source at Fujairah in support to the Government of Abu Dhabi's initiative to support particularly the Northern Emirates and to bolster the domestic water supply security, TRANSCO's water transmission system have been increasingly integrated with its neighbouring Emirates through their respective concerned Authorities like FEWA, SEWA and soon DEWA. With these arrangements, one of TRANSCO's core of business is now demonstrated and fulfilled with the current level of expansion and development works as well as in the operation of the transmission network in the Northern Emirates region. The Drawing No. 5 under Appendix A of the NE Topology illustrates the extent of the Northern Emirates interconnections with the ADPC system which now expand to the demand centers of Ras Al Khaimah at Al Jazira Al Hamra and Burairat; to Umm Al Quwain and to Fujairah (Fujairah City, Dibba) and Sharjah (Kalba, Khorfakkan) with the completion of the implemented respective TRANSCO supply schemes in the Region except that for Kalba which is currently under execution.

Previously, initial undertakings are being polished between the inter-governmental organizations of the Gulf Cooperation Council's (GCC) possibly for the proposed establishment of a water transmission grid interconnections among the GCC member states whose overall aim is the security of supply from an unforeseen catastrophic event or scenario happening in the Gulf Sea or Member States which can be achieved through cooperation and sharing from this strategic scheme.

The summary of TRANSCO's interconnection details with its regulated customers ADDC and AADC is illustrated in Table 4.2 below. In fulfilling TRANSCO's effort to account all water entering and exiting from its transmission system, TRANSCO have identified those points, register and enter into an agreement with both GENCO's and DISCO's which is called "Connection and Interface Agreement" that are strictly complying with the requirements of Water Transmission Code (WTC); and that of the Metering and Data Exchange Code (MDEC). TRANSCO requires registering all entry points (inflows) and exit points (outflows) from its network in order to get its revenue through the Transmission Use of System (TUoS) charges.

Based on current information (as of 31 March 2019 Status), the total numbers of identified interfaces or exit points with the Distribution Companies is 259 wherein about 165 connections are with ADDC while about 74 connections are with AADC. In the Northern Emirates TRANSCO have

already signed about 20 connection agreements with FEWA and SEWA and have already identified more interfaces of the newly completed supply pipelines to the VIP Farms and Palaces in the Region that are yet to be agreed and processed. On the production side (entry points) the total is 50 points which leads to an overall total of 309 DMP's for the whole transmission system. A schematic representation of the locations of these interfaces can be found under the Appendix A –Drawings, Backbone of the Water Transmission System (Year 2019-2026) - Schematic Diagram.

Below is a table representing the current status of interface points including information whether they are MDEC metered and are already integrated to the Water Network Operations Directorates systems based on the information gathered from Asset Information Department (AID).

Table 4.2: Status Summary of the Identified Interfaces Points with DISCO's/NE/GENCO's

Locations	Company Name	No. of DMPs	MDEC Metered	Integrated to LDC
Exit Points	Abu Dhabi Distribution Company	165	164	160
	Al Ain Distribution Company	74	74	65
	Other (NE-FEWA/SEWA)	20	15	8
Totals		259	253	233
Entry Points	AMPC	0	0	0
	Fujairah (Sembcorp)	6	6	6
	Shuweihat (SCIPCO)	3	3	3
	Taweelah A1(GTTPC)	5	5	5
	Taweelah A2(ECMS)	2	2	2
	Taweelah B (TAPCO)	5	5	5
	APC	15	4	4
	Shuweihat - S2 (6 meters / 4 DMPs)	4	4	4
	Fujairah F2 (8 meters / 4 DMPs)	4	4	4
	MIPCO (9 meters / 6 DMPs)	6	6	6
Totals		50	39	39
Overall Totals		309	292	272
% Total DMPs			94.50%	88.03%
Total for DISCO (ADDC & AADC)		239	238	225
% age of Total DMPs			99.58%	94.14%

#### 4.4 Water Transmission Supply Zones

Based on the TRANSCO developed planning strategy, Abu Dhabi including the Northern Emirates Water Transmission Network has been divided into Five (5) Supply Zones defining the areas mainly served by the particular existing Desalination Plants and Pumping Stations. Based on last Year's planning statement TRANSCO had adjusted the supply zone boundary between Zones 2 and 3 which is now split corresponding on the actual regional geographical boundary divisions among the Mainland (Eastern) and Al Dhafra (Western) Regions.

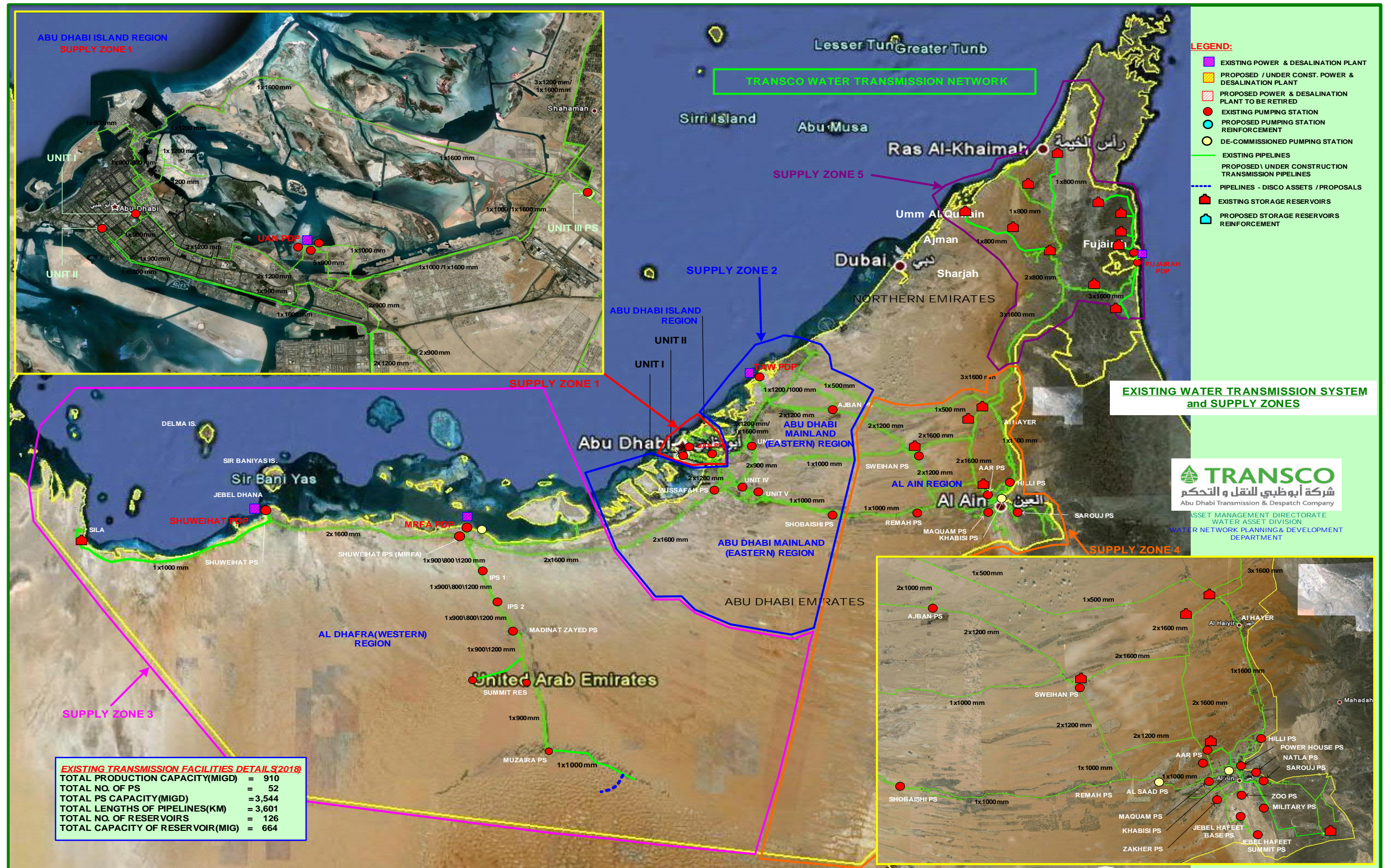
The Five Zones are shown on Figure No. 4.1 (See related Drawing Nos. 2 and 3 in Appendix A-Drawings) which are enumerated and described as follows:



- a. Supply Zone 1: Abu Dhabi Island and Adjacent Islands.
- b. Supply Zone 2: All areas extending from Taweelah to Unit 3 and Ajban Pumping Station, Areas towards Abu Dhabi-Dubai Border. Areas supplied from Shuweihat and Mirfa starting from the Al Dhafra (Western) Region border up to Mussafah PS, Unit IV and Shobaishi Pumping Stations.
- c. Supply Zone 3: All Areas extending from Sila to Mirfa; Mirfa towards Liwa\Muzairah and from Mirfa up to the Abu Dhabi Mainland (Eastern) Region border.
- d. Supply Zone 4: Al Ain Region, no available Production Plant but can be supplied from three main sources, namely: from Shuweihat-Mirfa-Umm Al Nar P&DP or Taweelah P&DP or Fujairah P&DP or combination of the three.
- e. Supply Zone 5: Northern Emirates (i.e. FEWA, SEWA, DEWA and RAK) supplied from various Interface Points of the FWTS.



Figure 4.1: Water Transmission Network Supply Zones





## 4.5 Mode of Supply and Supply Limitations

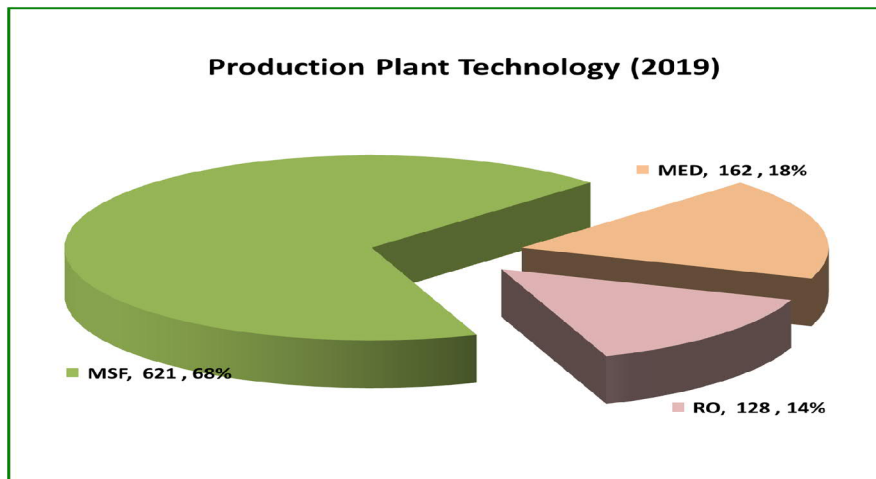
### 4.5.1 Sources of Water

The major sources of water for the whole ADPC system is potable water produced from production plants located along the coast of Abu Dhabi and Fujairah utilizing three types of conventional technologies which are thermal (MED and MSF) and non-thermal (RO) processes. Currently there are five (5) Desalination Plants sites as shown below with their corresponding current existing total plant capacities that are owned and operated by different IWPP's. Figure 4.2 below illustrates the percentage composition of the technology currently utilized in the production of water supplying the transmission networks according to the detailed capacities on Table 4.3. The Figure 4.3 below presents the annual comparative illustration of each technology based on the growth of production plants to sustain the increasing demand of the system..

Table 4.3: Existing Production Plant Site & Capacities by Technology - Gross (Year 2019)

Plant Site	Existing Capacity (MIGD)	MSF	MED	RO
Umm Al Nar / Sas Al Nakhl (Arabian Power Company)	95	88	7	0
Taweelah A1 (Gulf Total Tractebel Power Company)	85	32	53	
Taweelah A2 (Emirates CMS Power Company)	51	51		
Taweelah B (Taweelah Asia Power Company)	162	162		
<b>Total Taweelah</b>	<b>297</b>	<b>245</b>	<b>53</b>	<b>0</b>
Al Mirfa (Mirfa International Power & Water Company )	53	23		30
Shuweihat 1 (Shuweihat CMS Power Company)	101	101		
Shuweihat S2 (Ruweis Power Company)	101	101		
<b>Total Shuweihat</b>	<b>202</b>	<b>202</b>	<b>0</b>	<b>0</b>
Fujairah F1 (Emirates SembCorp Water &Power Company)	101	64		38
Fujairah F1 Ext.(Emirates SembCorp Water &Power Company)	30			30
Fujairah F2 (Fujairah Asia Power Company)	132		102	30
<b>Total Fujairah</b>	<b>263</b>	<b>64</b>	<b>102</b>	<b>98</b>
<b>TOTAL Available Capacity (MIGD)</b>	<b>910</b>	<b>621</b>	<b>162</b>	<b>128</b>

Figure 4.2: Existing Production Plant Technology Composition



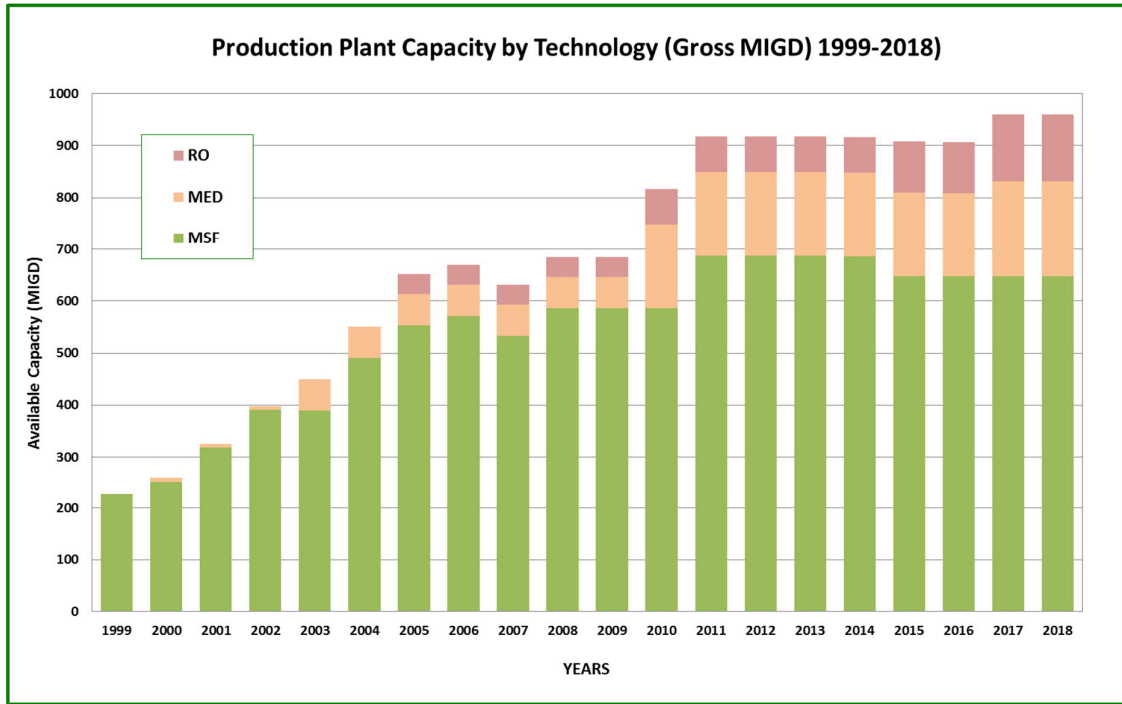


Figure 4.3: Annual Production Plant Capacity by Technology

### 4.5.2 Supply Regime

The creation of the above five (5) supply zones enables TRANSCO to study and clearly define the surplus or shortfall in water supply within each zone as well as to determine the most economical import-export route between these zones.

Figure 4.4 demonstrates the existing Supply Zones of the whole water transmission network including the established import-export routes and the possible mode of transfer capabilities between each supply zones. Supply Zone 1 is mainly supplied by UAN Plant and as the UAN East and West Plants are not yet de-commissioned it will still has the capability to supply its adjacent Zone 2. This supply mode will significantly change once these Plants will be removed from the system as Zone 1 will now rely on Zone 2 for waters coming from Taweelah and from Shuweihat through Mussafah PS to supplement its demand in the future. This shall be the supply scenario unless a new plant will be constructed at UAN to replace the decommissioned capacity. Throughout the contents of this statement , UAN E and W was already retired as of April 2019 following a major decision of EWEC to retire early the net dependable water capacity of these Plants without adhering to the End of Term Agreement which was previously end of year 2020. Supply Zone 2 mainly supplied by Taweelah, has the overall capability and flexibility to supply all its neighboring Zones 1 and 4 through the established routes and facilities towards each Zone as shown. With the adjustments made on the Zonal boundary between Zones 2 and 3, part of the Supply Zone 2 areas will be supplied from Zone 3 (Shuweihat) similarly as before though they are now bounded within Zone 2. For Supply Zone 3, with its current source of supply from Shuweihat and Mirfa Plants, it has the facilities to supply Zone 2 only but with the available transmission network within Zone 2 water can reached towards

Zone 1 using the Lot M scheme through Mussafah PS which is now capable of transferring water to the Abu Dhabi Island and even until Al Ain through Unit IV PS.

Supply Zone 4 (Al Ain Region), has no existing Water Production Plants due to its geographic location and is fully dependent for its supply from all the possible developed supply routes from:

- Zone 2 through the Taweelah to Ajban
- Zone 2 Unit IV to Shobaishi corridors
- Zone 5 (Fujairah) through the FWTS

Zone 5 consumers are basically supplied by the Fujairah system which has also the capacity to provide water to Zone 4 (Al Ain). But in view of the recent successful commissioning on part of the planned strategic schemes, particularly during emergency cases, the Fujairah water is now capable to reach or transfer water back by gravity supply to Zone 2 via Sweihan-Ajban-Taweelah Unit III system and the new system utilizing some of the existing facilities and routes of Zone 4 towards Abu Dhabi which is from Sweihan-Remah-Shobaishi to Unit IV scheme.

Similarly, due to the nature of its distribution network, Supply Zone 4 which is Al Ain Region was also sub-divided into three (3) Supply Zones with the same purpose of water allocation from the available supply from designated future major sources, see Figure 4.5 below which are described as follows:

AA Supply Zone 1: Supplied from Sweihan to Remah Bypass line (1x1000 mm).

- Al Saad, Al Yahar, Remah, Al Maquam Palace, Al Gharaba Palace
- Direct connection from Shobaishi – Remah – Khabisi DN1000 transmission line.

AA Supply Zone 1A: Supplied from Unit IV Shobaishi PS (1x1000 mm).

- Al Khazna

AA Supply Zone 2: Supplied from Summit Reservoir Tap Off 9A (Gravity-1x1600 mm)

- Hilli, Al Hayer, Faga, Shoaib, Al Nabag, BBS, Al Oha Khaleef

AA Supply Zone 2A: Supplied from Summit Reservoir by-passing Al Ain Reception. (1-1200 mm)

- Al Dhama, Al Khabisi

AA Supply Zone 3: Supplied by AAR PS New Pumping Station (Pressurized)-(2x1600 mm)

- Al Maquam, Jimi Wadi Farms, Al Maquam Palace and Shuaiba Farms
- Zakher, Zoo and Sanaiya, Al Natlah and Sarouj, Power House
- Military, Mazyad, Umn Ghafa, Al Dhaher and Khreyr
- Jebel Hafeet, Al Wagan and GIC

Supply Zones 2 and 2A are supplied by gravity from the Fujairah IPS while Supply Zone 3 shall be considered the pressurized system with the establishment of a new pumping system at AAR that are intended to by-pass, directly supply the consumers and ultimately paves the way for the de-commissioning of most of the TRANSCO existing pumping station in Al Ain Region except Jebel Hafeet Base.

The above five (5) Supply Zones used for planning are also compared to the Unit Commitment Zones being used by TRANSCO-Networks Operations Directorate for dispatch purposes. The established five Supply Zones, which is intended for transmission planning, includes the same coverage areas of

the identified water zones in the LDC established Unit Commitment Zones whose separate purpose is for the optimized operation and economic dispatch of the production system on a daily basis. The Figure 4.6 below illustrate the schematic view of the developed Unit Commitment (UC) zoning scheme by NOD in collaboration with EWEC as against the planning supply zones. The UC Zoning scheme is composed of 20 major demand centers of the network segregated based on the supply capability of the transmission system and according to the allocation of available water from Production facilities.



Figure 4.4: Water Transmission Supply Zones Showing the Import and Export Capabilities and Mode of Transfer

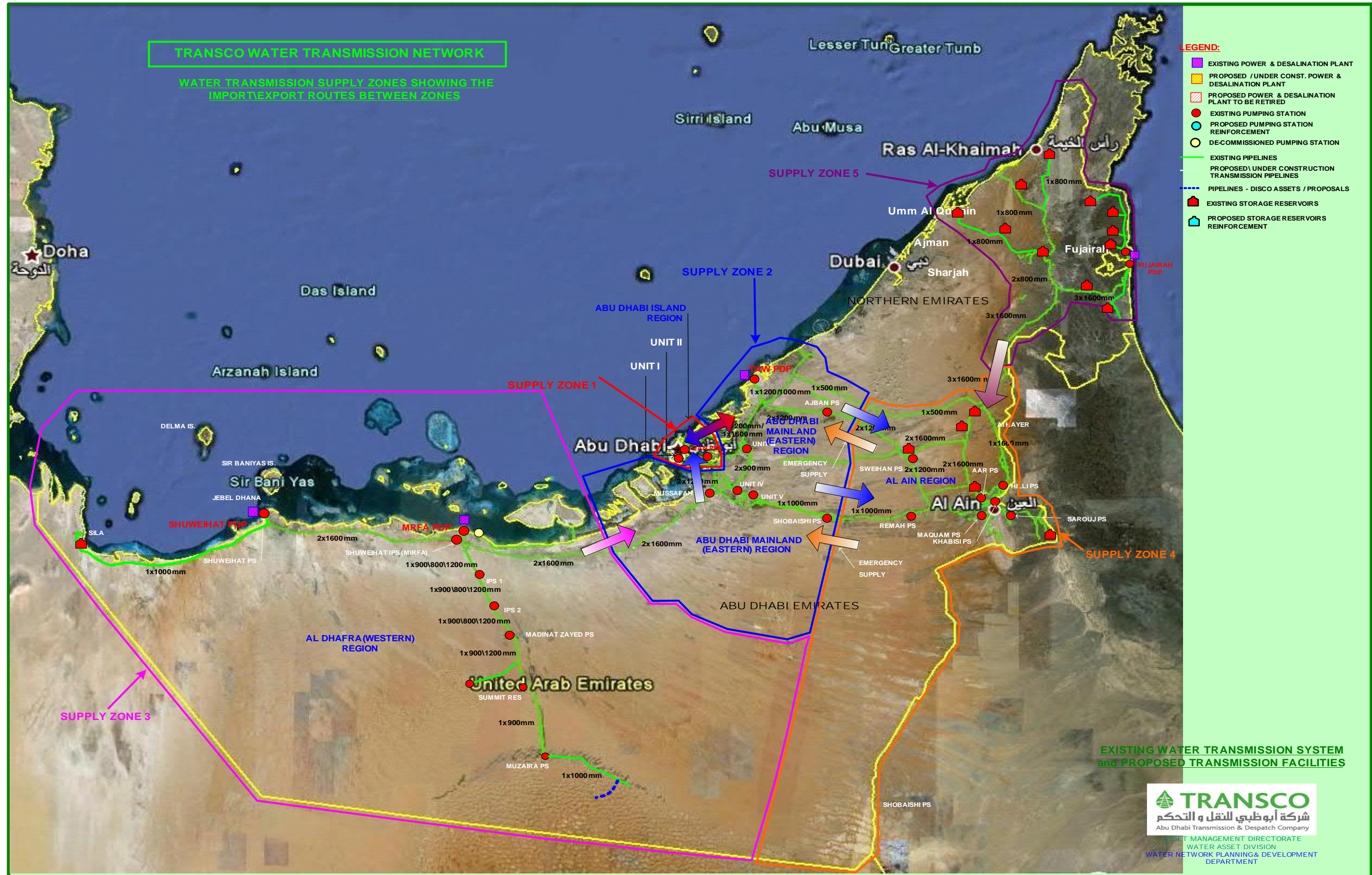
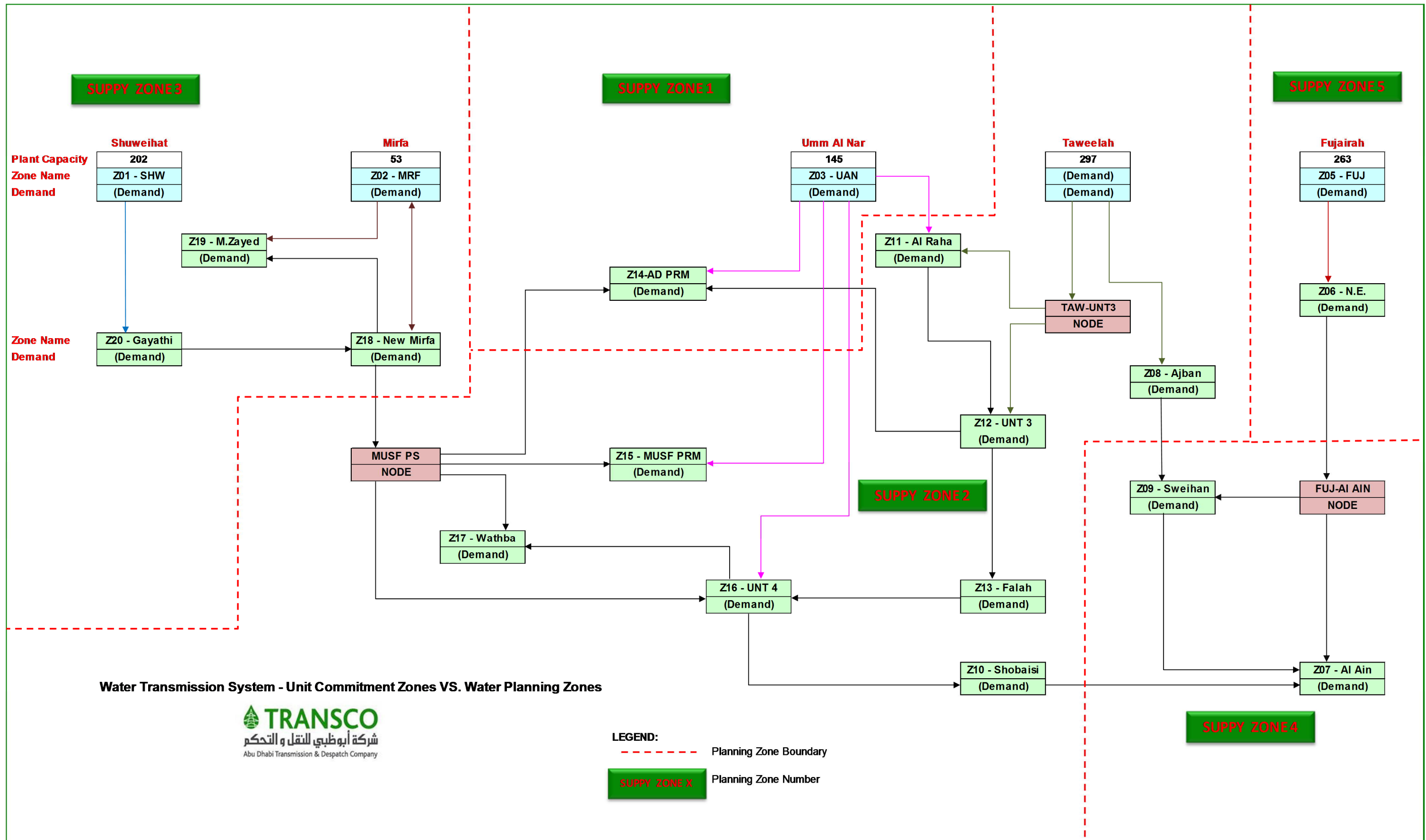








Figure 4.6: Unit Commitment Zoning Scheme VS. Water Transmission Planning Supply Zones



### 4.5.3 Supply and Demand Management

TRANSCO is obliged under its license conditions to operate and maintain the water transmission system in accordance with defined or agreed security standards. Within TRANSCO, the Water Network Operation Division under the Network Operations Directorate (NOD) is entrusted to manage and control the scheduling and dispatch of water to balance production with potable water demand at strategic locations in the transmission system. These locations include desalination outlets or entry points and all potable water pumping stations and storage assets up to the interface or exit points with the distribution.

As per WTC procedures the DISCO shall provide to TRANSCO their daily water demand targets or estimates which then will be translated into operational scenario or schemes based on available water production and capabilities of the transmission system guided by the principles of the economic despatch being implemented. The actual data delivered are monitored and documented; records of them are available at NOD's disposal.

Critical in the achievements of the demand targets will be the production and supply constraints that exist within the system which limit TRANSCO's transmission capability to meet its despatch plans and target as per demand requirements.

Presently but on a limited scale now as compared before, demand and supply management is still being enforced on some areas due to transmission constraints. This is experienced in the transmission segment of Mirfa to Madinat Zayed and Liwa Areas where ADDC system is implementing a restricted timed supply regime due to transmission constraints wherein the present and future demand cannot be completely satisfied from the current level of supply being despatch to these areas. This situation is expected to be mitigated by Q4-Year 2021 with the completion of the transmission schemes from Mirfa to Liwa in order to complement the shortage of supply to these localities of the ADDC distribution.

## 5. Demand Forecast and Production Overview

### 5.1 Introduction

With the creation of the Emirates Water And Electricity Company (EWEC) in November 2018 as the new subsidiary company of the Abu Dhabi Power Corporation (ADPC) replacing the Abu Dhabi Water and Electricity Company (ADWEC) as the single buyer and seller of water and electricity in the Emirates of Abu Dhabi.

EWEC, retains its obligation “to ensure that there is sufficient production capacity to satisfy all reasonable demands for water and electricity in the Emirate; and to engage in the economic purchase of water production and electricity generation capacity.”

In order to meet the above legal requirements EWEC prepares the followings annually:

- a. A long Term Electricity & Water Demand Forecast
- b. A Statement of Future Capacity Requirements

Generally, EWEC prepares annually the water demand forecast for the following main purposes;

- a. Planning the water production installations.
- b. Calculation of Fuel Requirements
- c. Calculation of BST (Bulk Supply Tariff)

Accordingly within the provisions of the Water Transmission Code (WTC), EWEC is designated to prepare and submit to TRANSCO and all Users a coordinated long term demand forecasts in which TRANSCO shall utilize for its planning purposes.

The provided water demand forecast and production expansion and retirement plans of EWEC are the main starting data and information which TRANSCO should consider in the water supply network planning of its transmission system. These task shall include analyzing the capability of existing network and designing an economically feasible new system development schemes for a specified planning horizon, which for this Statement is for years 2020 to 2026.

### 5.2 Analysis of Historical Data, Assumptions & Forecast Methodology

#### 5.2.1 Data Input Time-line

The Figure 5.1 below shows the data submission time line requirements to enable TRANSCO prepare its strategic plan and annual 7YPS.

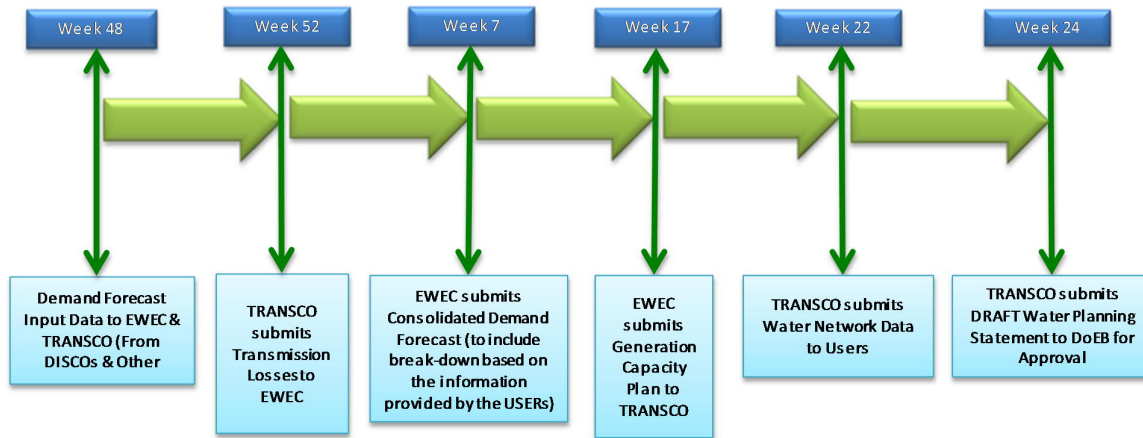


Figure 5.1: Data Submission Time Line Requirements

To enable TRANSCO to start its planning phase, it must receive the long term demand forecast prepared by EWEC by Week 7 of the current year, as mutually agreed in the WTC Review Panel with DoE's concurrence concerning water planning data provisions. The data obtained from EWEC must be a detailed area-wise breakdown of the demand forecast intended for TRANSCO network expansion plans and water balance requirements. This type of details is essential to enable TRANSCO to incorporate and reflect geographically at each respective demand nodes of the hydraulic model based on the established Connection & Interface Points with the DISCO's. The timely provision of these planning and analysis data is essential in the delivery of the TRANSCO 7 YPS as per its obligation to DoE.

### 5.2.2 Historical Data – Water Supply and Production Patterns

The water demand forecast is updated by EWEC on a yearly basis which are formulated based on the data and information supplied by ADDC, AADC and TRANSCO; and is essentially required for adequate assessment and planning of the existing and future transmission network. Because of the various factors attributed to the growth and development of the Emirate of Abu Dhabi including the Northern Emirates, in general terms, the water demand requirements is notably increasing yearly.

The annual historical records of the total water supplied and the average daily supply of the system from Years 1990 to 2018 is presented in Figure 5.2; while the peak water supplied (actual) to the transmission network from year 1999 to 2018 is represented in Figures 5.3 below. The peak water supply had increased considerably from 220 MIGD (in 1999) to 828 MIGD (in 2018) translating to an annual growth of 7.20%. It is to be noted that there was a drop of about -0.24% of the actual peak supply between years 2016 and 2017 whereas between years 2017 and 2018 of -0.36%. For the similar period, the total annual production had evidently risen from 70,917 MIG to 267,107 MIG about 277% or at an annual growth rate of 7.2% posting a slight decrease between 2016 and 2017 of approximately -0.83% and about -0.34% between 2017 and 2018.

Considering a shorter duration, Figure 5.4 below provides a clearer outlook of the peak water supplied on a regional level from 429 MIGD in 2004 to 828.0 MIGD in 2018 which translates to an annual growth rate of about 4.8% during these periods. Based on the above results as portrayed by these below illustrative Figures, it is worth mentioning that the Emirates water demand requirements denotes an increasing trend which is mainly focused in the Governments' future policies and visions of a developed and sustainable Abu Dhabi; in conjunction to its main aspirations to support the other Emirates' needs and developments through the provision of enough water and power. The noted decrease in the total water supplied between the succeeding Years of 2015, 2016 and 2017 could probably be attributed on the imposition of the tariff increase that had forced the consumers to save the precious water and the negative impact on the introduction of the Value added Tax (VAT) on the manner of usage on the part of the consumers.

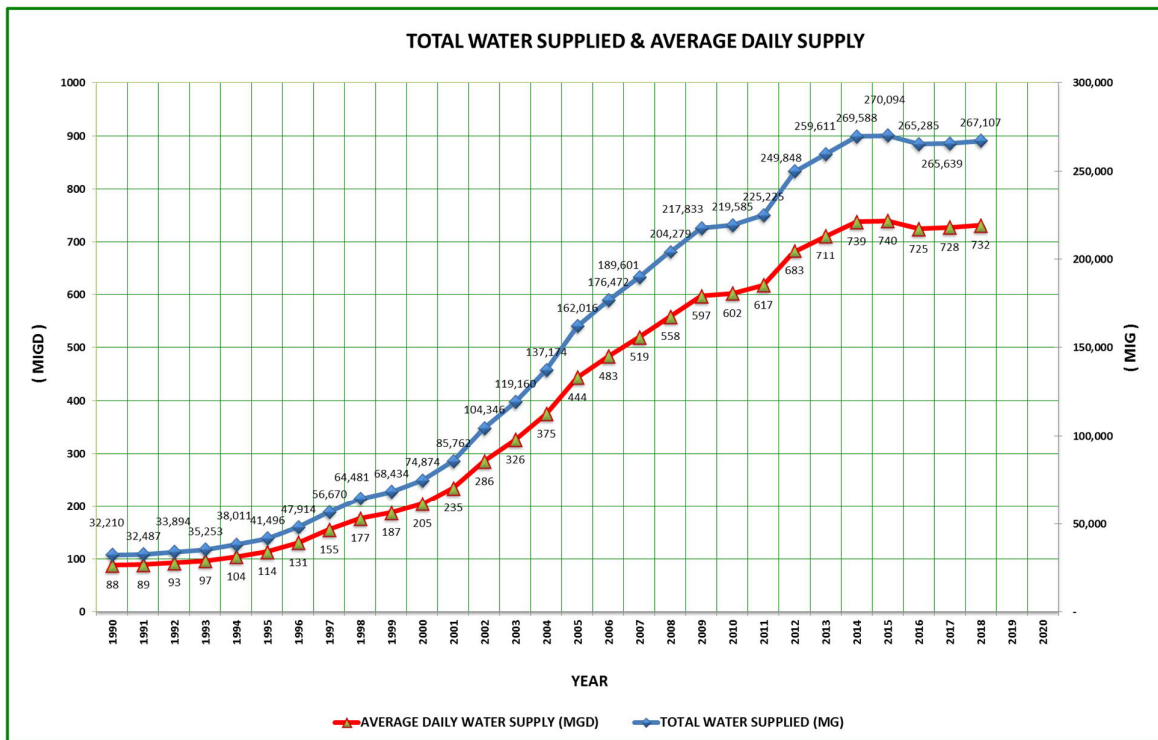


Figure 5.2: Water Supplied and Average Daily Supply Historical Trend (Source EWEC Statistical Record)

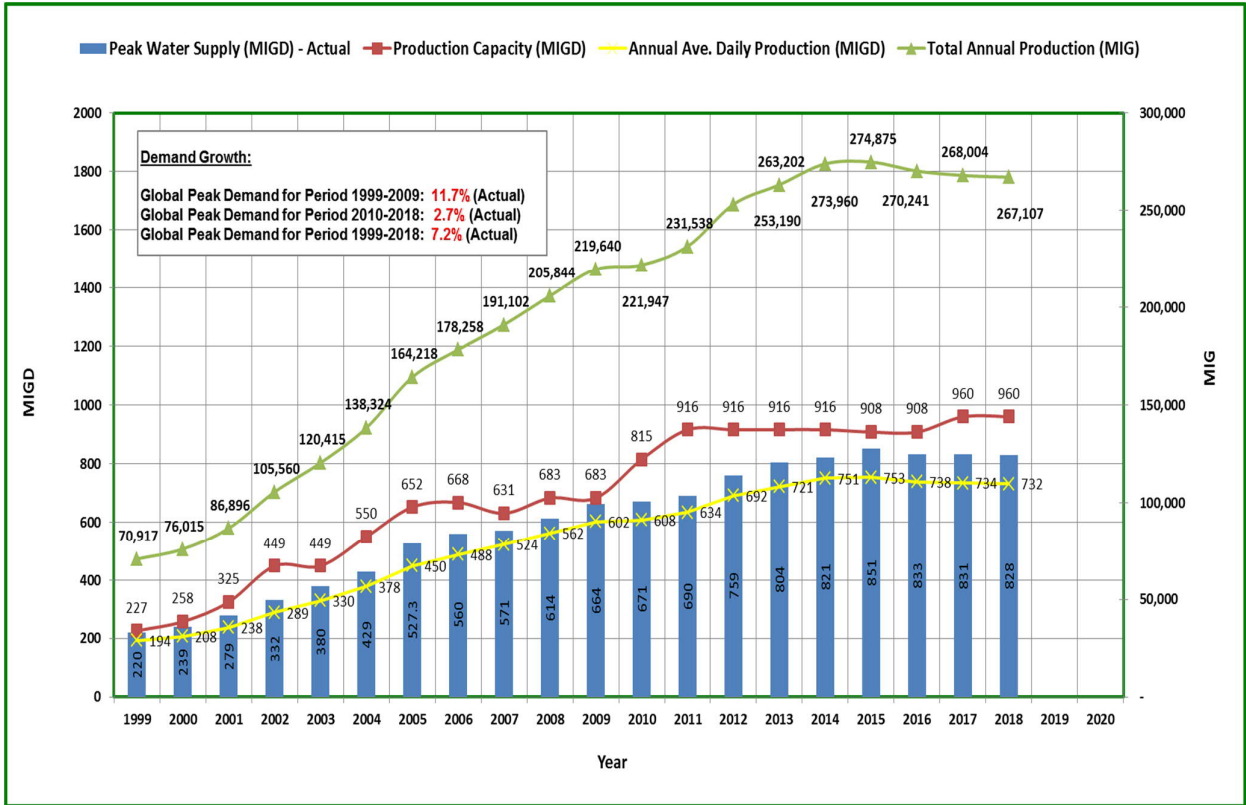
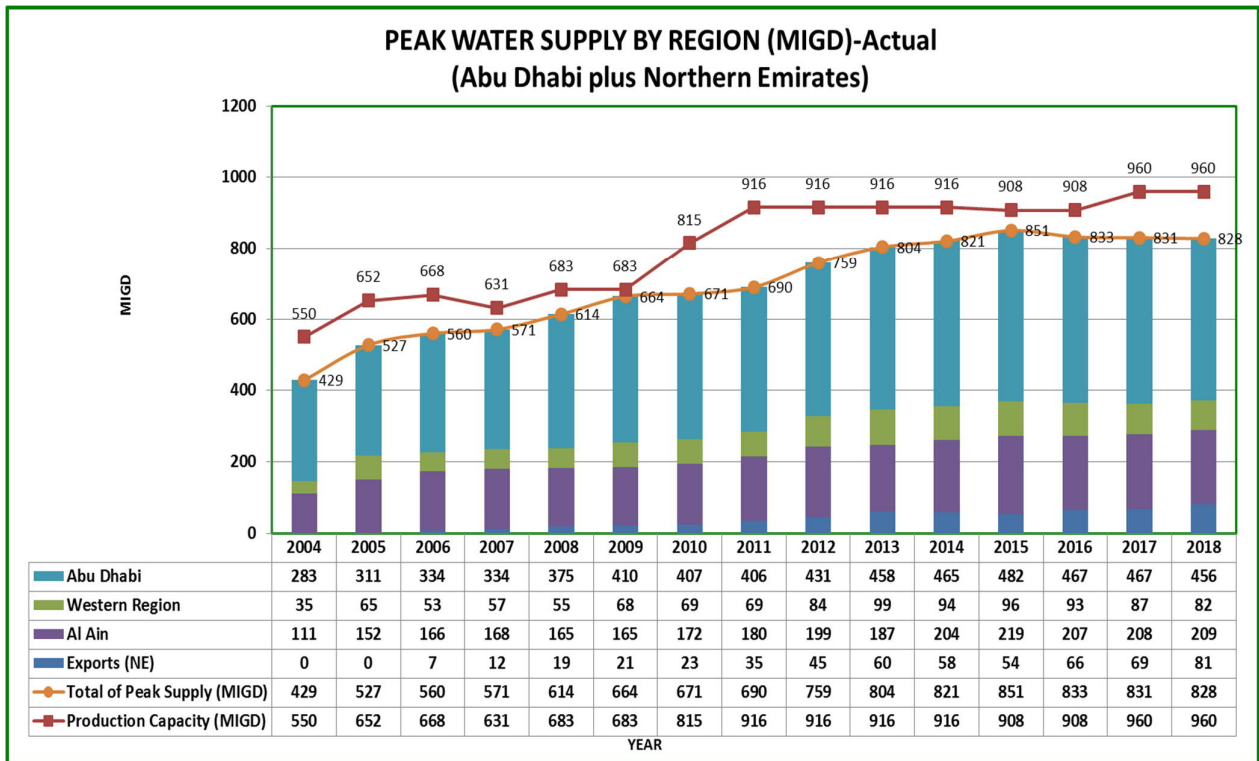


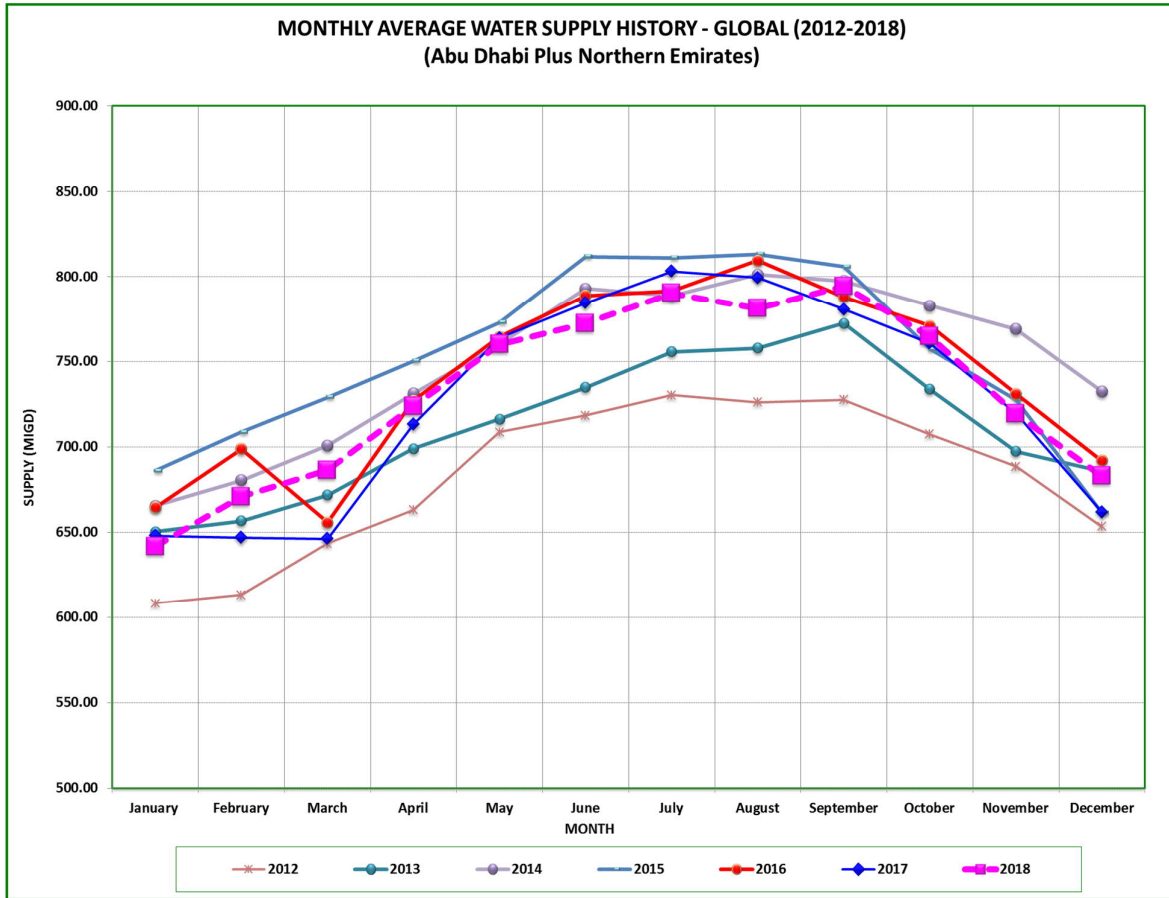
Figure 5.3: Water Supply and Production Historical Trend



Source: Years 2004 to 2018 from EWEC Statistical Data

Figure 5.4: Peak Water Supply\* by Region and Production Historical Trend (2004-2018)  
 (\* At the Time of System Peak Supply)





Source: Years 2012 to 2017 from EWEC Statistical Report 1998-2017 / Year 2018 from TRANSCO Compiled Water Database Report Data

Figure 5.5: Monthly Average Actual Water Supply History - Global (2012-2018)

The Figure 5.5 above illustrates the annual supply pattern and it provides an outlook of the actual global water supply on a monthly basis starting from the year 2012 up to 2018. It provides an overview of the seasonal change in the supply pattern of the water demand wherein the peak monthly average demand may be easily forecasted or identified during a certain consumption year. These values is of course influence by various factors that adversely contribute in properly establishing an actual representative pattern of water usage. The Year 2015 actual figures exceeds all monthly recorded averages from January to September which means that the water demand requirements is at pace with growth in population and the developments being implemented in Abu Dhabi and the neighbouring Emirates. Succeeding years 2016, 2017 and 2018 portrays a downward trend of supply on the manner of consumer consumption.

In the absence of the EWEC’s monthly average global supply statistics for year 2018, the AMD compiled records of the water database from Water Network Operation Division was used.

### 5.2.3 EWEC Forecast Assumptions\Projections

The demand forecast, compiled by EWEC, is based on a set of assumptions that influence both value and timing of the demand on the network. It is important to recognize that these assumptions exist and hence note that any change in an assumption is likely to impact either demand phasing, demand value or both.

EWEC's water demand forecast groups the consumers into three main categories to forecast the peak water demand which consists of the residential (includes domestic, house gardens, mega project residential part); irrigation (includes agricultural, bulk, mega project landscaping); and industrial (includes industrial and district cooling). In order for EWEC to arrive to a more precise analysis and conclusion on their demand forecast and the various factors that affect them, the demand is further split into eight basic categories which are domestic, villas, shabiyats, town houses, agricultural, mega projects, industrial and bulk.

The source of EWEC's data originates from the Census (i.e. thru Statistics Center of Abu Dhabi-SCAD), the Abu Dhabi 2030 Master Plan (i.e. thru Urban Planning And Municipalities), the demand projections for the mega-projects from developers and from historic water flow database of TRANSCO, AADC, ADDC and ADSCC. EWEC adopts several approaches in their forecast as they termed them the top-down, bottom-up and center approaches, which is either one or a combination two or of all the three approaches depending on several factors that is directed mainly by the availability and quality of the necessary available data to support the forecast.

EWEC's forecast considers all possible scenarios of demand development resulting into the creation of the low, most likely and high demand Scenarios. All these scenarios follow the same probabilistic methodology producing a demand probability envelope that includes all possible demand uncertainties and sensitivities considered in the analysis.

Demand uncertainties that are modelled in the water demand forecast model include:

- ✓ Rates of Consumption  
These are affected by factors such as demand side management and tariffs etc. Sensitivities to these factors are therefore modelled for every year of the forecast.
- ✓ The size of each of the demand categories  
These are also changing throughout the forecast due to factors such as migration, population growth, financial crisis effect, mega projects progress (lag factor, phasing factor, relocation factor, economic activity, losses, demand patterns, etc.), market conditions and government policies.

The EWEC's water demand forecast uses statistical software to represent these uncertainties via a probability distribution curve. Each uncertainty, whether rate of consumption, growth rate, occupancy rate etc., is represented with a probability distribution curve. The most likely value, i.e. mean, is the value used by EWEC for desalination capacity expansion planning.

### 5.2.4 EWEC Forecast Methodology

The Figure 5.6 below, which is the "Demand Forecasting Methodology Flow Chart" courtesy of EWEC, is reproduced herein to provide a clear overview of the general methodology EWEC had pursued in order to provide the desired level of water demand forecast accuracy based on prevailing factors,

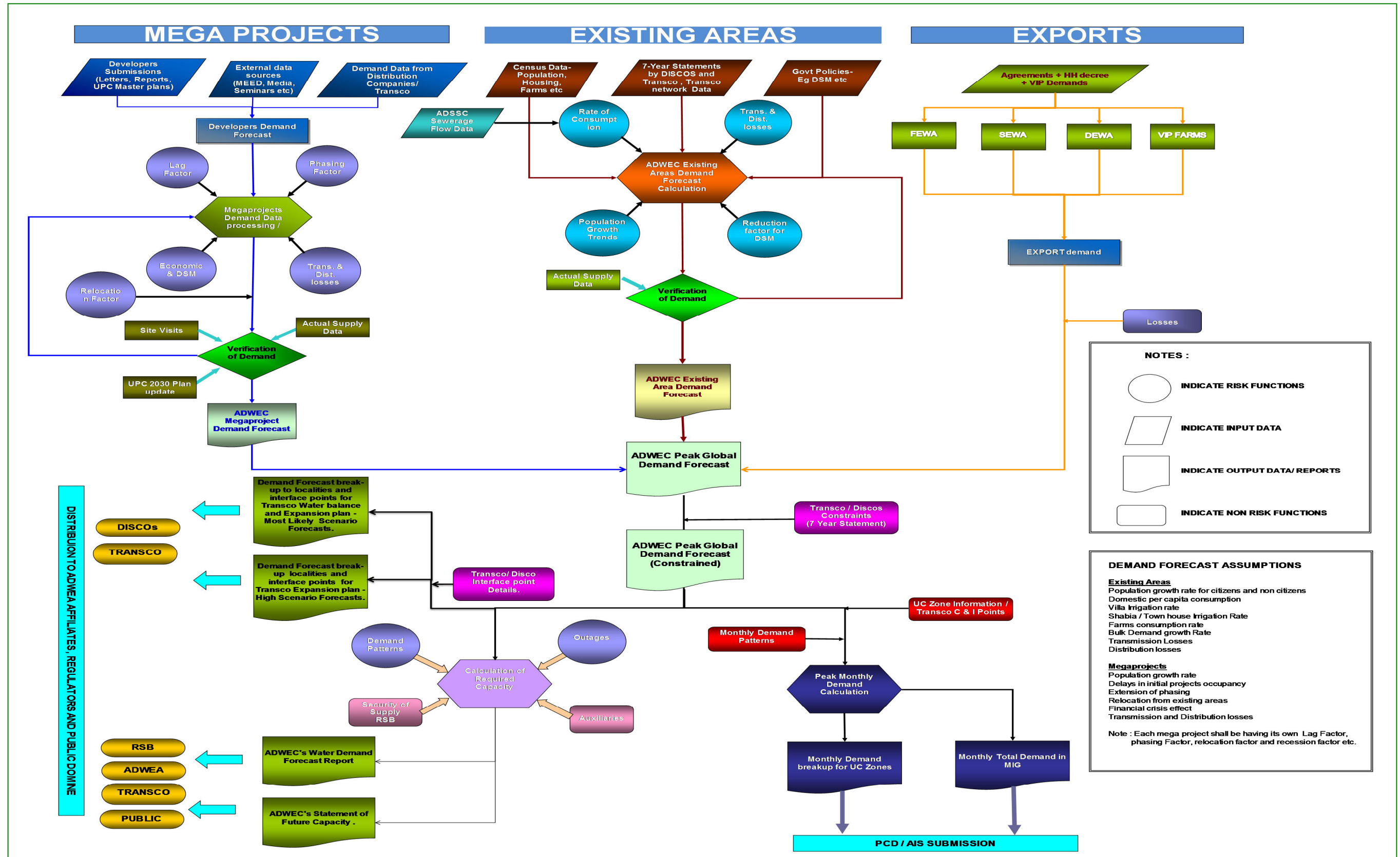
assumptions, conditions, etc. encompassing the mega projects and existing areas supplied with water throughout Abu Dhabi and the exports to Northern Emirates.

Based on the received data from EWEC, TRANSCO utilized the diversified most likely water demand forecast scenario in the water balance analysis in identifying the network developments related to production based on EWEC's expansion plans, while the undiversified most likely demand scenario was used for the capacity assessment and future planning of its related existing terminal facilities.

With the aid of the important planning tool, which is the ADPC geographical information system (GIS) database, EWEC provided TRANSCO the locality-wise demand data of these two demand scenarios, details of which are enclosed in Appendix B (Tables). The forecast comprises and classifies the calculated demand of the existing Areas (normal growth); the mega projects and exports (i.e. the Northern Emirates demand) grouped by regions covering the entire water system. EWEC's methodology captures all factors influencing the future demand such as population growth supplemented by the UPC 2030 Plan data, considerations about GDP/Industrial growth, water tariff, and instituted government and ADPC policies concerning water policy/DSM, environment policy/ESTIMADA, agricultural policy, treated sewage effluent (TSE) utilization, etc. It covers the future water prerequisites of the whole of Abu Dhabi Emirate including all the major developments requirements covering Abu Dhabi and Al Ain Regions whose locations are depicted in Drawings Nos. 8, 9 and 10 as attached in Appendix A through the kind courtesy of ADDC and AADC respectively.

The process on how this planning data and information has been developed by EWEC is likewise demonstrated in Figure 5.6 below which shows how systematically EWEC's calculations were formulated according to their forecasting methodology.

Figure 5.6: Demand Forecasting "Methodology Flow Chart" (courtesy of EWEC)



## 5.3 EWEC Winter Demand Forecast

### 5.3.1 Demand Forecast Results

The subsequent sections below describes and illustrates the analysis made of the demand forecast received by TRANSCO which is the EWEC Winter 2018-2019 Demand Forecast for the Diversified Most Likely Demand Scenarios. The EWEC's Week 7- 2019 Water Demand Forecast Report containing the regional "global" water demand forecast for the Abu Dhabi Emirates inclusive of the Northern Emirates was officially submitted to DoE and circulated to all ADPC stakeholders and/or users vide their letter of Ref. ADWEC-PSD/MD(A)/L-022-B/02.19 dated the 18<sup>th</sup> February 2019.

The detailed area-wise break-up of the EWEC 2019 Demand Forecast containing the "most likely demand (diversified) and high demand scenarios", was initially received by TRANSCO vide e-mail dated 17<sup>th</sup> February 2019. The finalized version was provided to TRANSCO on 13<sup>th</sup> of March 2019 after considering the comments and observations elicited on the submissions. These sets of data represents and fits TRANSCO's requirements for adequately planning the present and future developments of its transmission system as it contains the area-wise detailed breakdown of localities containing the existing areas and mega developments demands, ADNOC requirements, etc. scattered throughout the Abu Dhabi Emirates. It also includes the projected demand of the Northern Emirates respective Areas that will be interconnected and supplied by the existing and future water transmission system that were originally based on agreed quantities as stipulated in the executed Master Agreements between ADPC and FEWA-SEWA. FEWA requested for additional quantities of water in June 2018 which resulted in an increased water demand allocation of EWEC for the Northern Emirates in this year's forecast.

As jointly agreed previously by the major stakeholders or users EWEC, ADDC, ADDC and TRANSCO the forecast should be submitted as per requirements of the Water Transmission Code which is the allocation and grouping of these demands by "Connection and Interface Points" that were completed accordingly. Likewise, it was decided between TRANSCO and EWEC to utilize the Most Likely Diversified WDF for water balance analysis while the Most Likely Un-Diversified WDF shall be used for TRANSCO's capacity planning and/or analysis of its transmission facilities.

The results of EWEC's comprehensive water demand forecast projections using the @ Risk program is quantified in Figure 5.7 below between the low, most likely and high global water Demand forecast. As depicted in the Figure, from an actual global peak of 828 MIGD in 2018, the demand is projected to range between 862 MIGD (Low Scenario) and 981 (High Scenario) in year 2030. The range further widens to 891 MIGD and 1075 MIGD or about an uncertainty gap of approximately 184 MIGD.

The Figure 5.8 below indicates the graphical comparison of the above three demand scenarios of the global 2019 EWEC Water Demand Forecast as superimposed against the Actual Peak Supply of the system from 1999 to 2018 and the Available Production Capacities until 2030. The Figure demonstrates the global trend of these demand figures with respect to the actual "peak water supply" of the system and as against the "available production capacity" for the same duration on the assumption that no additional plant capacities are introduced to the system from year 2019 to



2030 periods and UAN East and West early retirement in 2019 and Taweelah A2 decommissioned in 2022. Likewise, Figure 5.9 below represents the closer picture of Figure 5.8 below from years 2010 to 2030.

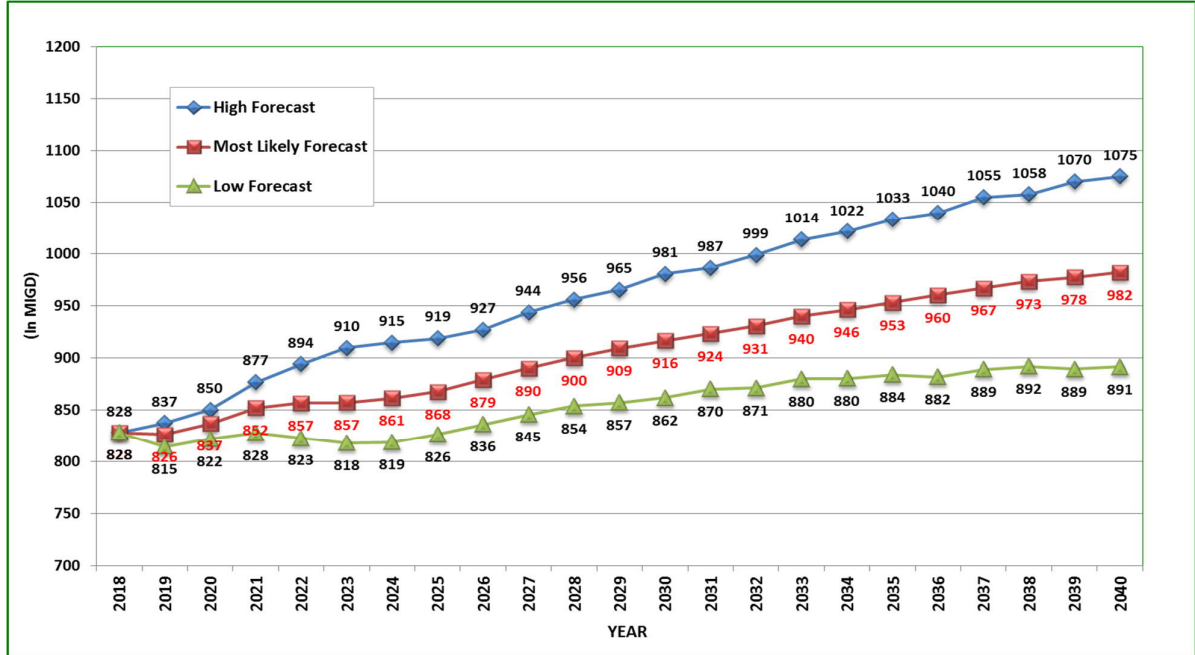


Figure 5.7: EWEK 2019 Global Water Demand Forecast with Low, Most Likely & High Demand Scenario

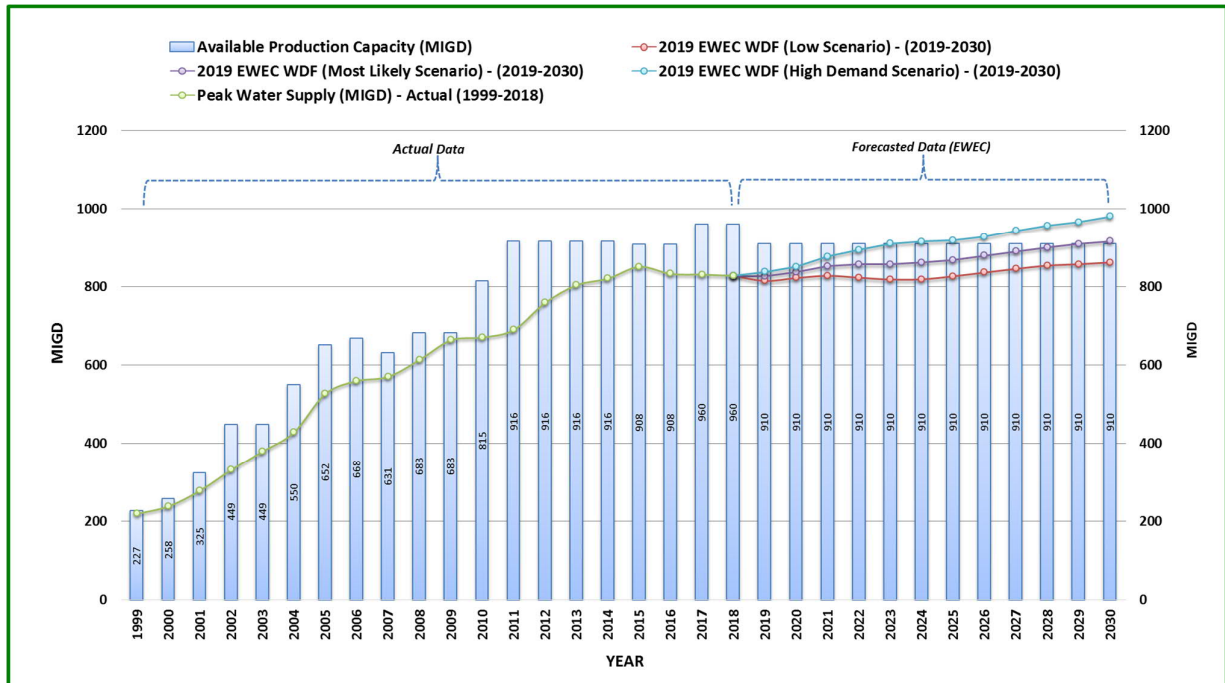


Figure 5.8: EWEK 2019 Water Demand Forecast (Low, Most Likely & High Demand Scenario) vs. Available Production Capacity for period 1999-2030 with the Actual Peak Water Supply (1999-2018)

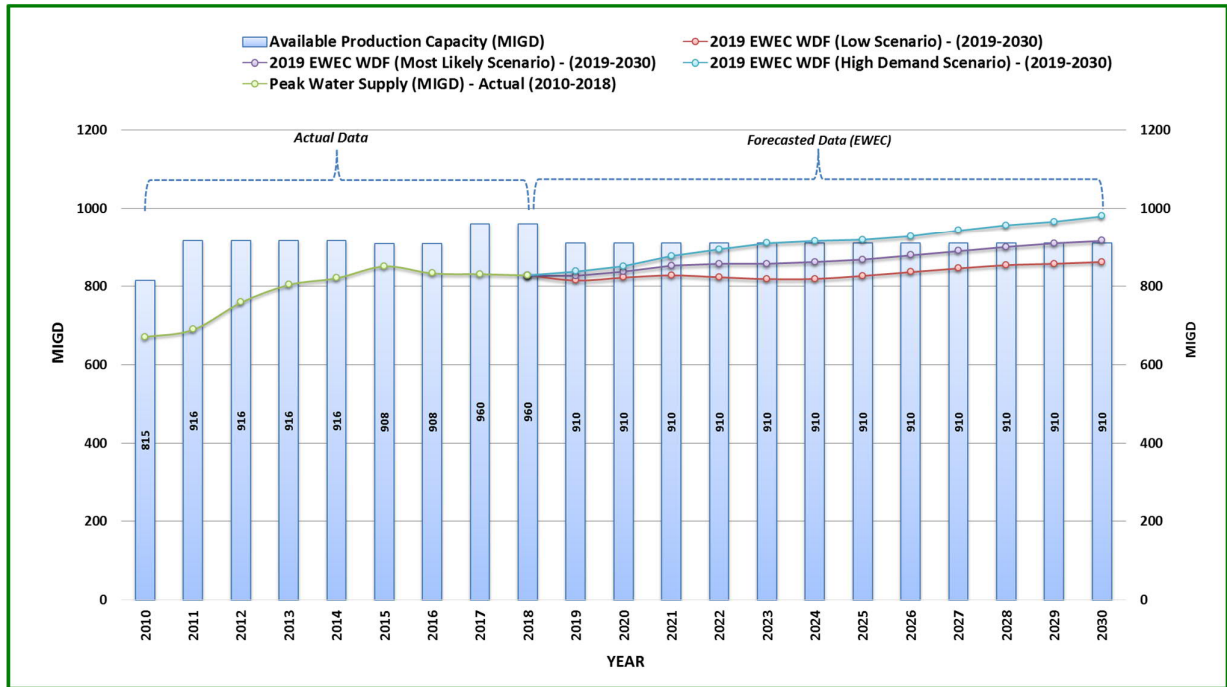


Figure 5.9: EWEC 2019 Water Demand Forecast (Low, Most Likely & High Demand Scenario) vs. Available Production Capacity for period 2010-2030 with the Actual Peak Water Supply (2010-2018)

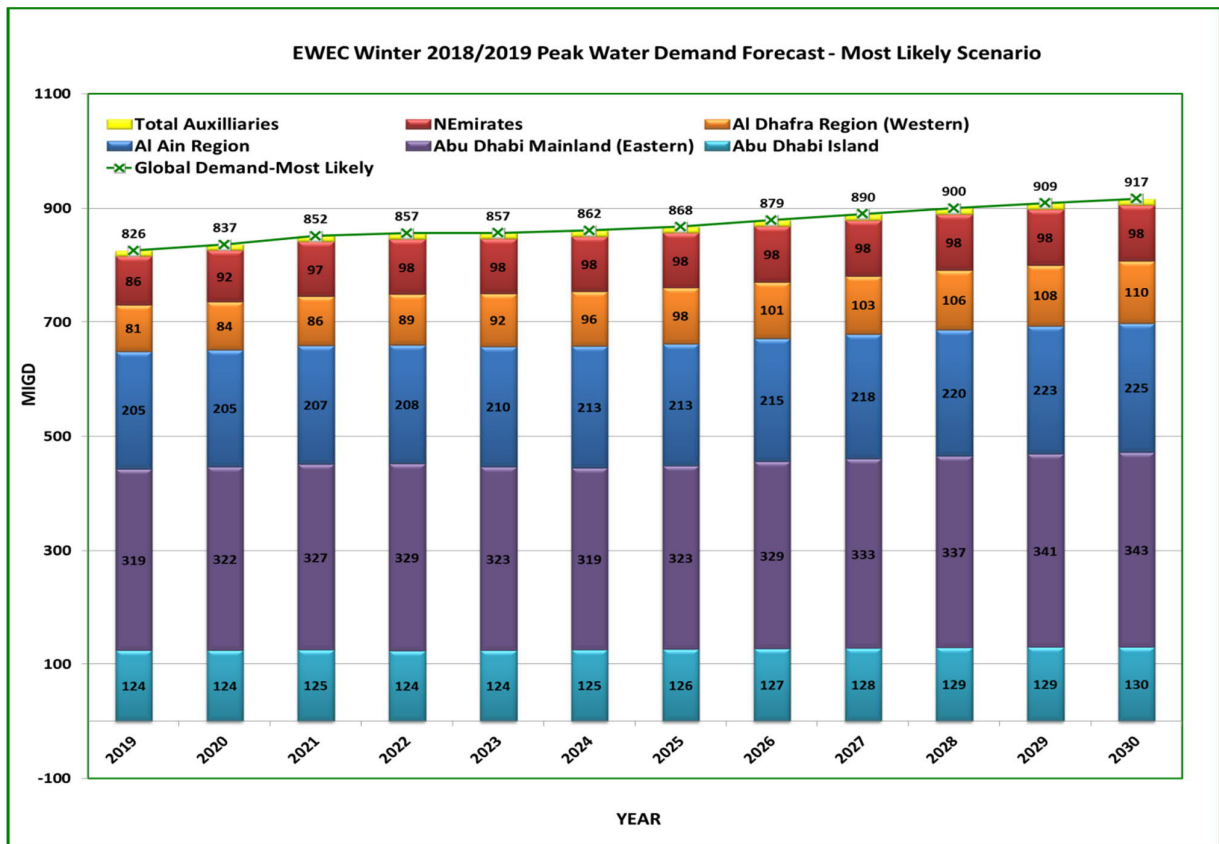
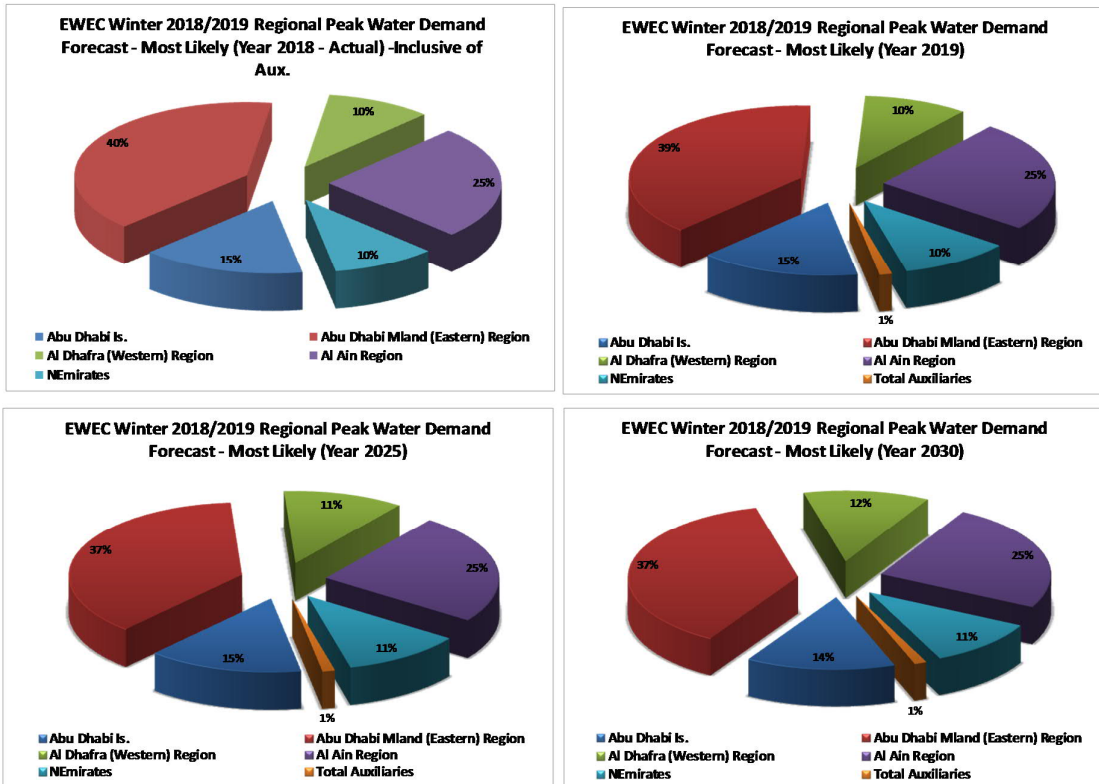


Figure 5.10: EWEC Water Demand Forecast 2019-2030- Most Likely Scenario (Diversified) by Region- Including Auxiliaries



The presented Figures 5.10 above represents the EWEC's provided data of the diversified regional peak water demand forecast for 2019 - 2030 for the most likely demand scenario of the entire Abu Dhabi Emirates network including the auxiliaries and exports to the Northern Emirates. In global terms, the forecast shows an annual growth rate of 0.95% from 2019-2030 or an at an annual rate of 0.89% for the current planning horizon of 2019-2026.

Figures 5.11-A-B-C & D illustrates the regional percentage distribution of the Global demand forecast of the diversified "most likely demand scenario" separately shown each for Years 2018 (actual), 2019, 2025 and 2030. All the graphs consistently demonstrate the high concentration of the demand to be in the Abu Dhabi Mainland Region which comprises about 39% in 2019 and at 37% both for Years 2020 and for 2030 of the global projections which is mainly due to its strategic location as the major developments hub for most of the industrial, commercial, residential, etc. expansions envisioned under the 2030 Plan. Al Ain Region follows second with an estimated average percentage share of almost similar 25% share for the same years considered. Abu Dhabi Island and its surrounding Areas, the demand is in the range of 14%-15% of the total global forecast. There was an observed slight increase to the anticipated water requirement of Al Dhafra Region at 10%, 11% and 12% respectively in 2019, 2025 and 2030, while the Northern Emirates requirements which is about 10-11% for the years compared. The auxiliary demand contributes to about a measly 1% for the same periods.



Figures 5.11-A-B-C & D: EWEC Water Demand Forecast 2018-2030 for Most Likely Demand by Regional Percentage Share for Years 2018 (Actual), 2019, 2025 & 2030.

### 5.3.2 TRANSCO Assessments and Data Comparisons

#### 5.3.2.1 Global Comparison Between EWEC's 2016, 2017, 2018 and 2019 Water Demand Forecast of the Most Likely Demand Scenario Used in the 7 YPS

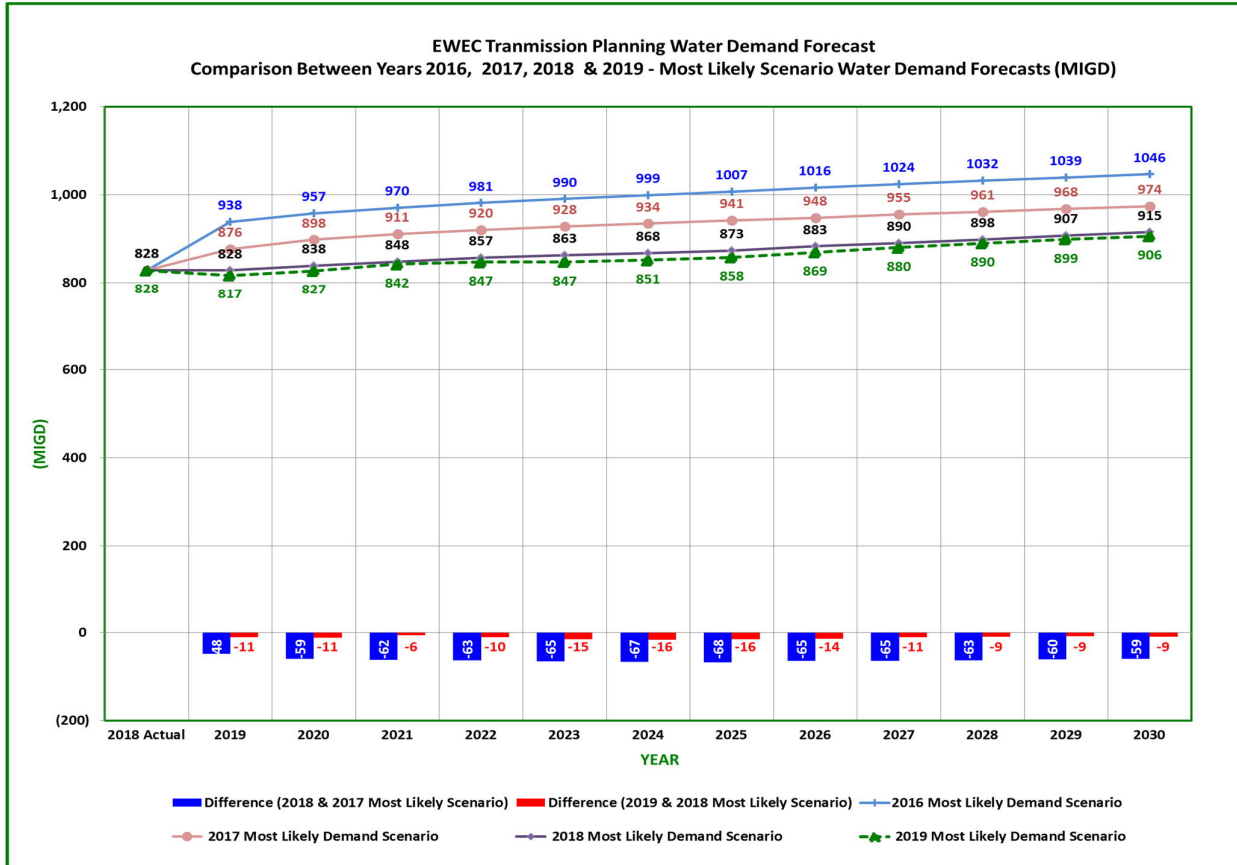


Figure 5.12: Comparison of EWEC'S 2016, 2017, 2018 and 2019 Water Demand Forecast Data of the "Most Likely Demand Scenario" used in the 7YPS (Excluding Auxiliaries)

The Figure 5.12 above depicts the comparative analysis of the "most likely demand scenario of water demand forecast" data and information provided by EWEC used by TRANSCO for the respective previous planning horizon of year's 2016, 2017, 2018 and in this year's 2019 planning statements. By comparing the forecast between Years 2019 and Year 2018 data, the demand from year 2019 up to 2026 there is an average drop of -12 MIGD or an average decline of about -11 MIGD for the 2019 to 2030 period. While in considering the Years 2019 and 2017 comparison of the same durations, there is an average difference of about -75 MIGD and -73 MIGD respectively. The difference as notified by EWEC is attributed mainly to the mega projects where numerous uncertainty factors are expected to influence their projected requirements such as construction completion, changes in phasing, occupancy rates, Estimada implementation, relocation factor, market conditions and government policies among others. Most interesting to note could be the imposition of the tariff increase and the on the introduction of the Value added Tax (VAT) that are influential on the pattern and manner of usage on the part of the consumers.

### 5.3.2.2 Regional Comparison Between EWEC's 2016, 2017, 2018 and 2019 Water Demand Forecast of the Most Likely Demand Scenario

#### A. Abu Dhabi Island Region

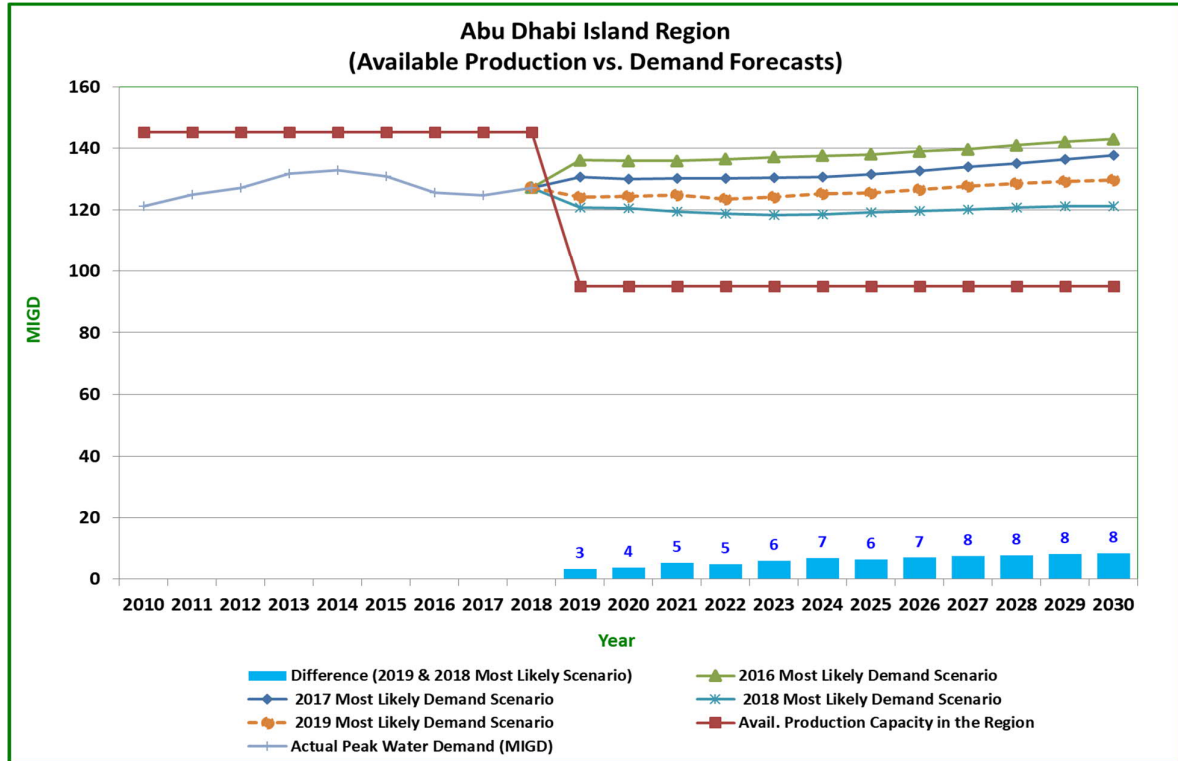


Figure 5.13: Abu Dhabi Island Region Comparison between EWEC 2016, 2017, 2018 & 2019 Water Demand Forecast Data for "Most Likely Demand Scenario" used in Transmission Planning

The Figure 5.13 above reflects this Region's 2016, 2017, 2018 and 2019 water demand forecast data comparisons of the most likely demand scenario used by TRANSCO in its respective statements for transmission planning. The comparative graphs indicates a declining forecast for Abu Dhabi and its nearby Islands for the successive years of 2016 to 2018 but rises a bit in the 2019 forecast. The average difference of the 2018 and 2019 forecast comparison from 2019-2026 is about 5.0 MIGD or an average increase of 6 MIGD between 2019 to 2030 period.

Detailed look of the most likely demand projections for 2019 indicates that, there is an annual average growth rate increase from 2019 to 2026 of about 0.28%, and an observed annual growth of 0.39% between years 2019-2030. This indicates that based on the forecast there is an appreciable growth in demand requirement within the Region and its adjacent Islands. Likewise, it is to be accounted that based on EWEC's projections, the existing or normal growth demand decreases at a rate of -2.29% while the Mega Developments demands constantly increases at a rate of 9.34% from 2019-2026 periods. In comparing both consumers demand forecast, it can be observed that the total Mega Projects water requirements presents an increasing trend from 2019 to 2030 whereas the normal growth demand shows a downward trend which EWEC attributed to the issue of migration of occupants within the Island.

The graph also illustrates the status of the total Region's forecasted demands against the available production capacity, which is that of the UAN Plants, which has reduced with the early de-commissioning of the UAN East and West in April 2019. Because of this, the Regions current supply relies with the remaining UAN capacity and from its adjacent Abu Dhabi Mainland Region to complement its expected shortfall from import source points of Unit III (Taweelah) and Mussafah PS (Shuweihat and Mirfa) unless a new replacement plant at UAN itself pushes through which will alter the situation.

**B. Abu Dhabi Mainland (Eastern) Region**

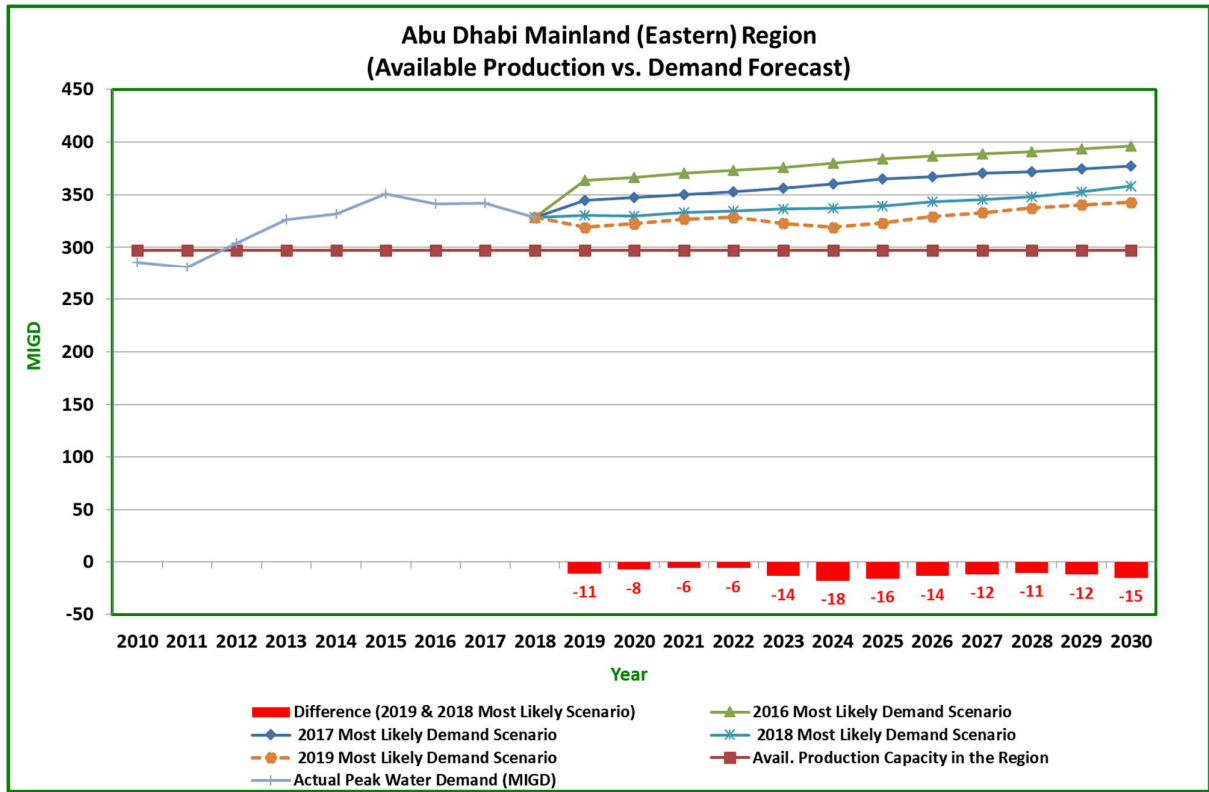


Figure 5.14: Abu Dhabi Mainland Region Comparison between EWEC 2016, 2017, 2018 & 2019 Water Demand Forecast Data for "Most Likely Demand Scenario" used in Transmission Planning

The assessment of the Abu Dhabi Mainland Region's demand forecast of the most likely demand scenarios is as shown in Figure 5.14 above, it is apparent that there are significant decreasing difference of the demand forecast between the successive planning years. The comparison for the 2018 and 2019 forecast between years 2019-2026 shows an average reduction of -12.0 MIGD or an average similar decrease of -12.0 MIGD for the 2019-2030 duration.

For a closer consideration, the most likely demand figures for 2019, EWEC's forecast shows an annual growth rate of about 0.45% between years 2019-2026 or around 0.66% growth for years 2019-2030. It is to be noted that this Region lies the bulk of the Major Developments which composed of a variety of industrial, commercial and residential projects which comprise a big share of the global demands as projected.

The most remarkable Projects found under this Region are the KPIZ, Yas Island, Capital District, ICAD's, Al Falah, South of Shamka, Al Shamka Housing, North Wathba, South Hudayriyat and other major developments but has been affected by the Government's priorities based on the Abu Dhabi 2030 Master Plan thereby delaying their phasing and implementation plans. As a result, there is an overall total decline of the Regions global demand requirements based on EWEC's previous forecast though results for this year indicates an annual growth of 0.66% between 2019 to 2030 of the most likely scenario.

Likewise, Figure 5.14 above presents an overview of the available Production capacity within the Region, which is the Taweelah Plants, as against both the most likely (diversified) demand scenarios of EWEC in the 2016, 2017, 2018 and this year's statement. It can be easily concluded that the existing production capacity is less than the required demand though it has the capability of supplying the Al Ain as well as Abu Dhabi regions as it is now currently operated. Bulk of the supply to this region originates from the Al Dhafra (Western) Region to complement the exported capacity and the demand within its Region.

### C. Al Dhafra (Western) Region

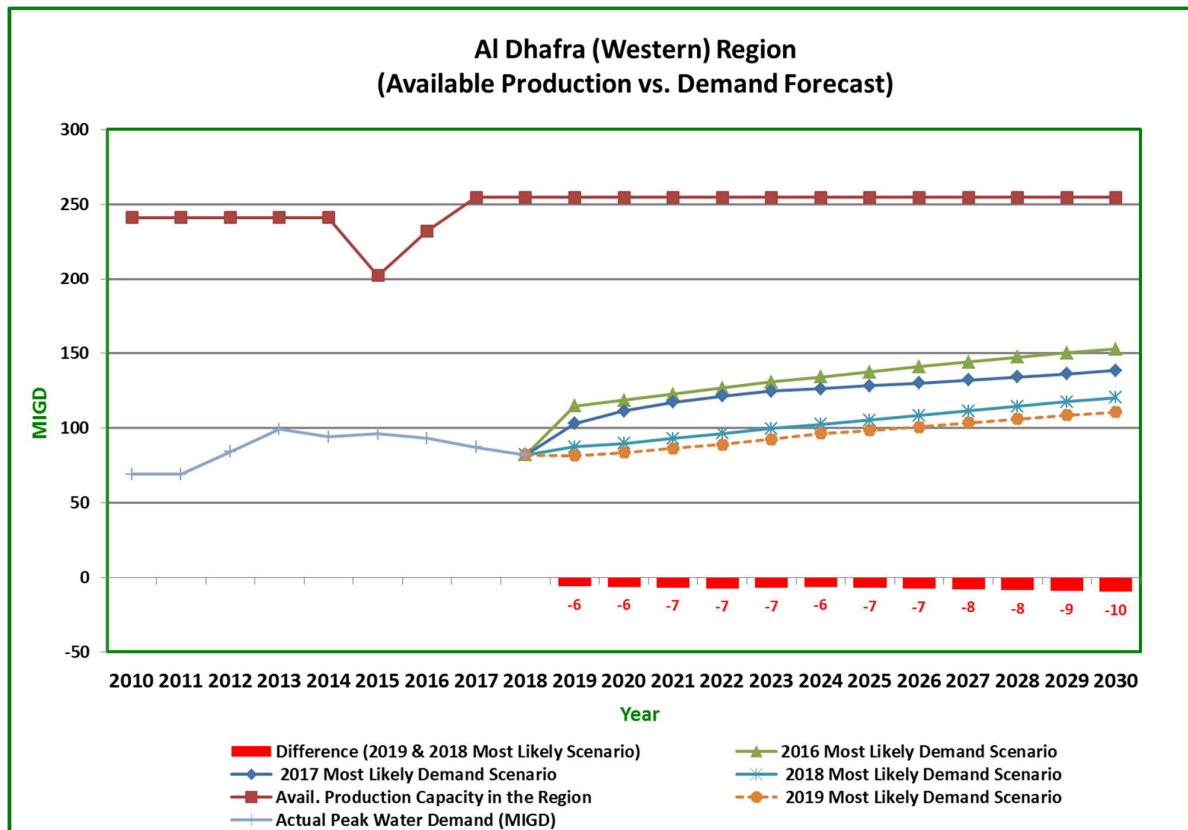


Figure 5.15: Al Dhafra Region Comparison between EWEC 2016, 2017, 2018 & 2019 Water Demand Forecast Data for "Most Likely Demand Scenario" used in Transmission Planning

The demand comparison in Figure 5.15 illustrates the differences of the forecast for Al Dhafra Region demand requirements as provided by EWEC for the “most likely demand scenario” for the last four (4) years. The year 2019 and 2018 projections shows that there is a decline of about -6.0 MIGD in 2019, about -7 MIGD in 2026 and -10 MIGD for year 2030 or an average yearly difference of about -6.0 MIGD for the periods 2019 to 2026. The EWEC’s forecast of the most likely demand used in the water balance analysis shows an increasing 3.09% growth rate for the 2019-2026 period, or approximately 2.82% between 2019 and 2030. The increasing demand pattern covers the growing requirements of the ADNOC, New Industrial Developments, UPC Projects-AI Gharbia Master Plans, ENEC and Municipality irrigation demands.

The graph similarly illustrates the capability of the region to export part of its available existing production (i.e. Shuweihat and Mirfa Plants) in particular to Abu Dhabi Mainland and Abu Dhabi Island which in the foreseeable future shall remain due to its strategic coastal resources for additional future production expansions.

#### D. Al Ain Region

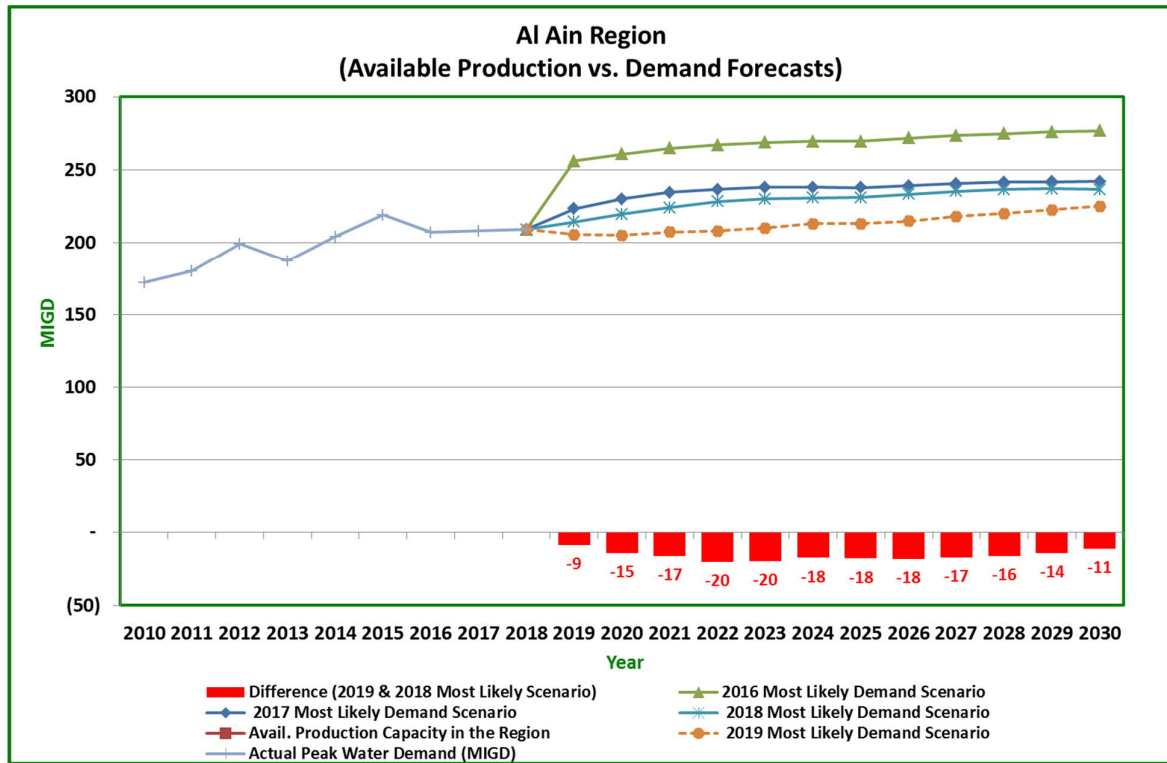


Figure 5.16: Al Ain Region Comparison between EWEC 2016, 2017, 2018 & 2019 Water Demand Forecast Data for “Most Likely Demand Scenario” used in Transmission Planning

The Figure 5.16 shown above displays the overall water demand forecast graphical trend for Al Ain Region for the period of 2019 up to 2030 of the EWEC’s most likely demand scenarios for years 2016, 2017, 2018 and this year’s statements. Comparing the graph for the 2018 and 2019 forecast, there are difference of -9.0 MIGD in 2019, -18.0 MIGD in 2026 and about -11.0 MIGD in 2030. This



corresponds to an average difference of -17.0 MIGD between years 2019-2026 or around -16.0 MIGD from 2019 to 2030.

In detail, considering the most likely (diversified) scenario in 2019, EWEC’s forecast for Al Ain posted an average annual growth rate of 0.64% between years 2019 to 2026 or roughly 0.84% from year 2019 to 2030. EWEC’s estimate for 2018-2030 of the Region’s urban areas demand comprise about an average of 56% of the total demand whereas the rest of 44% accounts for the sub-urban areas around Al Ain region which have an annual growth rates of 0.95% and 0.70% respectively of the 2019-2030 duration.

Due to its geographical location, the supply to the Region rely mainly from the available water emanating mainly from the Fujairah system; and in part from Abu Dhabi Mainland Region which is Taweelah; and from UAN, Shuweihat and Mirfa system through the Unit IV and Shobaishi transmission import supply points. Based on the year 2018 average inflows from these sources about 74%, 20% and 6% of the Al Ain Region supplies is accounted from these respective supply points.

**E. Northern Emirates Region**

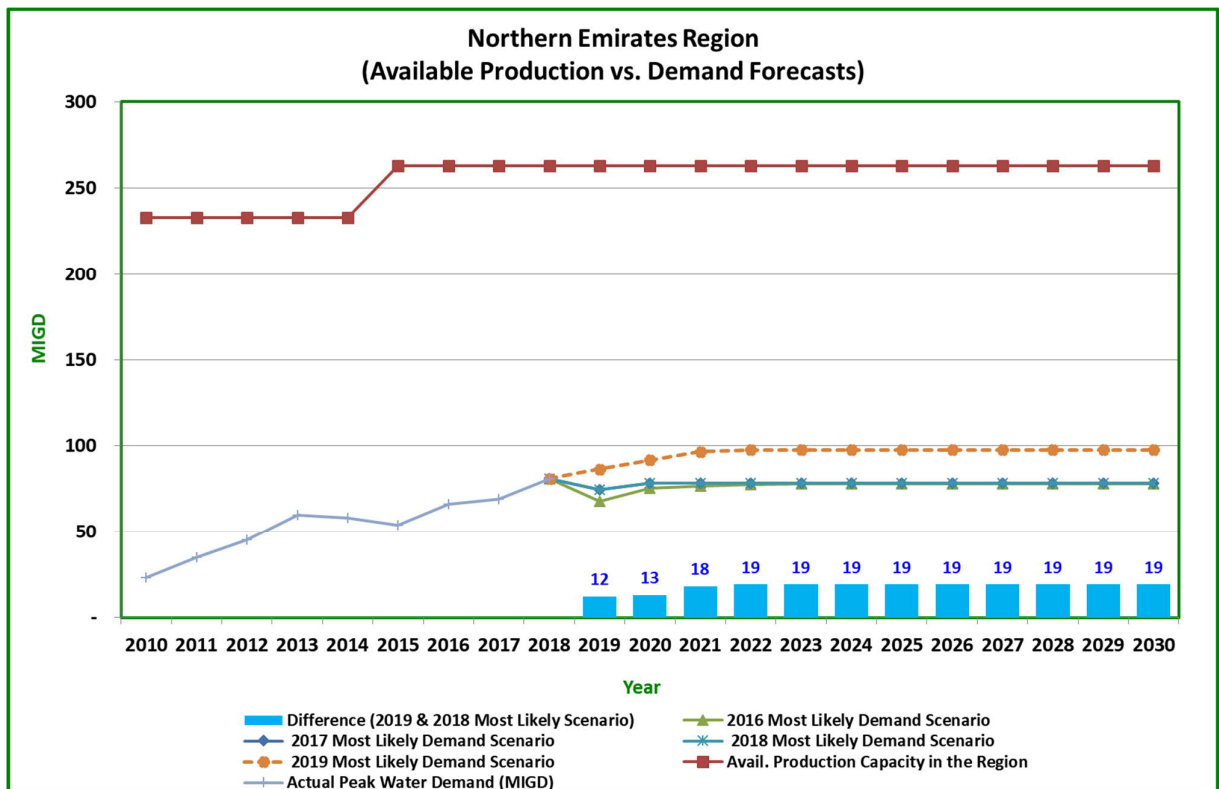


Figure 5.17: Northern Emirates Region Comparison between EWEC 2016, 2017, 2018 & 2019 Water Demand Forecast Data for “Most Likely Demand Scenario” used in Transmission Planning

EWEC’s demand forecast covering the Northern Emirates water supply requirements is shown in Figure 5.17 above for the most likely demand scenario provided for years 2016, 2017, 2018 and 2019. The forecast is identical for years 2017 and 2018 data which according to EWEC are limited



and governed according to the agreed quantities under the executed water Master Agreement between ADPC and FEWA. But in June 2018, FEWA requested additional quantity of water to supply the shortfall in meeting its demand projections until year 2021. This was formalized last October 2018 and as a result an additional 6-13 MIGD was allocated by EWEC until 2021 and even extending it beyond in its forecast to allow for the uncertainty of the FEWA requirement up to a maximum of 98.0 MIGD until year 2030. Due to this, it was observed that the demand for the Region has risen from an actual recorded 2017 peak of 68.0 MIGD to a maximum of 80.0 MIGD for year 2018.

The graph in Figure 5.17 likewise depicts the overview of the available production in the Region which are the existing IWPP Plants at Fujairah reaching already a total of about 263.0 MIGD wherein currently the bulk of the water is being transmitted to supply Al Ain Region and partly to augment the water supply to the Northern Emirates.

Figure 5.18 below indicates a graphical representation of the respective Authorities or Northern Emirates demand allocations as projected for this year from EWEC. On the average, the FEWA demand requirements leads the overall total which is roughly 82% while SEWA about 18%. Presently, the DEWA network is not yet linked with the ADPC system, though initial negotiations are already underway to interconnect both networks on two identified locations with the main important considerations or objective is to enhance the security and flexibility of supply during emergency situations between Dubai and Abu Dhabi and the UAE in general terms.

Successive Coordination Meetings with FEWA representatives conveyed of an eminent plan for the implementation of a massive FEWA Master Plan that includes production and transmission facilities to be constructed to cater the FEWA NE demand requirements aimed at reducing dependency of water from AD Power-TRANSCO system. This Master Plan, if it materializes, could create a major impact on the utilization of the existing TRANSCO transmission facilities that could result a potential network upgrading and reinforcement to fully evacuate the water from Fujairah towards Al Ain and Abu Dhabi system. This matter is presently under due consideration and negotiation between EWEC and FEWA to attain a strategy for the best interest of the sector. Figure 5.19 below represents the reduced demand Scenario for NE that was considered by TRANSCO in the analysis of its evacuation facilities and capabilities at Qidfa towards Al Ain brought about by this reduction starting in Year 2022.

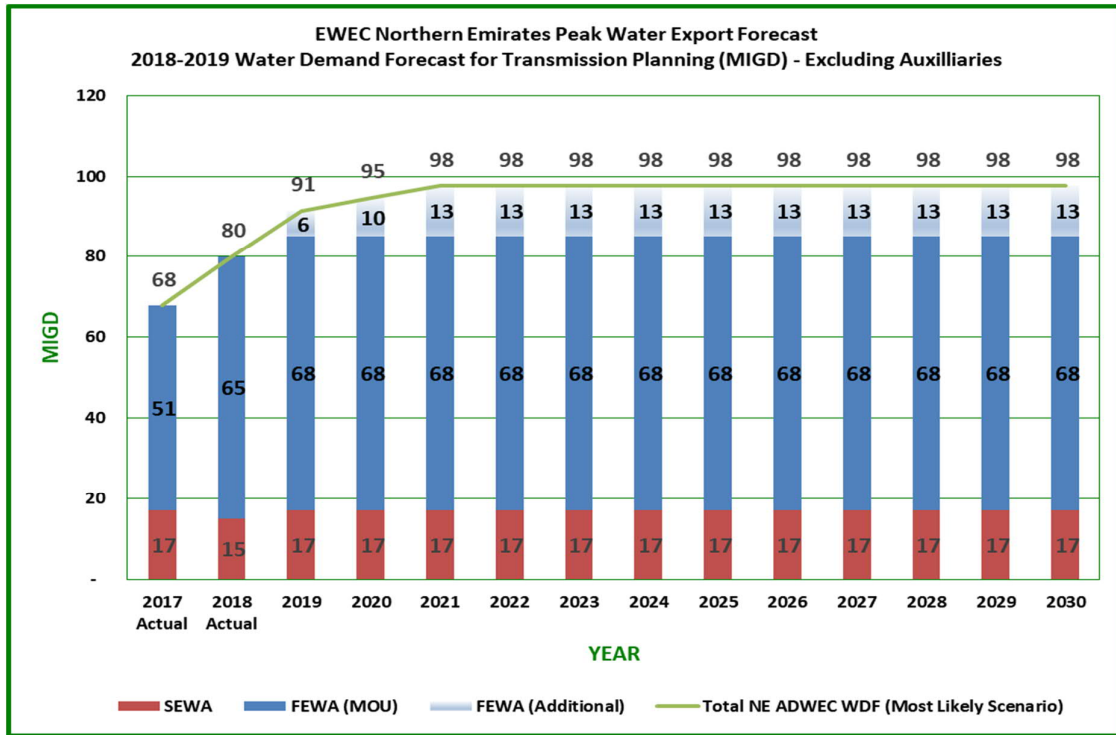


Figure 5.18: Northern Emirates Region Breakdown of EWEC 2018/2019 Water Demand Forecast Data of the “Most Likely Demand Scenario” By Authority

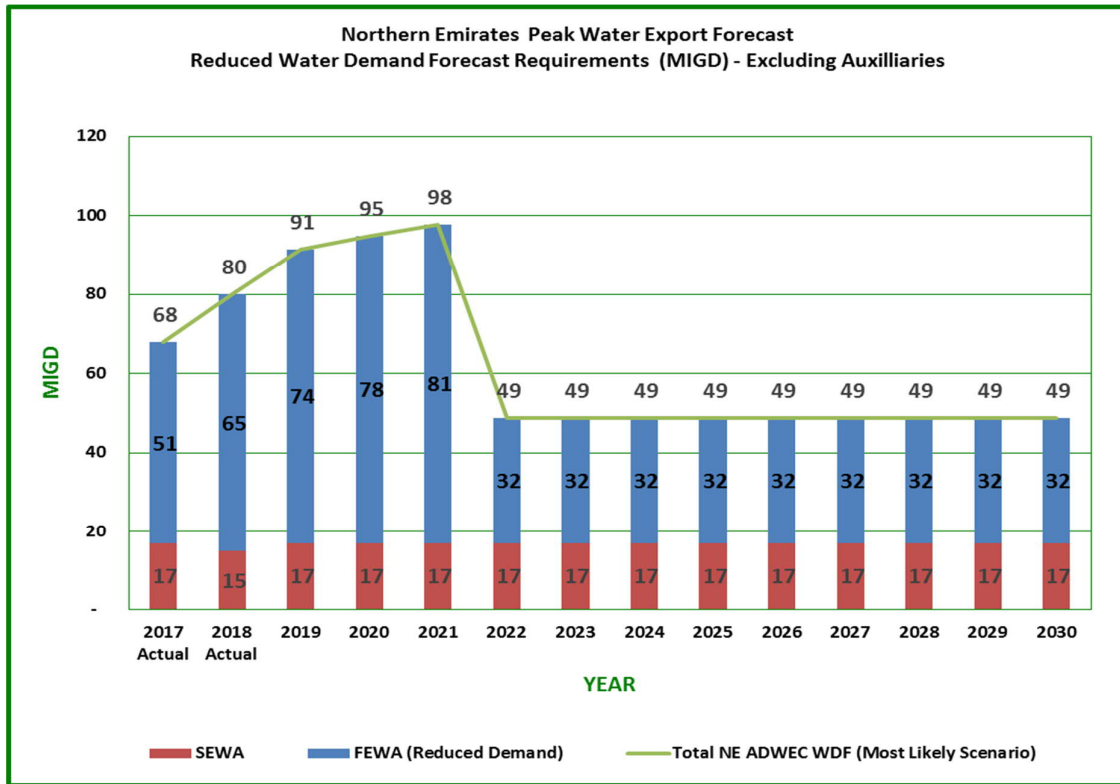


Figure 5.19: Northern Emirates Reduced Water Demand Forecast Requirements (NE Master Plan Implementation Scenario)

### 5.3.2.3 EWEC 2019 Water Demand Forecast by Category (Most Likely Demand Scenario)

The EWEC’s water demand forecast is also segregated by categories or sectors as illustrated in Figure 5.20 below. In global terms, their sector-wise forecast reveals that the demand shows an overall increasing pattern which is dominated by the Bulk Consumers (i.e. municipalities demands, palaces, private islands, golf clubs, hotel landscaping, etc.); the residential demands (domestic) and gardens landscaping demand for Villas, Shabiats, Townhouse irrigations; Industrial (including ADNOC, ICAD, KIZAD, and other industries); agricultural demand of farms distributed by the government to Emirates; Mega Project Demands (such as Reem, Sadiyat, Yas, etc.) and exported demands in particular the NE requirements. The most evident of the growth is attributed to the requirements of the mega projects which has an average annual growth of 11.9% for the period 2019-2026 and 4.5% for 2027-2030; and the Industrial demand which is estimated to expand annually by 6.6% and 3.4% for the same periods as per individual developments requirements in line with the Abu Dhabi 2030 Master Plan. EWEC forecast for the other categories such as bulk consumers, garden consumptions and domestic, and agricultural demand are projected to decline for the same period due to the imposition of tariff reforms, use of recycled water in place of potable water, etc. as part of the DSM measures being implemented.

Figures 5.21 A-B-C-D respectively for years 2018 (actual), 2018, 2025 and 2030 shows the percentage share by each sector/category of the “global demand” totals which evidently validates the above stated observations of the EWEC global forecast, wherein initially about 42% reducing to 30% (2030) of the produced water is predicted to be consumed for irrigation purposes.

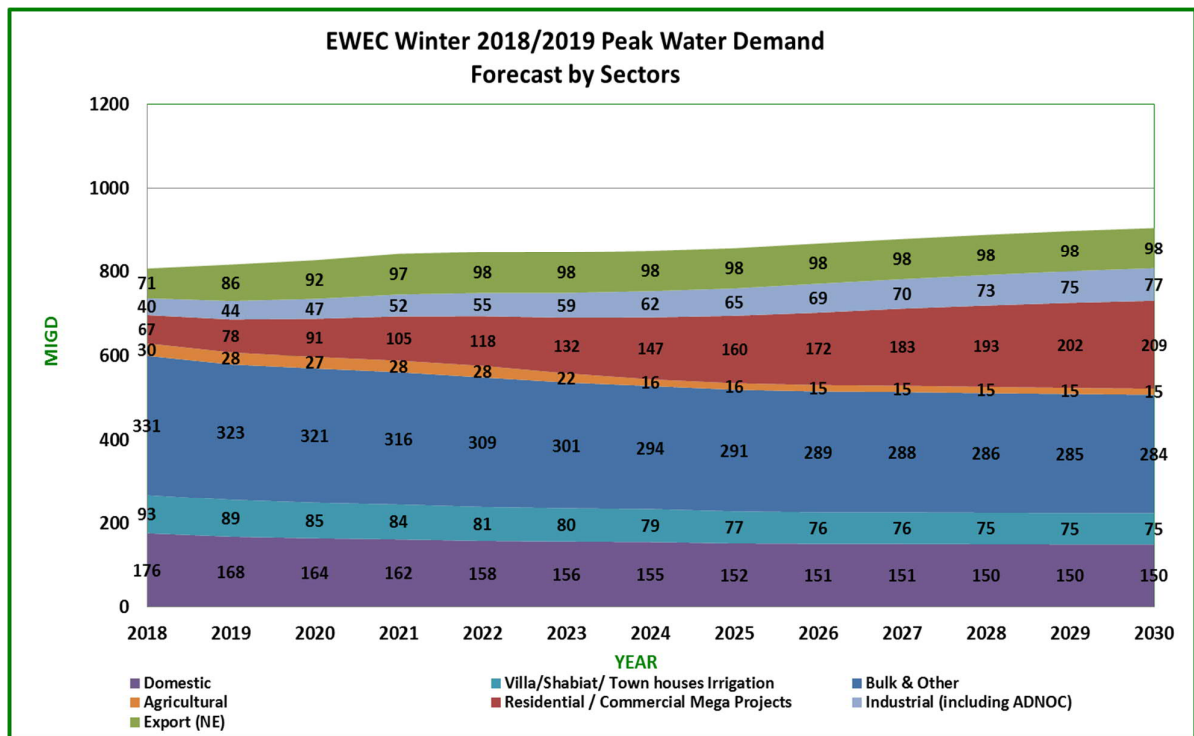


Figure 5.20: EWEC 2017/2018 Water Demand Forecast by Category Based on “Most Likely Demand Scenario” (Excluding Auxiliaries)

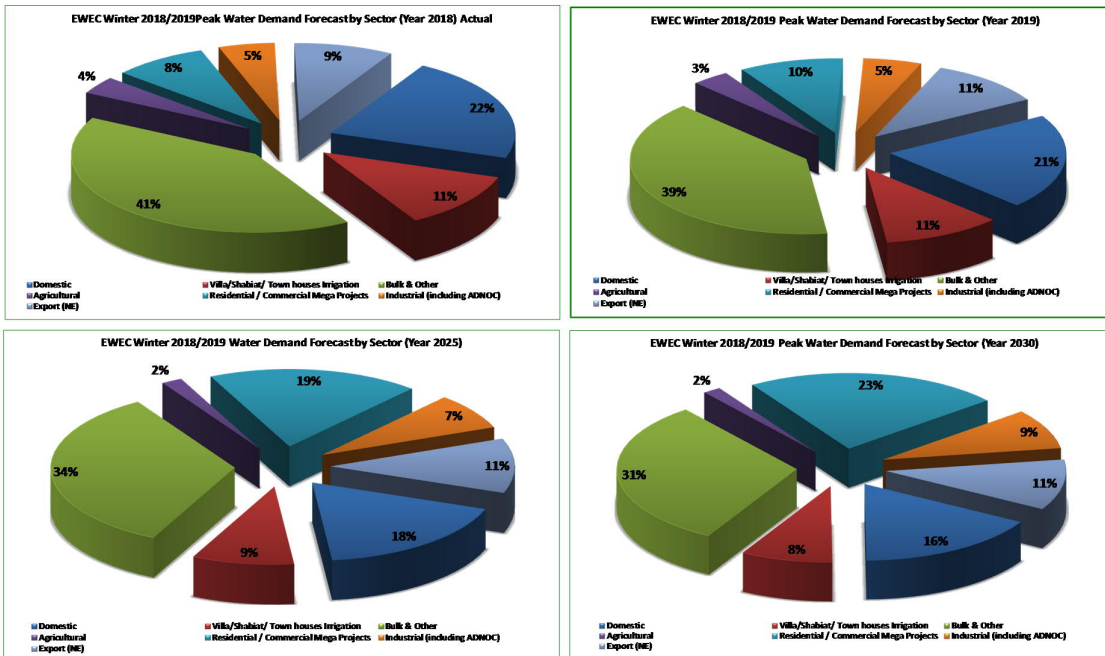


Figure 5.21 A-B-C-D: EWEC 2018/2019 Water Demand Forecast by Category based on “Most Likely Demand Scenario” for Years 2018, 2019, 2025 and 2030

## 5.4 Production Expansion Plan

The Generation and Production Plants expansions are determined by the ADPC and EWEC especially with regards to the timing, location and capacity requirement to balance the demand and supply. The generation planning coordination activities are well established between EWEC, TRANSCO and DoE. EWEC conducts the future demand forecasting for power and water and translate these requirements to generation\production expansion plans. TRANSCO on the other end reviews the expansion plans and assesses the power and water transmission system capabilities and plan accordingly for transmissions network developments to adequately cater the addition and\or deletion of power and water capacity at the respective recommended or identified sites.

The Figure 5.1 shown in Section 5.2.1 above, denotes the data submission time line requirements for TRANSCO to receive the EWEC’s “Generation/Production Expansion Plan” must be on Week 17 of each year to assure the timely preparation of its strategic plan and annual 7 YPS. The EWEC’s 2019 Draft “Statement of Future Capacity Requirements” was received by TRANSCO on 9<sup>th</sup> June 2019 vide their letter of Ref. EWEC-DFPD/CEO/L-020C/06.19 dated 9<sup>th</sup> June 2019. Presented below are some of the data and information that were extracted and incorporated to this statement:

### 5.4.1 Existing Production Capacities

The details of the water production capacities of the existing water Production Plants of the whole EWEC-AD Power system including the plant type and the corresponding current PWPA contract expirations are shown in the table below:

Table 5.1: Details of EWEC Existing Production Capacities

Plant Name	IWPP Owner	Region	Plant Type / Gross Cap. [MIGD]			Contract Expiry
			RO	MSF	MED	
Umm Al Nar West	Umm Al Nar / Sas Al Nakhl (Arabian Power Company)	Abu Dhabi Island				2019 (EWEC Early Retirement- 28 MIGD)
Umm Al Nar East		Abu Dhabi Island				2019 (EWEC Early Retirement- 22 MIGD)
Umm Al Nar B (SAN)		Abu Dhabi Island		88	7	2027
Taweelah A1	Taweelah A1 (Gulf Total Tractebel Power Company)	East		33	53	2029
Taweelah A2	Taweelah A2 (Emirates CMS Power Company)	East		51		2022
Taweelah B	Taweelah B (Taweelah Asia Power Company)	East		70		2028
Taweelah B2		East		23		2028
Taweelah New B		East		68		2028
Shuweihat S1	Shuweihat 1 (Shuweihat CMS Power Company)	West		101		2025
Shuweihat S2	Shuweihat S2 (Ruwais Power Company)	West		101		2036
New Al Mirfa	Mirfa Independent Power and Water Company)	West	30	23		-
Fujairah F1	Fujairah F1 (Emirates SembCorp Water & Power Company)	Northern Emirates	67	64		2029
Fujairah F2	Fujairah F2 (Fujairah Asia Power Company)	Northern Emirates	30		102	2031
		SUBTOTAL	127	621	162	
		TOTAL	910			

## 5.4.2 Retirement Plans

The below Table represents the plants that are to be retired within the current planning horizon. Throughout this statement, UAN E and West was retired earlier than expected in accordance with EWEC Letters EWEC-PCD/CEO/UAN-TRANSCO/L-008/04.19 dated 01-04-2019 and EWEC-PCD/CEO/UAN-APC/L-192/04.19rev dated 21-04-2019. Taweelah A2 is assumed to be retired by 2022. All other Plants whose PWPA's will expire from year 2025 and beyond especially that of Shuweihat S1 (2025) are assumed extended in all succeeding Tables related to production capacities in view of EWEC's on-going study and negotiations with individual IWPP's bearing in mind the feasibility and economics of the plan.

Table 5.2: Retirement Plans

Year	Retirement Plans	
	Site	Capacities (MIGD)
2019 April (EWEC Early Retirement)	UAN E	22 MIGD
2019 April (EWEC Early Retirement)	UAN W	28 MIGD
2021 (End)	TAW A2	51 MIGD



### 5.4.3 Available Production Capacities

The available water production capacities from 2019 to 2026 based on the retirement of the above Production facilities are as shown in the table below:

Table 5.3: Available Production Capacities 2019-2026

Plant Site	2019	2020	2021	2022	2023	2024	2025	2026
Umm Al Nar B / Sas Al Nakhl	95	95	95	95	95	95	95	95
Total	95	95	95	95	95	95	95	95
Taweelah A1	85	85	85	85	85	85	85	85
Taweelah A2	51	51	51					
Taweelah B	162	162	162	162	162	162	162	162
Total	297	297	297	247	247	247	247	247
Shuweihat 1	101	101	101	101	101	101	101	101
Shuweihat S2	101	101	101	101	101	101	101	101
Total	202	202	202	202	202	202	202	202
New Al Mirfa	53	53	53	53	53	53	53	53
Total	53	53	53	53	53	53	53	53
Fujairah F1	101	101	101	101	101	101	101	101
Fujairah F1 Extension	30	30	30	30	30	30	30	30
Fujairah F2	132	132	132	132	132	132	132	132
Total	263	263	263	263	263	263	263	263
Available Capacity	910	910	910	860	860	860	860	860

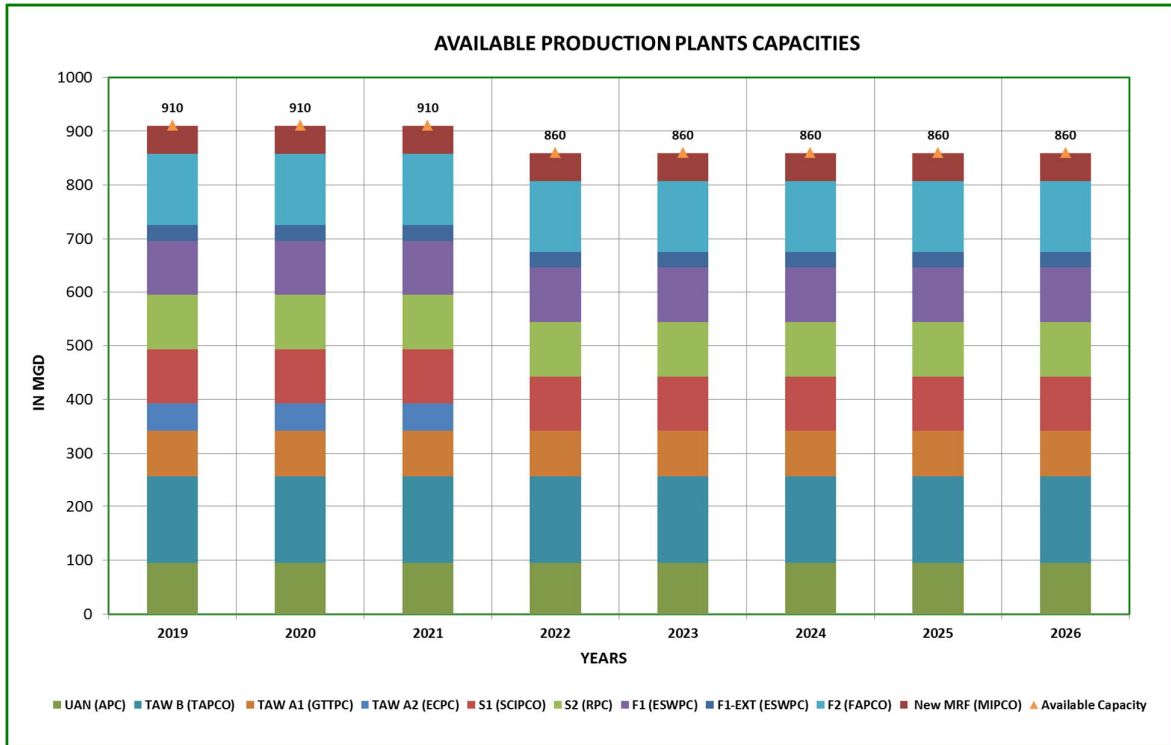


Figure 5.22: Available Production Plants Capacities 2019-2026

#### 5.4.4 Committed Production Capacities

The below Table 5.4 represents the new committed plant capacities based on confirmed information and assumptions from EWEC's Draft 2019 SFCR as covered within this year's planning horizon. It should be noted that the EWEC's SFCR, as in previous versions of the statement, does not contain the exact location and timing of the next RO Plant after the 200 MIGD Taweelah RO Plant in 2022 as well as the dispatch schedules of the Production Plants that are required in the detailed analysis of transmission network upgrade or developments. Purely, the recommended production capacity investments are according to the licensed and contractual commitments that EWEC had already entered into that is at the moment the Taweelah RO Plant.

Table 5.4: EWEC New Production Committed Capacities

Year	New Committed Capacities	
	Site	Capacities (MIGD)
2022	New RO at Taweelah	2x100 MIGD
(2023)	New RO (No Location)	150 MIGD

#### 5.4.5 Future Installed Capacity Outlook

Tables 5.5, 5.6 and 5.7 illustrates the overview of the future installed capacities with the incorporation of the above assumptions and boundary conditions:

Table 5.5: Total Installed Production Capacity Including Retired & New Committed Capacities

Plant Site	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Umm Al Nar B / Sas Al Nakhl	95	95	95	95	95	95	95	95	95	95	95	95
Taweelah A1	85	85	85	85	85	85	85	85	85	85	85	85
Taweelah A2	51	51	51									
Taweelah B	162	162	162	162	162	162	162	162	162	162	162	162
Shuweihat 1	101	101	101	101	101	101	101	101	101	101	101	101
Shuweihat S2	101	101	101	101	101	101	101	101	101	101	101	101
New Al Mirfa	53	53	53	53	53	53	53	53	53	53	53	53
Fujairah F1	101	101	101	101	101	101	101	101	101	101	101	101
Fujairah F1 Extension	30	30	30	30	30	30	30	30	30	30	30	30
Fujairah F2	132	132	132	132	132	132	132	132	132	132	132	132
Available Capacity (MIGD)	910	910	910	860	860	860	860	860	860	860	860	860
Taweelah (RO)				200	200	200	200	200	200	200	200	200
Total Additional Capacity (MIGD)				200	200	200	200	200	200	200	200	200
Total Installed Capacity	910	910	910	1060	1060	1060	1060	1060	1060	1060	1060	1060

Table 5.6: Additional Production vs. EWEC's Diversified Most Likely Demand Forecast (Incl. Auxiliaries)

Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Total Avail. Production (MIGD)	910	910	910	860	860	860	860	860	860	860	860	860
Global TOTAL Most Likely WDF Scenario (MGD)- Incl. Auxiliaries	826	837	852	857	857	862	868	879	890	900	909	917
Surplus\Shortfall (MIGD)	84	73	58	3	2	-2	-8	-20	-31	-41	-50	-57
Additional Capacity (MIGD)				200	200	200	200	200	200	200	200	200
Surplus\Shortfall (MIGD)	84	73	58	203	202	198	192	180	169	159	150	143

Table 5.7: Additional Production vs. EWEC's Diversified Most Likely Demand Forecast (Excl. Auxiliaries)

Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Total Avail. Production (MIGD)	910	910	910	860	860	860	860	860	860	860	860	860
Global TOTAL Most Likely WDF Scenario (MGD)- Excl. Auxiliaries	817	827	842	847	847	851	858	869	880	890	899	906
Surplus\Shortfall (MIGD)	93	83	68	13	12	8	2	-10	-20	-30	-39	-46
Additional Capacity (MIGD)				200	200	200	200	200	200	200	200	200
Surplus\Shortfall (MIGD)	93	83	68	213	212	208	202	190	180	170	161	154

It is evident that the added production expansion is for the purpose of decoupling as it is more than the demand by 190.00 MIGD by the planned year 2026. It is worth to mention that even in the year 2030, there is a surplus of approximately 154.00 MIGD. It is then up to EWEC on how to fully optimize this excess in production and TRANSCO will only adapt what is best and most techno-economical in terms of transmission system.

## 5.5 Water Balance Analysis

### 5.5.1 Global Water Balance Analysis – Existing System

The global water balance was prepared to identify the annual surplus/deficit within the planning horizon which was prepared accordingly based on the EWEC demand forecast and production expansion plan. The surplus/deficit is calculated using the EWEC's demand forecast of the "most likely demand scenario (diversified including auxiliaries)" together with the available production capacity (as per production expansion plan) which considers only the existing IWPP's and/or under construction IWPP's.

The subsequent chart illustrates and summarizes the water surplus and/or deficit from year 2019 to 2030. Figures 5.23 & 5.24 shows the regional breakdown and total of the water demand forecast as against the overall available water production capacity considering the full and reduced NE demands. On the other hand, Figures 5.25 and 5.26 quantifies the surplus or deficit of the system based on the results of comparing the available water production versus the total global demand of the NE demand scenario.

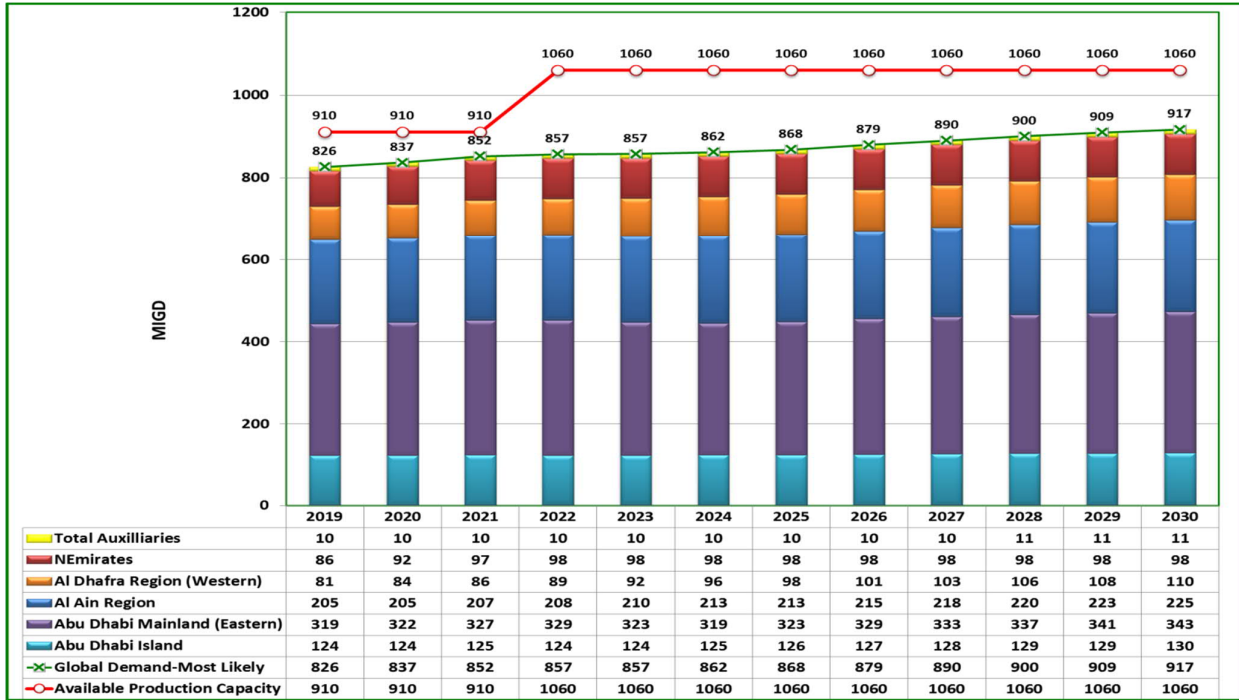


Figure 5.23: EWEK 2018/2019 Regional Peak & Global WDF – Most Likely Scenario VS. Available Production Capacity (Full NE Demand)

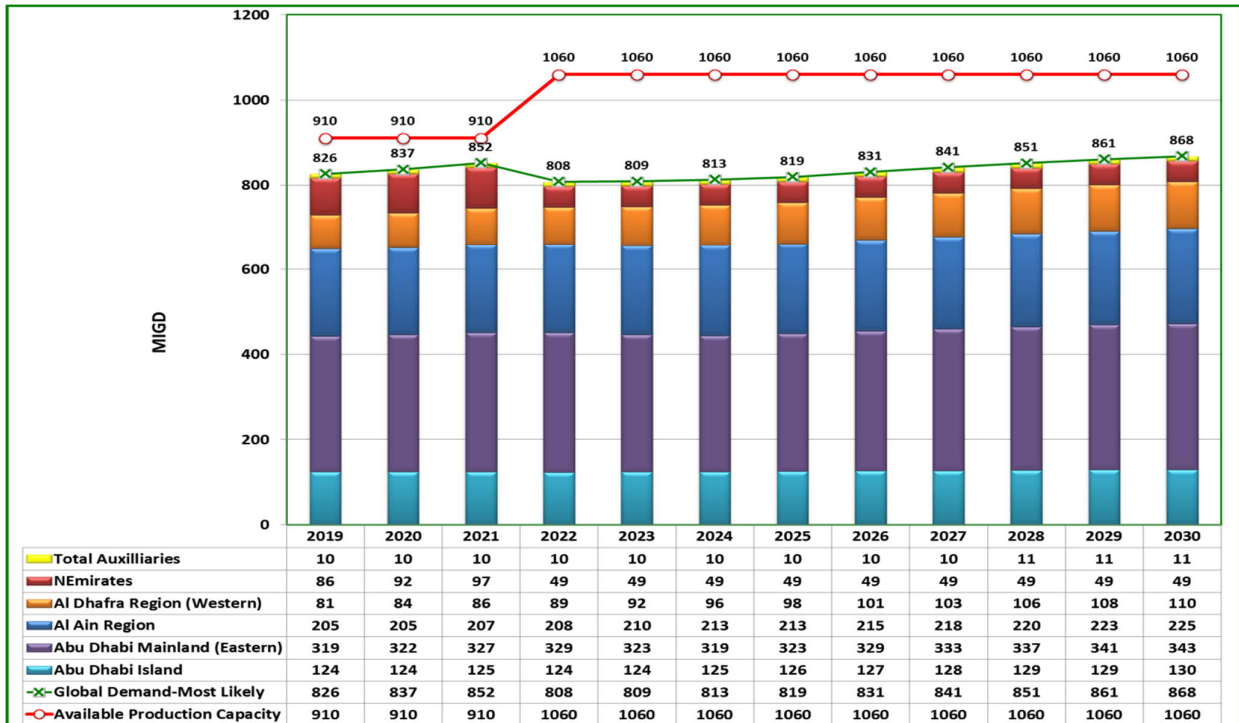


Figure 5.24: EWEK 2018/2019 Regional Peak & Global WDF – Most Likely Scenario VS. Available Production Capacity (Reduced NE Demand)

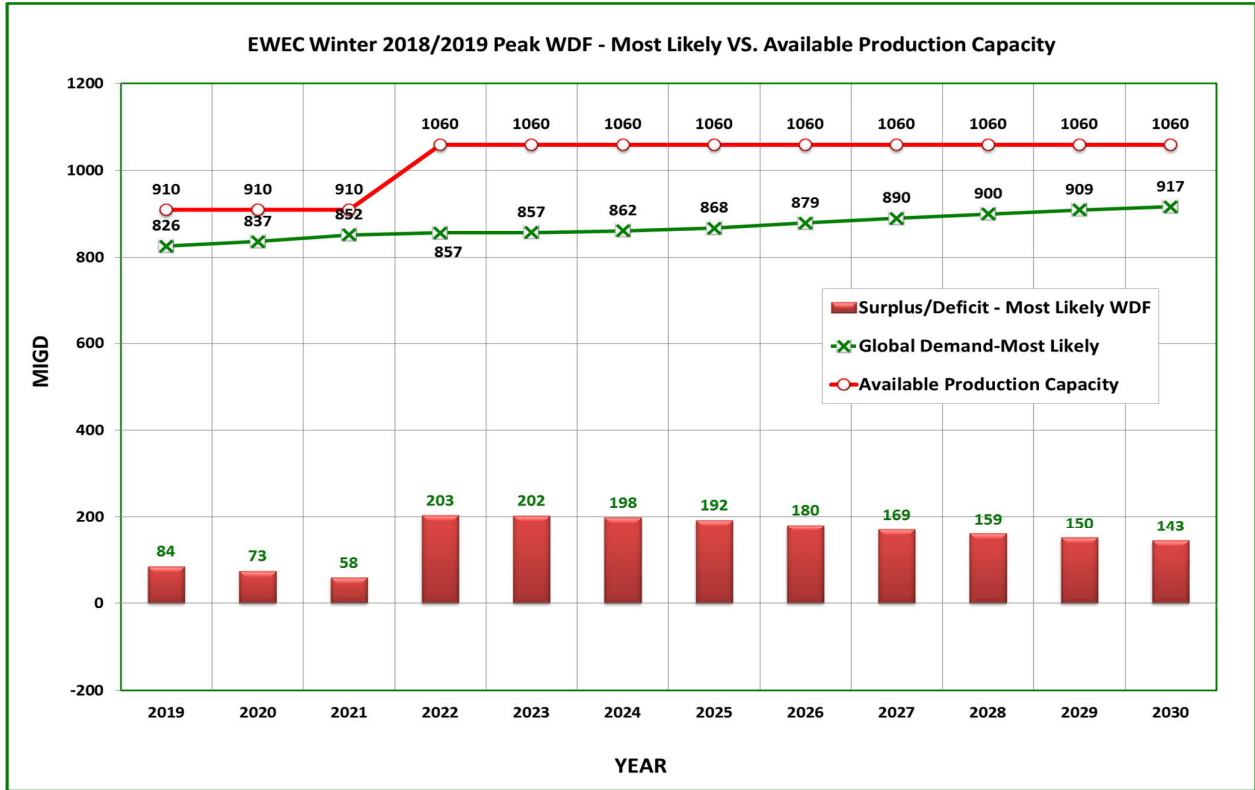


Figure 5.25: Most Likely Demand Scenario WDF (Inc. Auxiliaries) VS. Available Production Capacity (Full NE Demand)

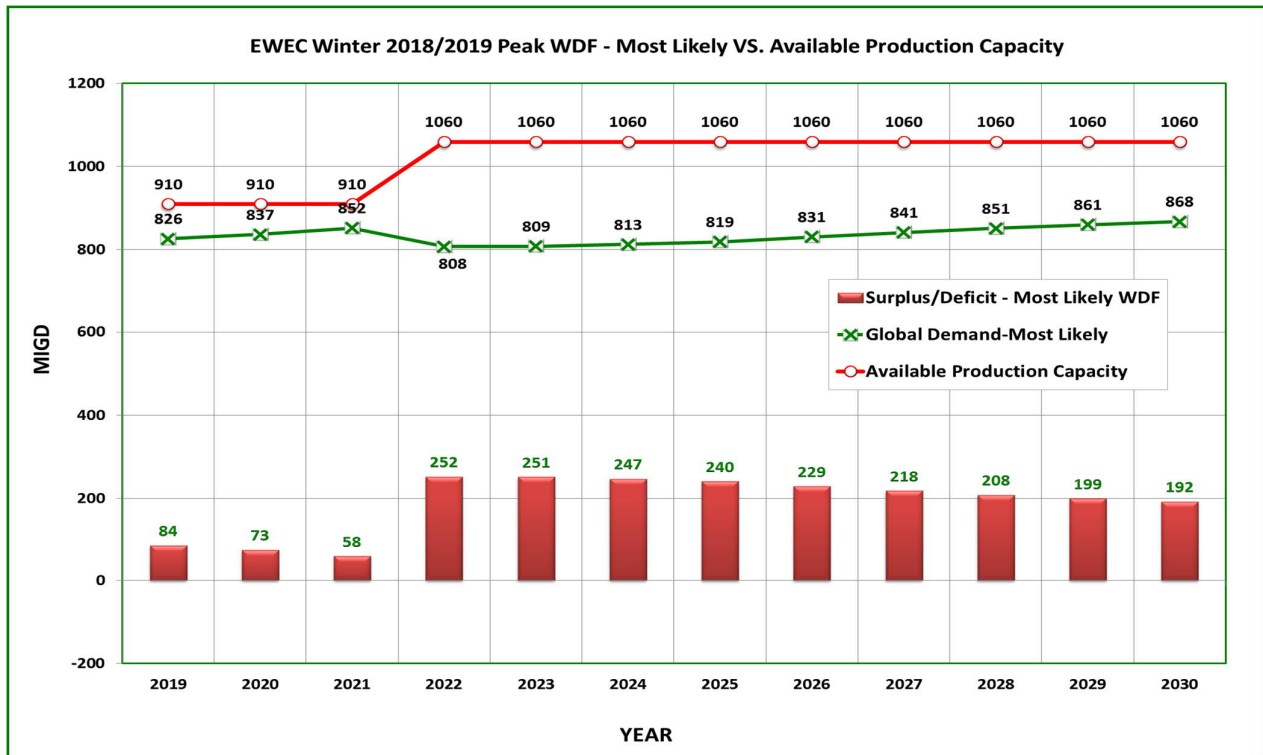


Figure 5.26: Most Likely Demand Scenario WDF (Inc. Auxiliaries) VS. Available Production Capacity (Reduced NE Demand)



## 5.5.2 Global Water Balance Conclusions – Existing System

Utilizing the EWEC’s “most likely demand scenario (diversified-including auxiliaries)” for water balance analysis and considering the two assumptions that is with and without the new Taweelah RO Plant additional production capacities are introduced into the system from 2019 to 2030, the following can be concluded according to the results of the above global water and supply balance analysis using the above specified data and information from a global perspective:

- a. Referring to Tables 5.6 above, on the assumption that there is no additional RO production at Taweelah, the calculations for Years 2019 to 2023 indicates an excess of supply against the demand, which explains that the global water demands for these years are relatively lower than the available production even with UAN East and West and Taweelah A2 Plants are de-commissioned. It could be seen that the system is expected to experience a shortfall starting the year 2024 and onwards.
- b. In the case with the introduction of the Taweelah RO in Year 2022, the same Table 5.6 illustrates the global surplus quantity of system from as high as 203 MIGD in 2022 to 143 MIGD in 2030 which is demonstrated in Figure 2.23 above utilizing the case with full NE Demand and Figure 5.24 for the case of the anticipated reduction in the NE demand.

Due to the magnitude of the surplus, TRANSCO assumes that these quantities shall be utilized by EWEC for establishing their decoupling strategy and in conjunction to the efficient dispatch recommendations for TRANSCO’s implementation. This likewise covers the DSS allowance of at least 5% on individual production plants as depicted in the water balance analysis undertaken in the succeeding sections below.

- c. TRANSCO reiterates that, the new Plant capacity and location should take into an important consideration its proximity to the water demand centers in order to minimize the cost of water transmission schemes involve; foremost of which should comply with the environmental aspects and the security of the network to sustain the water supply to the variety of populations it serve.

## 5.5.3 Water Balance Analysis - Details and Results

Using the obtained EWEC’s water demand forecast for the most likely demand forecast (excluding the auxiliaries demand), TRANSCO carried out a comprehensive water balance breakdown, covering the period of 2019 to 2026, 2028 & 2030, where demands are allocated at each interface point with the distribution companies.

The forecast accounts for the mean peak water demand forecast, as per EWEC terminology, which contains and details the requirements of the normal growth consumers, based on Mega Projects Demand, from the ADNOC and that of the Northern Emirates based on FEWA’s strategy and plans as per Government’s initiative in catering their water demand requirements. These data and information was utilized by TRANSCO in the overall network analysis and systems expansion planning gathered from EWEC.

In preparing the water balance the following were considered:

- Existing water Transmission System Details and capabilities.
- Running Projects (under construction and under-study, tendering and award stage projects) based on the enumerated list in Table 6.1 under Section 6.20 below.
- EWEC's regional and locality-wise demand forecast
- EWEC's production retirement and committed Plants based on their "Statement of Future Capacity Requirements" report.

The comprehensive water balance analysis of the specified periods is discussed in details in the Volume 1 of TRANSCO's detailed "Comprehensive Analysis of Abu Dhabi Water Transmission Network - Water Balance Analysis" summary of which are extracted below. The main objective of the Analysis is to determine the overall flow regime of the system considering the existing and planned production plants with respect to the existing and future demand requirement of the entire system. The process will determine the required infrastructure facilities for the efficient dispatch of water from the source (Production Plant) and the most feasible location of this source of supply base on transmission point of view.

#### 5.5.3.1 Analysis 1 - Water Balance Analysis of Existing Transmission System-Without Additions of Future IWPP's

The Water Balance Analysis is carried out, first by considering only the existing Independent Water and Power Producers (IWPP) and under construction IWPP's to determine which Region or Supply Zone will experience the surplus or shortfall in supply. Upon determination of the location of the surplus or shortfall, then the possible options to evacuate the surplus or to supply the shortfall to the affected Zone are studied and new additional IWPP and the associated Transmission Network are simulated.

Refer to Appendix D (Water Balance Analysis – Existing Scenario) for the corresponding Tabular Results of the Water Balance Analysis and Water Balance Diagrams and is as summarized below under Table 5.5.

The Water Balance Analysis results as shown below indicate the following conclusions with respect to the whole of Abu Dhabi Emirates:

- Table 5.8 presents the overall situation of the Abu Dhabi Emirates Water System from Year 2019 to 2030 utilizing the above Boundary Conditions of the Analysis.
- Based on the Demand Forecast supplied by EWEC (Diversified Demand Forecast) which is covering the year 2019 up to year 2026, the system will experience minor shortfall from 2019 to 2020. This shortfall is located on the Al Dhafra (Western) Region mainly at Muzairah area due to transmission constraints. Transco Project will be completed by year 2021 at which the constraints will be resolved.
- Comparatively, constraints for this year analysis is less than compared to the constraints calculated on last year planning statement which is mainly attributed to the decline in demand forecast.
- By year 2021 with the commissioning of TRANSCO projects in Al Dhafra Region and Taweelah to Al Ain, there will be no constraints in the system.

- From year 2019 till year 2020, the total available productions are not totally dispatched to DISCO considering the constraint at transmission system as shown in Column 5 (Production vs Demand) and Column 6 (Transmission vs Demand).
- Based on the results of the water balance in comparing the supply versus demand, there is a shortfall of a capacity of 9.00 MIGD (2026) and 46.00 MIGD by year 2030.

Table 5.8: Global Water Balance of the Water Transmission Network 2019-2026, 2028 & 2030

Year	Total Supply (MIGD)	Total Demand (MIGD) Including NE	Surplus at Production Plant (Available)	Overall Surplus / Shortfall Production vs Demand	Overall Surplus / Shortfall Transmission vs Demand	Overall Surplus / Shortfall Details (MIGD)								
						Zone 1 (Abu Dhabi Island)		Zone 2 (Abu Dhabi Mainland)		Zone 3 (Al Dhafra Region)		Zone 4/5 (Al Ain Region + NE)		
						DEMAND	Surplus / Shortfall	DEMAND	Surplus / Shortfall	DEMAND	Surplus / Shortfall	DEMAND	NORTHERN EMIRATES DEMAND	Surplus / Shortfall
2019	910.30	816.63	94.98	93.67	-1.31	124.19	0.00	319.19	0.00	81.38	-1.31	205.45	86.42	0.00
2020	910.30	826.94	84.59	83.36	-1.23	124.32	0.00	322.47	0.00	83.51	-1.19	204.95	91.69	0.00
2021	910.30	842.10	68.20	68.20	0.00	124.84	0.00	326.88	0.00	86.33	0.00	207.40	96.65	0.00
2022	860.30	846.60	13.70	13.70	0.00	123.51	0.00	328.58	0.00	88.91	0.00	207.95	97.65	0.00
2023	860.30	847.25	13.05	13.05	0.00	124.23	0.00	322.75	0.00	92.49	0.00	210.13	97.65	0.00
2024	860.30	851.45	8.85	8.85	0.00	125.32	0.00	319.24	0.00	96.20	0.00	213.04	97.65	0.00
2025	860.30	857.70	2.60	2.60	0.00	125.54	0.00	323.35	0.00	98.19	0.00	212.97	97.65	0.00
2026	860.30	869.13	-8.83	-8.83	0.00	126.63	0.00	329.33	0.00	100.69	0.00	214.83	97.65	0.00
2028	860.30	889.70	-29.40	-29.40	0.00	128.54	0.00	337.42	0.00	105.96	0.00	220.13	97.65	0.00
2030	860.30	905.86	-45.56	-45.56	0.00	129.62	0.00	342.98	0.00	110.47	0.00	225.14	97.65	0.00

\* Source: EWEC 2018/2019 Water Demand Forecast of the Most Likely Scenario (Diversified excluding Auxiliaries).

**NOTES:**

Column 4 – Surplus at Production Plant defines as the available water inside the Production Plant which is the sum of surplus of produced water and undelivered water due to transmission constraints.

Column 5 – Production Surplus/Shortfall, Produced water more than or less than the demand requirement.

Column 6 – Transmission Constraints

### 5.5.4 Production Expansion Plan Scenario

As presented in Table 5.8 above, the year-wise overall shortfall was determined and to balance the system onwards. By Year 2022, the additional 200.00 MIGD at Taweelah will be the basis of the balance. There are seven (7) scenarios presented of which the demand at FEWA are adjusted per scenario. Further, the scenarios were based on the assumed flow from Taweelah in the absence of any finalized and approved production expansion plan from EWEC.

If however, EWEC decided to construct additional production plant on top of the 200.00 MIGD RO Plant at Taweelah, it is assumed that this additional capacity will be used to replace thermal units

(MSF and MED) for economic purpose. There is an existing 202.00 MIGD in Shuweihat which are all MSF and 22.50 MIGD in Mirfa. The total capacity of which is equal to 224.00 MIGD plant.

As for the preparation of this report, the proposed decoupling was not considered and it should be emphasized that this concept of decoupling will have a major effect on Transco future infrastructure. EWEC to provide TRANSCO this decoupling strategy by providing TRANSCO how much water is coming out of each production plant at each specific year. TRANSCO will then re-analyze the existing transmission lines and any requirements as required.

#### 5.5.4.1 Analysis 2 - Water Balance Analysis with Additions of Future IWPP's

The Water Balance Analysis 2 – is carried out, to determine the most techno-economical reinforcements required based on the selected or identified location\’s of the additional IWPP’s. Since the location of the new production plant is known (200 MIGD at Taweelah) at year 2022, the system is then rebalance to determine the transmission network constraints and new transmission system required for the efficient evacuation of produced water.

As mentioned above that, until the production of this report, TRANSCO did not received any data for the profile of Desalination and RO plants specifically at Taweelah where the 200.00 MIGD is added. With this constraints, TRANSCO have formulated seven (7) scenarios which are described below:

Table 5.9: TRANSCO Production Expansion Scenarios

Scenario	Year	Taweelah	UAN	Mirfa	Shuweihat	Fujairah	Total (MIGD)	
1	Ms. Tractebel Data	2022	296.46	90.44	40.45	174.72	195.14	797.21
		2026	331.95	85.6	40.45	161.43	200.32	819.75
2	Max TL capacity	2022	296.46	90.44	40.45	174.72	244.53	846.60
		2026	302.7	90.44	40.45	185.84	249.71	869.14
3	Taw Replacement	2022	297.4	90.44	40.45	173.78	244.53	846.60
		2026	297.4	90.44	40.45	191.00	249.85	869.14
4	Winter Peak	2022	329.27	59.21	52.00	162.68	201.79	804.95
5	Winter Off Peak	2022	231.64	34.28	52.63	76.25	164.14	558.94
6	Summer Peak	2022	331.93	85.76	40.45	167.56	199.62	825.32
7	Summer Off Peak	2022	261.01	39.95	52.63	137.79	169.36	660.74

**Scenario 1:** Based on the data acquired from the Consultant Ms. Tractebel for the optimization of desalination plant with the arrival of Taweelah 200.00 MIGD and the Nuclear Power Plant at the Al Dhafra Region. Here the capacity of Taweelah is approximately 331.95 at maximum. This is more than the capacity of the existing pumping station and transmission lines at Taweelah.

**Scenario 2:** Based on the maximum system capacity of the transmission line from Taweelah to Unit III and to Ajban PS. This is to eliminate any transmission facilities required with the addition of Taweelah 200.00 MIGD. This is limiting Taweelah to Unit III at 152.00 MIGD utilizing twin DN1200 (Line 1 and Line 3) and DN1600 (Line 4).

**Scenario 3:** The scenario is based on the assumption that the 200.00 MIGD is just a replacement of the existing desalination plant at Taweelah. The additional 200.00 MIGD RO will only

replace the thermal units for economic dispatch. Existing plant is at 297.40 MIGD, future capacity will also be at 200.00 MIGD.

Scenario 4, 5, 6 and 7: The following Scenarios are based on the Ms. Tractebel output which is representative of the commissioning of the 200.00 MIGD RO plant. It has been divided into four (4) scenario which represents the annual cycle of water utilization of which is winter peak, winter off-peak, summer peak and summer off-peak.

The following scenarios were simulated and the demand forecast were adjusted to production supplies for water balance purposes. Moreover, for Scenario 1, 4, 5, 6 and 7, FEWA demand were readjusted as per the recent discussion and revised requirement of FEWA. Scenario 2 and 3 utilized the full requirement of FEWA of which will be supplied fully for the Fujairah system. Full details of the analysis can be found in the Volume 1 - "Comprehensive Analysis of Abu Dhabi Water Transmission Network - Water Balance Analysis" accompanying this statement.

#### 5.5.4.2 Recommendation on Production Expansion

The criticality of production profile plays an important input on the water balance. The capacity of flow evacuated from Taweelah with the inclusion of the 200.00 MIGD Reverse Osmosis plant and Fujairah dictates the transmission facilities required in the Taweelah system which also includes areas supplied by the Taweelah system (Mainland and Al Ain Region)..

With the absence of a firm production expansion, TRANSCO have utilized any available data based from Consultant's previous study to formulate scenarios.

Additional scenarios were generated by including the system capacity of the existing transmission lines and the option of a complete replacement at Taweelah. This is to provide the management of the required flow that can be added to Taweelah for evacuation without disturbing the system which would results to minimal investment until such time that EWEC production expansion have been finalized..

Based on the scenarios analyzed considering all the assumptions as stipulated above, there will be an investment involve only for Scenario 1 and Scenario 4 which includes transmission facilities from Taweelah to Unit III and Unit III pump station. However, it has to be noted that these investment comes when the production of Taweelah is above the 297.40 MIGD which is the existing production capacity.

In view of the above investment, which is large and very sensitive due to the uncertainty of the Taweelah output profile in addition to the unavailability of EWEC final production plan which has great influence on the above assumption, it is then recommended to proceed with "Scenario 3" which is a complete replacement of thermal units in Taweelah for the additional 200.00 MIGD. No investment is required and the majority of proposed transmission facilities proposed on the last 7YPS and business cases will still be required except for Taweelah to Unit III and Taweelah to Ajban water transmission system which are dependent on the Taweelah profile. The existing system and the proposed as per last year Planning statement can accommodate Scenario 2, 5 and 7.

In summary of the analysis, it can be concluded that:



- There is no impact on the system with the retirement of UAN as early as 2019. Surplus of water is around 88.00 MIGD within the year.
- Even with the retirement of Taweelah A2 (50 MIGD) by 2022, it has no major impact on the system even without the 200.00 MIGD as demand is approximately equal to production.
- The additional 200.00 MIGD can provide the requirements of Abu Dhabi up to year 2030 and further, however the strategy on efficient dispatch will dictate the future operation of Taweelah and any other plants that are planned to be built in Abu Dhabi.
- Any production that is planned at Al Dhafra Region should be used for decoupling purpose for economic reasons due to the location of Shuweihat and Mirfa to Abu Dhabi city. Relocating the replaced capacity to a different site would result to additional investment which can only be justified through WLCC analysis.
- With the unavailability of EWEC production plan at the time of the preparation of this report, all investments are likely to change as transmission lines are planned not only on demand but also on production. As for this year planning statement, major transmission lines (Production to Intermediate Stations) are based on production driven analysis due to surplus of production.
- Lastly, the 7YPS is developed without the input of SFCR 19, the 7YPS will be updated once we clear the uncertainty in the production profile..

Therefore, as the additional 200.00 MIGD will be used to replace the existing MED and MSF plants at Taweelah and utilizing the available transmission capacity of the system, there is no requirements for transmission facilities for the whole Abu Dhabi region including Northern Emirates.

As discussed above, majority of the proposed transmission line proposed in the last year planning statement is adequate to evacuate the supply to demand areas up to planning year 2026; except the Taweelah water transmission schemes (Taw to Unit III and Taw to Ajban) since it will be dependent on EWEC's recommended flow profile output of the plant which shall be the basis in the design of the transmission facilities, if any, that will be revisited by TRANSCO once available.

### 5.5.5 Water Balance Model-Schematics

Results of the detailed water balance analysis undertaken in the foregoing Sections 5.5.3 and 5.5.4 with their associated schematic diagrams are attached in the Appendices D and E. These schematic diagrams illustrate the analysis about the existing system without the additional capacities (Analysis 1) as well as the studied or analyzed scenario of additional plant capacities as incorporated into the network (Analysis 2), that is, the 200.0 MIGD RO Plant at Taweelah.

## 6. *Transmission System Capability*

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### 6.1 Introduction

In accordance to established strategic approach, the Water Transmission System is planned to meet the system demand forecast for the planning horizon and complying with planning and security criteria. These plans should be consistent with the long-term growth plans and aligned with generation expansion plan identified by EWEC.

For the past years, TRANSCO's investments has grown significantly necessitated by the fact that it has to further developed its Water Transmission System by constructing, reinforcing or replacing major new or existing water trunk mains, pumping stations and reservoirs to cope with the rising water demand requirements; to meet the desired level of service to its customers the DISCO's and to provide a high degree of security to its network. These investments should be aligned to the TRANSCO corporate strategies and initiatives that take into account the government objectives and policies, particularly those associated with the United Arab Emirates (UAE) future social, environmental and economic requirements.

In adherence to the planning process depicted in Section 3, an assessment and study of the Water Transmission Network must be carried out to determine the capability of its system and the required Water Transmission Network developments, if necessary. The study and analysis is driven by the EWEC demand forecast and production expansion and retirement plans within the Planning horizon for years 2020 to 2026 and guided by the planning criteria and principles discussed in Section 3 above of this statement. The subsequent sections hereunder explain the "capacity planning" methodology being under taken by TRANSCO in the analysis of its transmission capability from the production, transmission and distribution segments of its facilities. The outcome of this analysis serves as guide in the determination of the reinforcements, upgrading, improvements, etc. that are required by the network which will be revalidated by a more in-depth study and analysis from techno-economic viewpoint to justify their implementation.

### 6.2 Capacity Utilization / Flow Analysis

#### 6.2.1 Current Network Capacity

The transmission system capacity based on the current TRANSCO assets versus the EWEC latest demand is presented in Appendix C under the "Water Transmission Facilities Capacity Planning" Table. The table shows the existing assets of TRANSCO from Production plants to TRANSCO Intermediate and Terminal stations. Available capacity termed as "system capacity" is used in the analysis which is the maximum flow that both pump station and transmission line combined can hydraulically push from one station to the other station or directly to distribution system.

Referring to Table 6.1, the current total capacity of Transmission Facilities at Production Plant is approximately 1,198.62 MIGD. This capacity is in reference to TRANSCO Asset for each individual production plants. The limits or boundary of how much can be delivered from the station itself is in reference to the available water at the Production Plant. For instance, the available transmission

capacity at Taweelah is approximately 366.20 MIGD but the water to be transmitted is only limited to production availability of 297.40 MIGD. Similarly, Mirfa has a transmission capacity of 114.52 MIGD as against the currently available 52.5 MIGD. This capacity was based on the transmission interconnections between the production and transmission facilities of the system.

Table 6.1: Existing Network Capacity of Transmission Facilities at Production Plant

Production Sites	Location	Transmission Capacity (MIGD)
Umm Al Nar / Sas Al Nakhl	Zone 1 : Abu Dhabi Region	95.0
Taweelah	Zone 2 : Abu Dhabi Mainland (Eastern) Region	366.20
Al Mirfa (New Plant)	Zone 3 : Al Dhafra (Western) Region	114.22
Shuweihat	Zone 3 : Al Dhafra (Western) Region	224.00
Fujairah	Zone 5 : Northern Emirates	321.88
TOTAL CAPACITY (MIGD)		1,123.80

Table 6.2: Existing Network System Capacity of Transmission Facilities at Intermediate and Terminal Stations.

Intermediate/Terminal Station	Capacity (MIGD)	
	Distribution	Transmission/ Distribution
Zone 1 : Abu Dhabi Region		
Unit I	31.84	
Unit II	31.84	
TOTAL CAPACITY		63.68
Zone 2 : Abu Dhabi Mainland (Eastern) Region		
Unit III	121.94	43.30
Unit VI Ajban	31.49	84.00
Unit IV	44.97	21.00
Mussafah	109.32	
TOTAL CAPACITY		307.71
TOTAL CAPACITY		148.30
Zone 3 : Al Dhafra (Western) Region		
IPS-1		19.00
IPS-2		19.00
Madinat Zayed	39.24	48.12
Summit Tank		14.70
Muzeirah	10.43	
Mirfa IPS	10.00	180.20
TOTAL CAPACITY		59.67
TOTAL CAPACITY		281.02
Zone 4 : Al Ain Region		
AAR, Tap Off 9A, Remah to Khabisi and Northern Al Ain	311.42	
TOTAL CAPACITY		311.42
Zone 5 : Northern Emirates		
TOTAL CAPACITY		155.56
TOTAL CAPACITY		155.56

Table 6.2 is divided into two capacities, one for locally distributed water (Distribution) and the other a combination of transmitted flow from station to station plus distribution supply which are directly connected to the system (Transmission/Distribution). Totals for each zone are calculated, however it cannot be directly related to global demand forecast as demand are linked to individual pumping zones or coverage areas. Supply versus demand analysis can only be done through individual pump station system capacity. Attached in Appendix C is a Drawing illustrating the segment-wise system capacities of the major transmission network for ease of reference.

### 6.2.2 Capacity Utilization

The extents at which transmission facilities are utilized are based on demand growth and developments of an area. The current demand received from EWEC is less than the previous year and much lower than what was predicted few years ago. This will increase the percentage availability of transmission system.

For transmission system inside Production plant, it can be concluded that a number of total installed capacity of transmission facilities is above the capacity of production plants as presented in Table 6.3 below.

Table 6.3: Existing Capacity of Transmission Facilities at Production Stations.

Production Sites	Plant Capacity (MIGD)	Transmission Capacity (MIGD)	Difference	% Spare Capacity
Umm Al Nar / Sas Al Nakhl	95.0	97.50	2.50	2.5%
Taweelah	297.40	366.20	68.80	19%
Al Mirfa (New Plant)	52.50	114.22	61.72	54%
Shuweihat	202.00	224.00	22.00	10%
Fujairah	263.00	321.88	58.88	18%
TOTAL CAPACITY	909.90	1,123.80	213.90	

As for intermediate and terminal stations, capacity utilization is calculated individually as per pumping station and is presented in details in the TRANSCO Water System Station Capacity assessments (Appendix C, Water System Station Capacity vs. Demand Graphical Analysis).

Demand growth is one the investment drivers in the calculation of capacity planning and further checked and verified by Risk Analysis. Once the assets have reached its maximum utilization or at 100% utilization then additional infrastructure facilities are proposed with options on the most economical solutions.

The results of the capacity planning on Appendix C are fed back in Section 7.0 of this report "Network Development Plans and Business Opportunities" under the sub section "Planned Network Development".

As discussed above, the latest 2019 EWEC diversified demand forecast is less than the forecasted 2018 EWEC demand forecast which have resulted in the deferment or cancellation of some transmission projects for this year as presented in Section 7.1.2, Planned Developments.

## 6.3 System Capacity Forecast

### 6.3.1 Planned System Capacity

The capabilities of all the water transmission facilities, i.e. pipelines, pumps, and tanks, are likewise evaluated and verified according to the Planning Criteria and Water Security Standard as specified in Section 3.3 of this 7Y Planning Statement.

Based on the outcome of the water balance undertaken under Section 5.5.4.1 above, the expected volume of water or demand that are to be pumped or transferred from each station are compared with the corresponding system capacities of the individual facilities. If the system capacity is less than the expected amount of water to be distributed or transferred then reinforcement or upgrading, after hydraulic validation and operational optimization, is necessary for the system after further consideration of the long-term demand of these facilities.

The results of the overall analysis can be found in Appendix C, Water System Stations Capacity vs. Demand Graphical Analysis including the graphical representations of the capabilities of each pumping stations by regions. The graphs contain information of the maximum pumping capacity, the maximum pipeline capacity and the declared “system capacity” as against the expected volume of flow or demand from each station. Similarly, for tanks/reservoirs wherein their existing total capacities are compared with their expected capacity as per WTC and Security standards criteria which are dependent whether they are terminal or intermediate stations.

There are two types of graphs/charts - one is from pump station to pump station (transmission), and one is from pump station to ADDC or AADC local network (distribution).

The objective of these graphs is to give the reader a quick insight and/or overview about the capability of TRANSCO water system to deliver the required flow for the next seven (7) years, and shows clearly when the upgrades are needed either for pump or pipeline or storage tank.

These charts were prepared based on the following input data:

- a. The latest EWEC demand forecast (refer to Appendix B).
- b. Technical parameters of pump, storage tank and pipeline (Refer to Appendix C).
- c. In-house capacity planning study (Refer to Appendix C).

## 7. **Network Development Plans and Business Opportunities**

### 7.1 Network Development Plans

The TRANSCO's network development strategy, as discussed in Section 3.0 above under the precepts of the Asset Management Strategy framework, will continue to develop, operate and maintain a safe, flexible, accessible, robust, reliable, and efficient transmission system that meets the needs of its customers in a manner consistent with its License obligations.

In realizing and achieving its vision to be an innovative world class provider of sustainable water and electricity transmission services, TRANSCO adopts a long-term approach in the development of its transmission system with great emphasis on the principal drivers that are influential in shaping the future direction and backbone of the transmission network.

According to the results of the comprehensive study and evaluation carried out by TRANSCO, the subsequent sections presents the required reinforcements, upgrading and replacements in the Water Transmission Network that were either recommended earlier and are now under execution or are planned in the future for implementation. These projects are conceptualized in order to meet the increasing demand and/or to meet the required level of security of supply to its existing and prospective customers and in conjunction with EWEC's production expansion plans..

#### 7.1.1 Existing/Under Execution Network Developments

The Table 7.1 below enumerates the list of running and committed projects for the Water Transmission System Development that were conceived from previous Planning Statements that are now being implemented; the investment driver; the strategy and justification; the associated brief scope of works and schedule of these projects are included in the succeeding sections of the regional Systems Topology below. It identifies the Project's commissioning and/or completion that will be the basis of their inception to the transmission network that were considered in the water balance and hydraulic analysis.

The presented network topology takes into account the scope and implementation schedule of the current on-going projects, projects in the tendering stage and the proposed projects (under planning & feasibility study stage), together with the newly proposed projects as a result of detailed study and assessment of the transmission system covered by this Statement's planning horizon.

The whole water transmission systems geographic and schematics diagrams are attached in Appendix A - Drawings including the Water Transmission Topologies which are presented in regional manner for the planning period of Years 2019 (Base Year) to 2026.



Table 7.1: List of Running and Committed Projects for Water Transmission System Development

Serial No.	Projects Status	Region	Type of Work	Project ID	Contract Title	Current Expected Finish Date	Classification	Initiative Name\Drivers
<b>Abu Dhabi Region</b>								
1	Execution	AD	Consultant	N-6085	Consultancy Services for Umm Al Nar B P.S. Extension-During Execution & Warranty	30-Sep-19	Load	Production
	Execution	AD	Construction	N-6043	Umm Al Nar B Pumping Station Extension-Completion of Contract N2861.1	30-Sep-19		
2	Execution (Design stage)	AD	Consultant	N-16137	Consultancy Services for New DN1000 Pipeline at Sas Al Nakhl	17-Jun-21	Non-load	Asset Replacement
	Pre-Tendering	AD	Construction	N-W-18-0001-MA-Work	New DN1000 Pipeline at Sas Al Nakhl	17-Jun-21		
3	Execution	AD	Consultant	N-11547	Consultancy Services for the Replacement Works at UAN-B, TAW A2 Pumping Station & Submarine Pipelines Crossing UAN and Maqta Channel	26-Oct-21	Non-load	Asset Replacement
	Tendering	AD	Construction	N-14510.1	Replacement Works at UAN-B, TAW A2 Pumping Station & Submarine Pipelines Crossing UAN and Maqta Channel	26-Oct-21		
<b>Abu Dhabi Mainland (Eastern) Region</b>								
1	Execution	ER	Consultant	N-12705	Consultancy Services for the Additional Transmission Pipeline from Taweelah to Ajban PS	03-Sep-21	Non-load	Strategic/System Improvement
	Tendering	ER	Construction	N-15907	Water Transmission Scheme from Taweelah to Ajban PS	03-Sep-21		
2	Execution (Design stage)	ER	Consultant	N-14560.1	Consultancy Services for Additional Storage Tanks at Ajban & Mussafah Pumping Stations	25-Mar-22	Load	Compliance to Security Standards
	Pre-Tender	ER	Construction	N-16299	Additional Storage Tanks at Ajban & Mussafah Pumping Stations	25-Mar-22		
3	Tendering	ER	Consultancy	N-16307	Consultancy Services for Water Transmission Scheme of Unit III and Unit V PS	29-Sep-22	Load	Demand Growth
	Pre-Tender	ER	Construction	N-W-19-0005-MN-Work1	Unit III Water transmission scheme	29-Sep-22		

Serial No.	Projects Status	Region	Type of Work	Project ID	Contract Title	Current Expected Finish Date	Classification	Initiative Name\Drivers
	Pre-Tender	ER	Construction	N-W-19-0005-MN-Work2	Unit V Water transmission scheme	29-Sep-22		
4	Tendering	ER	Consultant	N-16300	Consultancy Services for Upgrading & Modification Works at Ajban Pumping Station	29-Dec-22	Non-load	Strategic/System Improvement
	Pre-Tender	ER	Construction	N-W-18-0009-MA-Work	Upgrading & Modification Works at Ajban Pumping Stations	29-Dec-22		
<b>Al Dhafra (Western) Region</b>								
1	Execution	WR	Consultant	N-12660	Consultancy Services for the Construction of a New Pumping Station at Mirfa to Supply the DN1200 Pipeline of the Aquifer Project	11-Nov-20	Load	Demand Growth
	Execution	WR	Construction	N-14673.2	Construction of a New Pumping Station at Mirfa to Supply the DN1200 Pipeline of the Aquifer Project	11-Nov-20		
2	Execution	WR	Consultant	N-11328 VO3	Consultancy Services for Water Transmission Scheme from Mirfa to Madinat Zayed, Liwa, and Presidential Palace in Qeshawira	24-Aug-21	Load	Demand Growth
	Tendering	WR	Construction	N-12192.1	Water Transmission Scheme from Mirfa to Madinat Zayed, Liwa, and Presidential Palace in Qeshawira	24-Aug-21		
<b>Al Ain Region</b>								
1	Execution	AA	Consultancy	N-15063	Consultancy Services for the Replacement Works at Jabel Haffet Pumping Station	20-Nov-21	Non-load	Asset Replacement
	Pre-Tender	AA	Construction	N-16297	Replacement Works at Jabel Haffet Pumping Station	20-Nov-21		
2	Tendering	AA	Consultancy	N-16301	Consultancy Services for Upgrading Works in Pumping Stations in Al Ain	31-Dec-22	Non-load	Strategic/System Improvement
	Pre-Tender	AA	Construction	N-W-18-0002-MA-Work	Upgrading Works in Pumping Stations in Al Ain	31-Dec-22		
<b>Northern Emirates</b>								
1	Tendering	NE	Consultancy	N-16203	Consultancy services for Kalba branch Pipeline and Reservoirs Station	12-Aug-20	Load	Government Initiatives
	Tendering	NE	Construction	N-15629	EPC Works for Kalba Branch Pipeline and Reservoir Station	12-Aug-20		

Serial No.	Projects Status	Region	Type of Work	Project ID	Contract Title	Current Expected Finish Date	Classification	Initiative Name\Drivers
2	Tendering	NE	Construction	N-16296	Modifications Works at Existing Tap-Off # 2 & 4 on FWTS (NE)	27-Aug-21	Load	Demand Growth
<b>Common Regions</b>								
1	Execution	AA-NE	Construction	N-14244.1	MDEC Compliant Installations at the Connection and Interface Points in Abu Dhabi Region and Northern Emirates	31-Jul-19	Non-load	Strategic/System Improvement
2	Execution (Design stage)	Common	Consultancy	N-14991.1	Consultancy Services for the Implementation of Bromate Control Study	15-Dec-21	Non-load	Strategic/System Improvement
	Pre-Tender	Common	Construction	N-16505	Modification & Upgrading of Disinfection Facilities for Bromate Control	15-Dec-21		
	Pre-Tender	Common	Construction	N-W-18-0007-MA-Work2	Supply and Installation of Mobile Chlorine Dioxide Plant	05-Mar-22		
3	Tendering	ER-AA	Consultancy	N-14659.1	Consultancy Services for the Replacement of SCADA Systems at Unit III, Ajban and Sweihan Pumping Station	06-Jan-22	Non-load	Asset Replacement
	Pre-Tender	ER-AA	Construction	N-16683	Replacement of SCADA Systems at Unit III, Ajban and Sweihan Pumping Station	06-Jan-22		
4	Execution (Design stage)	ER-NE	Consultancy	N-16498	Consultancy Services for Water Interconnection with DEWA Network	03-Feb-22	Non-load	Strategic/System Improvement
	Pre-Tender	ER-NE	Construction	N-W-19-0006-MA-Work	Water Interconnection with DEWA Network	03-Feb-22		
<b>OPEX PROJECTS</b>								
1	Execution	Common	Consultancy\ Works	N-13881.1 \N-P-C-B-20-0002-MA	TRANSCO Water Management System at LDC	Oct-2022	Non-load	Strategic/System Improvement
2	Execution	Common	Consultancy	N-16230	Consultancy Services for Calibration, Study and Optimization of Water Transmission Network	Dec-2019	Non-load	Strategic/System Improvement

\* Source: DB 2020 Submissions & End of May 2019 Project Status Report from PMD Extracted Data of the Primavera-P6.

The Summary of the Regional System Topology for the planning period (2018-2025) as per Existing, Under Execution and Committed transmission network developments are as follows:

### 7.1.1.1 SYSTEMS TOPOLOGY OF ABU DHABI ISLAND REGION

- Project ID: Contract N-6085 (Consultancy) / N-6043 (Construction)  
Project Name : Umm Al Nar “B” Pumping Station Extension.

Investment Driver: Production expansion.

Strategy: The works at Umm Al Nar ‘B’ pumping station will extend the existing pumping station to increase the duty pumping capacity at 10-bar discharge pressure to 50 MIGD to provide an overall pumping station duty capacity of 95 MIGD which will be the ultimate capacity of the Plant after the retirement of UAN East and West Plants.

Scope of Works: The major works involved are:

- a. Installation of Additional 2 -12.50 MIGD pump units similar to the existing.

Key Date: The project is in under construction stage and the expected completion date is September 2019.

- Project ID: Contract N-16137 (Consultancy) /(Budget Code N-W-18-0001-MA-Works)  
Project Name: New DN1000 Pipeline at Sas Al Nakh

Investment Driver: Pipeline replacement\relocation.

Strategy: The proposal originates from a Case Study recommendation of a joint committee composed of WASPD and O&M TRANSCO about the situation of the segment of the DN 1000 pipeline from UAN to Unit III PS. This pipeline portion is passing through a Military critical area and high security infrastructure. Due to the high security condition, the maintenance and line inspection is extremely difficult and is not easy to access inside the Camp to follow any preventive or corrective Maintenance. In addition, the pipeline is located in a very salty and sabkha soil condition which are very corrosive that is affecting the life expectancy of the pipeline. The works is further justified with TRANSCO receiving instructions from the Joint Logistic Command-Command of Military Work-Project Department of the Armed Forces concerning the immediate relocation of the pipeline.

Scope of Works: The scope of work of the projects includes the following:

1. New DN1000 pipeline with all required approximate length of 1600m as shown in the attached drawings, including valves, fittings, road/ facilities crossing and all works required for the connection
2. Supply, install, test and commission Fiber Optic Cable (FOC) along the pipeline rout including connect and disconnect with the required splices.

3. Disconnect / connect to the existing DN1000 pipeline
4. Grouting the ends or removal of the abandoned pipeline as per requirements of the concerned authorities.
5. All associated civil, electro-mechanical, instrumentation, control & communication, Testing and commissioning works including flushing and disinfection

Key Date: The scheme is planned for completion by June 2021.

- Project ID: Contract N-11547 Consultancy / N-14510 (Construction),  
Project Name: Replacement Works at UAN-B, TAW A2 Pumping Station & Submarine Pipelines Crossing UAN and Maqta Channel.

Investment Driver: Asset replacement/refurbishments.

The Project covers the following Major type of works:

A. Replacement Works Submarine Pipelines Crossing the UAN and Maqta Channel.

Strategy: These proposed works are vital for the evacuation of the production capacity of UAN Plants to supply particularly the Abu Dhabi Island, Adjacent Islands and the Mainland. An "Investigation Report" prepared by Water Asset Strategy and Performance Department (WASPD)-AMD is available to further substantiate the proposed works.

Scope of Works: The major works involved are:

Pipelines at UAN Channel:

1. Replacement/Repair of 6 Nos. Water Transmission 900mm CS Submarine Pipelines Crossing the UAN Channel (155.0 m each).
2. Two Jump over structures and piping on both sides of the channels including fittings

Pipelines at Maqta Channel:

1. Replacement/Repair of 3 Nos. 1000mm CS Water Transmission Submarine Pipelines Crossing the Maqta Channel (10.00 each).

Pipelines at Al Khaleej Al Arabi St. (System 2):

1. Replacement of the 2.60 km DN1x900 CS Pipeline (System U2) along Al Arabi St.

B. Replacement Works at UAN B Pumping Stations and other O&M Works within Abu Dhabi.

Strategy: This project was raised due to the following justifications: Assured security of supply to the Abu Dhabi Island, Adjacent Islands and the Mainland increase the life of the affected transmission pipelines and related equipment and ease of operation and Maintenance.

Scope of Works: The major works involved are:

UAN B PS Works:

1. Installation of Dismantling Joints for the valves at the Suction side and Discharge header and piping of the UAN B Pumping Station.

2. Replacement of existing GRP pipes at the suction side and CS pipes at the Discharge side to new pipes Carbon Steel including all associated works
3. Replacement of old double flanged GRP pipes at the Discharge side.

C. Replacement Works at Taweelah A2 Pumping Station.

Strategy: This project was raised due to the following justifications: The project Headers of TAW A2 are in Bad Condition, valves are passing, no flexible connections to replace gasket/valves. Any header failure will stop half/ full Taweelah pump station supply Capacity and cause consequent trouble for generation units. In addition, the project will be used to improve the security of supply to the Abu Dhabi Island, Adjacent Islands and the Mainland from Taweelah A2.

Scope of Works: The major works involved are:

Taweelah A2 PS Works:

1. Replacement of existing headers with carbon steel headers, Replace Existing Valves and install flexible Joints of the Taweelah A2 PS's GRP/GRV Suction and Discharge headers.

Key Date: The project is expected for completion on October 2021.

## 7.1.1.2 SYSTEMS TOPOLOGY OF ABU DHABI MAINLAND (EASTERN) REGION

- Project ID: Contract N-12705 (Consultancy)/N-15907 (Construction)  
Project Name: Additional Transmission System from Taweelah to Ajban PS

Investment Driver: Compliance to Security Standard/Strategic & System Improvement.

Strategy: To fully comply with the Security Standard, additional facilities were proposed to optimize the transmission system. The scheme will also maximize the utilization of the transmission facilities from Taweelah-Ajban-Sweihan to supply Al Ain Region's additional water requirements. The scheme will facilitate to supply the large quantity of water required by the Al Maha Farms from Ajban PS instead of from Sweihan (Fujairah Network).

Scope of Works: The following are the Major system requirements:

- a. Supply, Installation, testing and commissioning of one new pump similar to the existing capacity (1x25.00 MIGD) at Taweelah B Pump Station.
- b. Supply and Installation of a new 1.35 Km of DN1000 mm pipelines from the discharge header of the existing Ajban Transmission Pump Station to the existing twin DN1000 mm Sweihan Reception to Ajban transmission lines, including all work required for the connection.
- c. Supply, installation and all works required for a provision connection from three transmission pipelines, which are the existing twin DN1000 mm Sweihan Reception to Ajban transmission lines and 1x DN1200 mm Ajban PS to Sweihan PS transmission line, to supply in the future the required water quantity of the areas between Abu Dhabi-Al Ain & Abu Dhabi-Sweihan Roads.



- d. Supply, installation and all works required for the connection of a new 200 meters of DN1000 mm pipeline from the twin DN1000 mm Sweihan Reception to Ajban transmission lines to the existing twin DN1200 mm Sweihan Reception to Sweihan Pump Station transmission lines.
- e. Supply and Installation of a new 1.00 Km of DN1600 mm pipeline from the discharge header of the existing Sweihan Transmission Pump Station to the existing twin DN1600 mm Fujairah Water transmission lines, including all work required for the connection.
- f. Supply and replace the existing DN1200 pipelines and fittings (downstream of control valves in Sweihan Reception Tanks) with new higher pressure rating pipelines and fittings, including all work required for the connection.
- g. Supply, installation and all works required for the connection of the above proposed DN1200 mm pipelines with the existing twin DN1200 mm Ajban PS to Sweihan PS transmission lines bypassing Sweihan Reception.
- h. Supply, installation and commissioning for replacing the old existing SCADA and Control system with the latest technology new SCADA system of Taweelah B Pump Station, including the integration of Taweelah B Pump Station with Load Dispatch Center (LDC).
- i. All associated civil, electro-mechanical, instrumentation, control & communication works.

Key Date: The above works is planned to be completed and commissioned by September 2021.

- Project ID: Contract N-14560.1 (Consultancy)/N-16299 (Construction),  
Project Name: Additional Storage Tanks at Ajban and Mussafah Pumping Station

Investment Driver: Increase in Water Demand and security of supply.

Strategy: To provide additional reinforcement on the existing transmission facilities and to comply with the minimum requirements of the Water Transmission Code, additional facilities are required for security of supply to the vital consumers of the pumping station which includes the Ajban Palace and Zayed Military City.

Scope of Works:

The required infrastructures will be subdivided into Two Lots and include but not limited to the followings:

A. Lot A:

1. New Concrete Storage Tanks at Ajban pumping station with a total capacity of 3.50 MIG (1-3.50 MIG).
2. Piping System to connect the existing transmission lines to the proposed storage tanks including balancing line to the existing tanks. Pipes to be of the same material as the existing ones.
3. All associated civil, electro-mechanical, instrumentation, control & communication works

B. Lot B:

1. New DN1200 mm DI pipeline with length of 500 m approximately from AUH pump group to the outlet pipes of Unit IV pump group at Unit III PS, including all works required for the connection.
2. New 2 control valves on the DN900 mm inlet pipes of Unit IV Tanks, including all works required for the connection.
3. Modification works for the existing interface point connections on the twin DN900 mm pipelines (UAN PS to Unit IV PS) complying with the requirements of the latest version of the Water Transmission and Metering Codes as well as the increased maximum head due to the interconnection at Unit IV.
4. All associated civil, electro-mechanical, instrumentation, control & communication works.

Originally in the previous 2018 7 YPS, the above scheme includes a proposed new 3x10 MIG tank capacities. The scope was revisited and found that the tanks construction can be deferred for implementation attributed to the decrease in water demand causing a change in supply strategy of the proposed "transmission ring main" and triggered by the uncertainty of the proposed production at Mirfa which was envisioned to be after the 200 MIGD at Taweelah.

Key Date: The project is expected for completion on [March 2022](#).

- [Project ID: Contract N-16307 \(Consultancy\)/N-W-19-0005-MA Works 1/2 \(Construction\),](#)  
[Project Name: Water Transmission Scheme of Unit III and Unit V PS](#)

Investment Driver: Load related project due to increase in demand \ Strategic & System Improvement.

Strategy: The proposed water transmission scheme was developed to satisfy the following objectives and strategies:

Unit III Water Transmission Scheme:

- Meet the future requirements (flow & pressure) of the distribution networks within the Central Region of Abu Dhabi.
- Address the poor condition of Unit IV through bypassing of the Baniyas Pumping Group, Wathba Pumping Group and Construction of Unit V as a replacement of Shobaishi Pumping Group
- Transmit the water surplus wherever available in the production plants (i.e. TAW or UAN or Mirfa) to the Central Region for meeting its demand though forming the Transmission Ring Main.

The proposed Transmission Ring Main (TRM), consists of the following transmission pipelines. The TRM will be initially supplied by Unit III and Mirfa pumping stations and then Mussafah pumping station will supply it in the future as well.

- DN1600 mm & DN1000 mm pipelines along Abu Dhabi –Dubai road,

- Twin DN900 mm pipelines from Umm Al Nar Junction to Unit IV PS along Abu Dhabi – Al Ain Road
- Twin DN900 mm pipelines from Unit III PS to Unit IV PS, which will be interconnected to the above Twin DN900 under a Contract No. N-14560.1.
- DN1600 mm pipeline from Mirfa to Unit IV PS, which is already connected to the above two twin DN900 pipelines.

The proposed DN1200 mm pipeline from Unit III PS connected at Unit IV to the proposed interconnection under a Contract No. N-14560.1 between the twin DN900 pipelines from UAN and twin DN900 pipelines from Unit III.

Unit V Water transmission scheme – intended to replace Unit IV pump station based on condition assessments.

Lot 1: Unit III Water transmission scheme: The following are the scope of work

- a. New pump group to transmit the flow to Unit IV local network and to new Unit V PS with a total capacity of 48.00 MIGD (3+1: 16.00 MIGD for each @ 125.00 m head).
- b. New DN1600 mm pipeline from Unit III PS connected to twin DN900 pipeline and the new DN1200 pipeline with a total length of 0.40 Km.
- c. New DN1200 mm pipeline from the above DN1600 pipeline to Unit IV Pump station with a total length of 45.30 Kms.
- d. New DN 1000 mm pipeline from the proposed DN1200 to Unit V PS with a total length of 3.00 Kms.
- e. All associated civil, electro-mechanical, instrumentation, control & communication works.

Lot2: Unit V Water transmission scheme: The following are the scope of work

- a. New pump group to transmit the flow to Shobaishi PS with a total capacity of 12.00 MIGD (2+1: 6.00 MIGD for each @ 101.50 m head).
- b. New DN 1000 mm pipeline from Unit III PS to the existing DN1000 Unit IV to Shobaishi transmission line with a total length of 0.350 kms.
- c. New 1-5.00 MIG Steel Tank at New Unit V PS.
- d. All associated civil, electro-mechanical, instrumentation, control & communication works.

Key Date: The above overall scheme scope of works are planned for completion by September 2022.

- Project ID: Contract N-16300 (Consultancy) / N-W-18-0009-MA-Work  
Project Name: Upgrading & Modification Works at Ajban Pumping Stations

Investment Driver: System improvement due to Growth in Water Demand.

Strategy: The proposal involves minor works which will be required at the station intended for operational systems improvement.

Scope of Works: The scope of work of the projects includes the following:

1. Installation of control valve at the existing interconnection between Zayed Military City (ZMC) pump station and the pipeline supplying Ajban Palace, including the associated works. The purpose of this valve is to enable ZMC PS to supply the Palace in addition to its areas and achieve the objectives related to water supply security and cost optimization as mentioned in Section 1.

Ajban pumping station has two local pump stations; one is for water supply to Ajban Palace and the other one (ZMC) is for the Military area and Tabreed. The above interconnection cannot be operated without the proposed control valve because both destinations have different pressure requirements.

2. Interconnection works of ZMC pumping station outlet to either DN1200 mm transmission pipeline from Ajban to Sweihan PS or to the DN1000 mm Al Maha line, which is branched from the same above DN1200 mm pipeline. The purpose of this interconnection is to provide a backup water supply source that can be used only during the emergency cases in ZMC PS in order to ensure that no water interruption to the above critical areas.
3. All associated civil, electro-mechanical, instrumentation, control & communication works.

Key Date: The above overall scheme scope of works are planned for completion by December 2022.

### 7.1.1.3 SYSTEMS TOPOLOGY OF AL DHAFRA (WESTERN) REGION

- Project ID: Contract N-12660 (Consultancy) / N-14673 (Construction)  
Project Name: Construction of a New Pumping Station at Mirfa to Supply the DN1200 Pipeline of the Aquifer Project

Investment Driver: Systems reinforcement due to demand growth.

Strategy: The purpose of the project is the construction of additional pump capacity at Mirfa to supply the New DN1200 pipeline feeding the Aquifer Project. The pump capacity shall be achieved through either the addition of pumps to existing Mirfa pump station or the construction of a new pump Station. The pump station is supplied by the new foreseen Desalination plant at Mirfa as well as from the existing tank farm at Mirfa (SWTS) and delivers in the existing DN1200 pipeline between Mirfa and Madinat Zayed.

The New pumping capacity shall offer the flexibility of emergency pumping to Shuweihat or to Mussafah using the planned by-pass at Mirfa. The New pumping capacity shall also be integrated in the Liwa Aquifer Recharge Scheme.

The Security of Supply to the Al Dhafra Region Areas of Madinat Zayed and Liwa Areas including that of the ADNOC and other ADDC-VIP consumers is further enhance by this new scheme. Lesser investment cost by utilizing the new under construction 1x1200mm pipelines (during normal operations) to supply the additional water requirements of the above consumers.

Scope of Works: The following are the Major system requirements:

- a. Supply, Installation, testing and commissioning of two new pumps similar to the existing pumps (2 x 25.00 MIGD).
- b. Supply and Installation of new DN1600 discharge header piping and fittings to connect the proposed New Pumping Capacity to the existing Mirfa pump station so that two existing pumps can be used for supplying the DN1200, including all work required for the connection.
- c. Supply and Installation of a new 1xDN1200 mm (1.0 Km) to connect the proposed New Pumping Capacity header (DN1600) to the existing DN1200 to Madinat Zayed, including all work required for the connection.
- d. Supply and Installation of extension to the twin DN1600 header piping and fittings (to be defined by the consultant) of the existing Mirfa pump station so that the new pumps can be used to supply the existing transmission pipeline, including all work required for the connection.
- e. Supply and Installation of 1.50 Kms of 2xDN1400 mm to connect the proposed New Pumping Capacity to the under construction New Desalination plant at Mirfa (based on the provisional interface point), including all works required for the connection. It is to be noted that, the scope of the 1xDN1400 (without fittings-approximately 0.75 kms) is being tendered under separate Contract N-15202 above, once awarded shall be removed and the scope shall be reduced to:
  - Supply and Installation of 0.750 Kms of 1xDN1400 mm and fittings to connect the proposed New Pumping Capacity to the foreseen New Desalination plant at Mirfa (based on the provisional interface point), including all work required for the connection
  - Supply and Installation of 0.250 Kms of 1xDN1400 mm and fittings to connect the proposed New Pumping Capacity to the tie-in point with the new DN1400 (installed under project N-15202), including all fittings and work required to complete the installed portion of DN1400 (project N-15202).

Key Date: The above works are planned to be completed and commissioned by November 2020.

- Project ID: [Contract N-11328 VO3 \(Consultancy\)/ N-12192 \(Construction\)](#)  
Project Name: [Water Transmission Scheme from Mirfa to Madinat Zayed, Liwa, and Presidential Palace in Qeshawira](#)

Investment Driver: Growth in Water Demand specially to meet the ADNOC and VIP requirements.

Strategy: This project was the main original proposal intended to cater the water demand requirements of ADDC's consumers and new Developments supplied by the Liwa East Pump Group most importantly the H.H. the Presidents Palace and ADNOC's Development in Qeshawira, Al Ain Region. The Security of Supply to the Al Dhafra Region Areas of Madinat Zayed and Liwa Areas including that of the ADNOC and other ADDC-VIP consumers is further enhance by this new scheme.

Scope of Works: The major works involved are:

IPS 2 Interconnection:

- a. Pipeline Connection from existing 800mm Carbon Steel pipeline to IPS 2 Reservoirs.

Summit Tank Farm:

- a. New 1x1200 mm transmission line 16.0 km in length from Summit to Muzairah PS to reinforce the GRP Lines and provide the required security of supply to Liwa Area.
- b. New 1x900 mm transmission line 2.10 Km from the above 1200 mm transmission line to Old Muzairah PS.

Liwa-Muzairah PS:

- a. Installation of a new pump groups that will be dedicated for Liwa East area with a capacity of 16.00 MIGD (2+1 each at 8.00 MIGD).
- b. Construction of a DN1000 pipeline from New Muzeirah to Existing Muzairah PS with approximate length of 2.0 Kms.
- c. Construction of a DN800 pipeline from the existing DN1000 pipeline all the way to Abu Awana with approximate lengths of 20.10 Kms.
- d. Construction of a DN400 pipeline from Abu Awana all the way to ADNOC-Qeshawira / Presidents Palace with approximate lengths of 83.10 Kms.
- e. Construction of interconnection points to existing supply lines at Muzairah PS and interface points with the 400mm Liwa East distribution lines.
- f. Construction of a new 2x1.5 MIG (3.0 MIG) reservoir at Muzeirah.

Key Date: The Project's Consultancy is already on-going and the projected completion date of the Construction works is August 2021.

#### 7.1.1.4 SYSTEMS TOPOLOGY OF AL AIN REGION

- Project ID: Contract N-15063 (Consultancy)/ N-16297 (Construction)  
Project Name: Replacement Works at Jabal Hafeet Pumping Station

Investment Driver: Asset replacement due to age.

Strategy: The Project scheme was developed based on the recommendation by the Water Asset Strategy and Performance Department (WASPD) about the assessment on the condition of the existing Jabal Hafeet Pumping Station and its associated equipment's which are already obsolete due the ageing.

Scope of Works: The major works are:

- a. Construction of a new pump station building to replace the existing Jebel Hafeet base pump station to house the new pump sets, variable speed drives, switchgears, transformers, de-aerator (if required) and all ancillary equipment and facilities which shall be constructed within the available TRANSCO plot.
- b. Installation of new pump groups: transmission high lift pumps (to Jebel Hafeet Summit PS) with a capacity of 1.03 MIGD (2+1 at 0.52 MIGD each-approximately 889 m head) new Electrical Variable Speed Drive and motors; low lift pumping system with a capacity of 1.03 MIGD (2+1 at 0.52 MIGD each-approximately 16.75 m head) for the de-aerator including the distribution pump system (1+1 at 0.67 MIGD each) for Green Mubazarah.



- c. Suction pipework from the existing tank to the new base pumping station including all fittings, valves and flow meters.
- d. Discharge pipework from the new base pumping station to the existing pipes, that are connected to the distribution network and the transmission system to Jabel Haffet summit pumping station, including all fittings, valves and flow meters.
- e. New SCADA/control system with integration works.
- f. Surge protection equipment (if required).
- g. All required civil works, instrumentation, control & automation and associated electro-mechanical works.

Key Date: The scheme is planned for completion by November 2021.

- Project ID: Contract N-15063 (Consultancy)/ N-W-18-0002-MA (Construction)  
Project Name: Upgrading Works in Pumping Stations in Al Ain

Investment Driver: Asset Enhancement/Replacement.

Strategy: The project aims to enhance the water supply to Al Ain region by replacing the old pipelines located between the newly laid DN1600 transmission lines and pipelines laid by Al Ain distribution company (AADC). These are the interface points located at the eight existing pumping stations namely Al Maquam, Al Dhama, Zakher, Zoo, Al Hili, Power House, Sarouj and Military.

By replacing the old pipelines, the above pumping stations can now be isolated and removed from the system. Furthermore, TRANSCO can now operate the system based on its design criteria of providing enough pressure to AADC without the use of existing eight (8) terminal stations.

Scope of Works: As the project involves multiple scope of works, it is then divided into two lots, Lot A and Lot B and are enumerated below:

Lot A: Upgrading Works and Demolishing Related Works at Pumping Stations

1. The required works to connect the newly constructed receiving points (RPs) to the existing interface connection points (up to AADC FM), including all associated works required for the connection.
2. Provide power supply from an external source to the assets that will be retained after pumping stations disposal.
3. Chlorine injection/dosing points at the new RPs.
4. All works related to integrate the new RPs located in the above pumping stations to LDC for settlement purpose.
5. All the associated civil/modifications, electrical, mechanical, instrumentation, integration, control & communication works utilization of the existing pipelines that are feeding the pumping stations.
6. All the necessary works required to isolate the existing assets, which will not be used in the future, in order to have a functional and easy to operate independent system.
7. Replacement of the hydraulic actuator of the existing Control Valves by electric type at Tap-Off 10, Tap-Off 11 and Sweihan PS Inlet, including all associated works
8. New chlorination facilities with the associated works to resolve the low disinfectants levels at Tap-Off 27, Tap-Off 28 & Tap-Off 29 downstream of FWTS Tap-Off 09A.
9. All the associated civil/modifications, electrical, mechanical, instrumentation

Lot B: Dismantling & Demolishing of Pumping Stations

Decommissioning, demolition & disposal of old TRANSCO assets only in the nine (9) pumping stations (i.e. eight (8) existing and one (1) already by-passed).

Key Date: The scheme is planned for completion by December 2022.

### 7.1.1.5 SYSTEMS TOPOLOGY OF NORTHERN EMIRATES

- Project ID: Contract N-16203 (Consultancy)-VO1 / N-15629 (Construction)  
Project Name: Water Supply to Kalba

Investment Driver: Government Instructions and growth in Water Demand.

Strategy: The scheme shall facilitate the supply of Kalba Area under the SEWA Authority in connection with the TRANSCO Project N7396 (above) from the potable water produced by the Fujairah P&DP.

The scope of work developed is as described below:

- a. Supply, installation, testing and commissioning of approximately 4.50 Kms of DN600 Carbon Steel Pipeline.
- b. Installation of a 3.00 MIG Concrete Tank

Key Date: The above works are expected to be completed and commissioned by August 2020.

- Project ID: Contract N-16296 (Construction)  
Project Name: Modifications Works at Existing Tap-Off # 2 & 4 on FWTS (NE)

Investment Driver: Government Instructions and increase in Water Demand due to New developments.

Strategy: The proposed scheme shall facilitate to supply the required water quantity of FEWA and SEWA from ADPC-TRANSCO as per master agreement for water.

As the system is directly supplied from TRANSCO system through Tap Off 2 and Tap Off 4, there is no options available. The strategy is to increase the capacity of the existing Tap Off stations if the new demand is within the specifications of all existing equipment including the integration into existing facilities.

The scope of work for the system are the following:

#### Tap off Station - TOS 2

- a. Replacement of the existing flow control valve (FCV) with new flow control valve DN 300 with all necessary fittings required to install it on the existing station piping DN400, including all related works like required supports to suit the new valve etc.
- b. Replacement of the existing FEWA flow meter with electromagnetic flow meter with same size and pressure rate.
- c. Connection and configuration of new valve and flow meter with the existing PLC/RTU panel including all power and control cables, for the functioning of FCV
- d. All works related to testing and commissioning of TOS with new FCV and flow meter.
- e. All preparatory works for the replacement works including the PTW, shutdown, isolation and draining of existing system and normalization works.

#### Tap off Station - TOS 4 (SEWA)

- a. Supply and installation the DN 500 FCV including all related works like required supports to suit the new valves etc.,
- b. Supply and installation two (2) isolation valves (1 No. DN500 MOV & 1 No. DN600 MOV), two (2) dismantling joints ((1 No. DN500 & 1 No. DN600), one (1) strainer DN500, one (1) flow meter DN600 and data logger with all necessary fittings.
- c. Supply and installation the new DN 500 CS pipe inside the existing chamber for the new connection including pipe supports and all civil works etc.,
- d. Supply and construction the required pipeline connection size DN800 PN40 between the chamber and existing DN 800 CS pipeline (immediately outside the chamber) including pipeline route survey and soil investigations.
- e. Connection and configuration the new equipment with the existing PLC/RTU panel including all power and control cables, for the functioning of new connection.
- f. All instrumentation works including PTs and PGs etc., connection with the existing PLC/RTU panel including all power and control cables, for the functioning of new connection.
- g. Addition of new DI, DO, AI & AO cards in the PLC/RTU panel for the new equipment at the TOS connections.
- h. All power supply installations associated with the new station equipment.
- i. All works related to integrate the new flow meter to the existing LDC outstation/instation, include all requirement for license at outstation/Instation.
- j. All civil works upstream SEWA chamber related to replacing existing reducer DN600x400 and pipe piece DN400 penetrated the chamber by new reducer DN DN600x500 and pipe piece DN500.
- k. All civil works downstream SEWA chamber related to the connection the existing SEWA pipeline DN800 to the proposed arrangement at SEWA chamber.
- l. All works related to testing and commissioning of TOS with new connection arrangement.
- m. All preparatory works for the new connection including the PTW, shutdown, isolation and draining of existing system and normalization works.

#### Tap off Station - TOS 4 (FEWA)

- a. Replacement of the existing flow control valve (FCV) with new flow control valve DN 300 with all necessary fittings required to install it on the existing station piping DN400, including all related works like required supports to suit the new valve etc.
- b. Connection and configuration of new valve with the existing PLC/RTU panel including all power and control cables, for the functioning of FCV
- c. All works related to testing and commissioning of TOS with new FCV.
- d. All preparatory works for the replacement of FCV including the PTW, shutdown, isolation and draining of existing system and normalization works.

Key Date: The above works is expected to be completed and commissioned by [August 2021](#).

### 7.1.1.6 COMMON REGION SCHEMES SYSTEMS TOPOLOGY

- [Project ID: Contract N-14244 \(Construction\)](#)  
[Project Name: MDEC Compliant Installations at the Connection and Interface Points in Abu Dhabi Region and Northern Emirates.](#)

Investment Driver: System Improvement and Compliance with Code.

Strategy: By having those interface points fully complied with MDEC requirements, DoE will allow TRANSCO to claim for the revenues of all quantities transferred to ADDC and FEWA through the same interfaces. Remote monitoring and data acquisition of water consumption at each of those identified interfaces will be facilitated and enhanced for accurate data for settlement purposes.

Scope of Works: The major works involved are:

- a. Supply, installation and commissioning of data loggers and communication equipment for existing 21 interface point connections in Abu Dhabi and Northern Emirates in order to be compliant with MDEC requirements and specifications.

Key Date: The above proposal is planned to be completed by July 2019.

- Project ID: Contract N-14991.1 (Consultancy) / N-16505 Work 1 (Construction) / N-W-18-0007-MA-Work 2 (Construction)  
Project Name: Implementation of Bromate Control Study

Investment Driver: Systems improvement.

Strategy: The Project scheme was conceived as part of the initiative for the water quality improvement of TRANSCO whose main objective to enable the control of bromate formation in the ADPC system while maintaining a minimum disinfection level throughout the network. The project is needed because the bromate levels in some areas of TRANSCO are far exceeding the permissible values. This Project is driven by DoE Letter of Ref. 2113/SSQ/ 16/ 2052) dated 26 April 2016 (See copy in Appendix F) approving the use of chlorine dioxide whose scope of works will be implemented into Phases 1 and 2 as mentioned below.

Scope of Works: The major works are:

The project consists of the installation of mobile chlorine dioxide generation, hypochlorination systems, dosing and injection systems and monitoring equipment in order to maintain an adequate disinfection level of the water while at the same time prevent or limit the formation of bromate. The project will consider a number of locations, which have shown to provide the largest impact on the creation Bromate in TRANSCO. The project locations are IMR, AARC, Unit III, Mussafah and Mirfa.

Phase 1: Modification & Upgrading of TRANSCO Disinfection Facilities for Bromate Control (Project N-16505).

Phase 2: Supply & Installation of New Mobile Chlorine Dioxide Plant (Project Budget Code N-W-18-0007-MA-Work 2).

Key Date: The Phase 1 of the scheme is planned for completion by December 2021, whereas the Phase 2 is expected to be completed by March 2022.

- Project ID: Contract N-14659.1 (Consultancy) / N-W-18-0005-MA-Work (Construction)

Project Name: Replacement of the Existing Old SCADA Systems at Unit III, Ajban and Sweihan Pumping Stations

Investment Driver: Asset replacement due to aging.

Strategy: The assets have to be replaced due to age that could preserve the efficiency and performance of the various pumping stations. Provides the ease and flexibility of operation, monitoring and control for the Operation and Maintenance personnel. Facilitate the efficient monitoring, data acquisition and control of the different pumping stations that would contribute to the efficient performance and capability the water facilities.

Scope of Works: The summary of the major works involved are:

- a. Supply, configuration, installation, commissioning and replacing of the old existing SCADA Control System (SCADA HMI Server, Operation Work Stations, PLC, RTU, PMP, Plant Bus ,Terminal buss, etc.) with the latest SCADA system for Unit III, Ajban and Sweihan Pumping Stations.

Key Date: The above proposal is planned to be completed by January 2022.

- Project ID: Contract No. 16498 \ Budget Codes N-W-19-0006-MA-Works  
Project Name: Water Interconnection with DEWA Network

Investment Driver: Strategic System Improvement \ Government Initiative

Strategy: The Ministry of Energy & Industry (MOEI) has developed the UAE Water Security Strategy 2036. The strategy will ensure sustainable and continuous access to safe and adequate quantities of potable water during emergency situations impacting the country.

Based on this strategy outcomes, 3 interconnections were proposed between TRANSCO and Dubai Electricity and Water Authority (DEWA) networks to enhance water supply security in Abu Dhabi and Dubai in case of emergency. In this project; 2 interconnections, described hereunder, will be implemented.

Scope of Works: TRANSCO's study was built on the study outcomes of MOEI's consultant, considering the Water Transmission Code and Water Security Standard where applicable (i.e. within Abu Dhabi boundaries) to maintain the level of service and mitigate the risk of water supply failure. The study shows that the required works to achieve the purpose of this Project include but are not limited to the following:

- 1) T/DB/01: Seih Shuaib Interconnection
  - 1.1 New DN1200 DI pipeline with approximate length of 1500m at Seih Shuaib interconnection site, including the tie-in with Hizam Al Ghabat (HAG) pipeline and the works of the interface point with DEWA network.
  - 1.2 Water quality bypass arrangement at the interface point to avoid stagnation in the pipeline.
  - 1.3 Interconnection works of the existing HAG pipeline to the following: (1) existing Lot-1 emergency scheme at Taweelah interchange, (2) suction side of TAWB2 PS.
  - 1.4 All needed chambers to accommodate the new valves, flow meters and fittings.

1.5 All associated civil, electro-mechanical, instrumentation, control & communication, testing and commissioning works.

2) T/DB/02: Al Madam Interconnection

2.1 Tie-in with DEWA pipeline.

2.2 Water quality bypass arrangement at the interface point to avoid stagnation in the pipeline.

2.3 All needed chambers to accommodate the new valves, flow meters and fittings.

2.4 All associated civil, electro-mechanical, instrumentation, control & communication, testing and commissioning works.

Key Date: The scheme is planned for completion by [February 2022](#).

### 7.1.1.7 “OPEX\CAPEX NON-DEVELOPMENT” PROJECTS UPDATES

The Network Management Division (Load Dispatch Center) under the Network Services Directorate conceptualize the Project below and its eventual outcome will demonstrate TRANSCO’s initiative to achieve full automation of its water transmission system in the near future. Once completed TRANSCO shall disclosed this strategic goal whose main objective is to achieve operational excellence in line with the Abu Dhabi vision 2030 through efficient, safe and secured management of the whole water network.

- [Project ID: Contract N-13881.1 \(Consultancy\) \ N-P-C-B-20-0002-MA \(Works\)](#)  
[Project Name: TRANSCO Water Management System at LDC](#)

Investment Driver: Strategic / System Improvements / Asset Replacement.

Strategy: As part of TRANSCO long-term water control strategy and for ensuing Operation Excellence in managing TRANSCO’s water network, TRANSCO intend to develop a comprehensive “Water Management System” for monitoring and controlling the water transmission pumping stations, water pipeline schemes and interface points from the Water Control Center (WCC) at LDC, taking into consideration current assets as well as on-going or future Water Network Development Plan. TRANSCO operates a variety of water pumping stations and pipelines with the main goal of continuous supply of potable water to the highest standards. Most of these stations and pipelines are operated locally although many of them were designed with remote facility. Therefore, in order to achieve the safe optimum utilization and performance of the water network as well as system integrity it necessitates that a centralized water control system shall be developed and put in place.

Scope of Works: The summary of the major works to be undertake by the Consultant are:

To carry out review, assessment to TRANSCO’s existing water control facilities considering organizational structure, processes and water control strategy. To study and recommend the most effective method for integration of sites to LDC using value engineering, to assist TRANSCO in the successful implementation of a Water Management System project throughout all phases of Survey/Study, Tendering, Awarding and execution phases.



Key Date: Originally this was classified as a CAPEX Project but was later decided by Higher Management to be implemented as an OPEX Project. The scheme is planned for completion by October 2022.

- Project ID: Contract N-16230 (Consultancy)  
Project Name: Consultancy Services for Calibration, Study and Optimization of Water Transmission Network

Investment Driver: Strategic / System Improvements.

Strategy: Abu Dhabi production is designed to meet the demand of the peak week where the Transmission Assets are designed to evacuate this production. Disregarding constrains due to maintenance or unavailability of assets, this approach means that for the rest of the year i.e. 51 weeks there could be an excess in production or transmission capacity.

The prospect of such excess offers an opportunity to optimize the costs provided that the business is equipped to take advantage of this through adequate procedures and that efficient tools are available to identify the potential savings in time to grab them.

In order to optimize the costs for the complete Water Transmission Network through a hydraulic model, there is the need to update and calibrate the model and bring it up to the standard where it can be used for optimization as part of this project and for real-time operation and water quality investigations in the future.

Scope of Works: In order to achieve the project objective, the scope of consultancy services shall include but not limited to are:

- a. Data Collection and Recording
- b. Review, Update and Calibrate TRANSCO existing Water Transmission Hydraulic Model, including systems that are being commissioned at the time of the project execution.
- c. Study and Optimize the Operation of Water Transmission Network
- d. Perform cost / benefit analysis of applying the optimization procedures to the future operation of the Water Transmission Network.
- e. Setup and publish, within TRANSCO, comprehensive optimization framework to implement
- f. Prepare the Hydraulic Model, identify gap and setup procedures for future "Real-Time Operational Monitoring" implementation for the complete Transmission Network

Key Date: The above proposal is planned to be completed by December 2019.

### 7.1.2 Planned Network Developments

The following are the planned projects that were conceived in the previous 2018 7YPS and were re-validated based on the outcome of this Year's analysis of the Water Transmission System according to the latest EWEC Demand forecast and the future production plant as detailed in "Volume 1, Comprehensive Analysis of Abu Dhabi Water Transmission Network".

Please refer to Appendix A under Drawing No. 5 (in Sets), Regional Water Transmission Network Topology (Years 2019-2026) named “Overall View of Planned Projects based on the 2019 7 YPS (Year 2020-2026)” for a general outlook of the Planned Projects that were generated within the context of this planning statement horizon of years 2020-2026.

Table 7.3: List of Planned Projects for Water Transmission System Development

Serial No.	Projects Status	Region	Type of Work	Project ID	Contract Title	Current Expected Start Date	Current Expected Finish Date	Classification	Initiative Name\Drivers
<b>A PLANNED PROJECTS RELATED TO NETWORK EXPANSION (Committed)</b>									
1	Planned Projects	AM (ER)	Consultancy	N-16302	Consultancy Services for Replacement of DN1000 mm pipeline from Unit V to Shobaishi pump station	24-Dec-19	27-Apr-23	Non-load	Asset Replacement
	Planned Projects	AM (ER)	Construction	N-W-18-0008-MA-Work1	Replacement of DN1000 mm pipeline from Unit V to Shobaishi pump station	27-Apr-21	27-Apr-23		
2	Planned Projects	AM (ER)	Consultancy	N-W-21-0001-MA-Cons. (N-W-20-0001-MA-Cons.)	Consultancy Services for Upgrading Lot D Pumping Station at Mussafah	21-Apr-21	23-Aug-24	Load	Demand Growth
	Planned Projects	AM (ER)	Construction	N-W-21-0001-MA-Work (N-W-20-0001-MA-Work)	Upgrading Lot D Pumping Station at Mussafah	24-Aug-22	23-Aug-24		
3	Planned Projects	DR (WR)	Consultancy	N-W-21-0002-MA-Cons. (N-W-20-0002-MA-Cons.)	Consultancy Services for New Storage Tanks at New Muzairah Pumping Station	21-Dec-21	23-Dec-24	Load	Compliance to Security Standards
	Planned Projects	DR (WR)	Construction	N-W-21-0002-MA-Work (N-W-20-0002-MA-Work)	New Storage Tanks at New Muzairah Pumping Station	25-Apr-23	23-Dec-24		
4	Planned Projects	AM (ER)	Consultant	N-W-22-0002-MA (N-W-18-0008-MA-Work2)	Consultancy Services for Replacement of DN1000 mm pipeline from Shobaishi to Ramah pump station	18-Jan-22	22-May-25	Non-load	Asset Replacement
	Planned Projects	AM (ER)	Consultant	N-W-22-0002-MA (N-W-18-0008-MA-Work2)	Replacement of DN1000 mm pipeline from Shobaishi to Ramah pump station	23-May-23	22-May-25		
5	Planned Projects	AM (ER)	Consultancy	N-W-24-0001-MA-Cons. (N-16496)	Consultancy Services for New Pumping Station at Mussafah	19-Jan-24	23-May-27	Load	Demand Growth
	Planned Projects	AM (ER)	Construction	N-W-24-0001-MA-Work (N-W-19-0002-MA-Work)	New Pumping Station at Mussafah	23-May-25	23-May-27		

Serial No.	Projects Status	Region	Type of Work	Project ID	Contract Title	Current Expected Start Date	Current Expected Finish Date	Classification	Initiative Name\Drivers
B	PLANNED PROJECTS RELATED TO NETWORK EXPANSION (NEW based on 2019 7 YPS)								
	NIL								
C	PLANNED PROJECTS RELATED TO PRODUCTION EXPANSION								
1	On-Hold	AM (ER)	Consultancy	N-16306	Consultancy Services for Taweelah Water Transmission Scheme			Load	Production
	On-Hold	AM (ER)	Construction	N-W-19-0004-MA-Work1	Taweelah Water Transmission Scheme to Ajban & Unit III				
2	On-hold	AM (ER)	Consultant	N-W-19-0004-MA-Work2	Water Transmission Scheme of Ajban and Sweihan			Load	Production
D	PLANNED PROJECTS RELATED TO ASSET REPLACEMENT								
	Please refer to Table 7.4, List of planned Project Related to Asset Replacements under Section 6.3 below for the Details).							Non-load	Asset Replacement

## 7.1.2.1 PLANNED PROJECTS RELATED TO NETWORK EXPANSION (COMMITTED)

### 7.1.2.1.1 SYSTEMS TOPOLOGY OF ABU DHABI MAINLAND (EASTERN) REGION

➤ Project Name : Replacement of DN1000 mm pipeline from Unit IV to Ramah Pump Station

Investment Driver: Asset Replacement.

Strategy: The existing DN1000 transmission lines from Unit V to Shobaisi and Shobaisi to Remah need to be replaced due to the increased rate of failure of the pipes. There are ruptures that if left unaddressed, could affect the operation of the pipeline. The event that occurred previously should not be repeated as it will affect the image of TRANSCO in addition to its obligation to provide continuous water to its customer ADDC and AADC.

The condition of the pipeline with the presence of corrosion as reported by Asset Performance Department has also been considered and is mainly due to the age of the pipe and the properties of the soil within the area. Roughly, the age of the pipeline have already reach its useful life which would results to constant failure burst.

Furthermore, one of the main driver of the existing transmission line is that it will be used for contingency planning where in cases that if an event occurs at either UAN, Mirfa and Shuweihat production plant, the transmission line can provide supply from Sweihan pump station through pumping or by gravity from high reservoir tanks through the existing twin DN1600 transmission line. Based on the study, the transmission line can provide an approximately 30.00 MIGD from Taweelah or Qidfa through Sweihan pumping station.

The Project is divided into two Lots and are planned to be implemented separately as follows:

Lot 1:

Project ID: Contract N-16302 (Consultancy) / N-W-18-0008-MA-Works (Construction)

Project Name : Replacement of DN1000 mm pipeline from Unit V to Shobaishi Pump Station

Scope of Works: The major work involved for this Lot is:

- a. Construction work to replace the 42.28 km 1x1000mm from Unit V pump station to Shobaishi.

Key Date: The project is expected for completion by April 2023.

Lot 2:

Project ID: Contract N-W-22-0002-MA-Cons. (Consultancy) / N-W-22-0002-MA-Works (Construction)

Project Name : Replacement of DN1000 mm pipeline from Shobaishi to Remah Pump Station

Scope of Works: The major work involved for this Lot is:

- a. Construction work to replace the 48.87 km 1x1000mm from Shobaishi pump station to Remah Pumping Station.

Key Date: The project is expected for completion by [May 2025](#).

- [Project ID: Budget Codes N-W-21-0001-MA-Cons. & Works](#)  
[Project Name: Upgrading Lot D Pumping Station at Mussafah](#)

Investment Driver: Growth in Water Demand.

Strategy: Mussafah local network is supplied through two incoming supply point, through the existing U5 DN 900 line from UAN B\West and through Lot D pump group in Mussafah. The current demand of Mussafah local network is approximately 51.18 MIGD (2018 Water Database-average). The capacity of existing Lot D at Mussafah is 60.00 MIGD. Demand growth at Mussafah on 2030 67.90 MIGD and will reach a maximum of 72.20 MIGD (2040) based on the latest Planning Statement.

Based on the above data, reinforcement of the existing Lot D pumps will be necessary to provide the requirement and for security purpose in case the supply at UAN stops during an unforeseen event. It is to be noted that, the supply from either UAN and/or Unit III PS will still have to be maintained during the transition period especially when the demand already exceeds the system's capacity before the completion of the project.

Scope of Works: The scope of work of the projects includes the following:

1. Installation of 1 + 1 – 15.00 MIGD (15.00 MIGD) Pump units at Mussafah PS-Lot D pump group.
2. Surge analysis/Vessels, civil works, instrumentation, control & automation and associated electro-mechanical works.

Key Date: The scheme is planned for completion by [August 2024](#).

- [Project ID: Contract N-W-24-0001-MA1-Cons. \(Consultancy\) / N-W-24-0001-MA-Work \(Construction\)](#)  
[Project Name: New Pumping Station at Mussafah](#)

Investment Driver: Growth in Water Demand.

Strategy: Mussafah Lot M is currently supplying Abu Dhabi city and is connected from Lot F as the source of supply. Historically, TRANSCO have proposed a new pump station at Mussafah which is intended to be the source of supply of Lot M transmission line, However due to the decline of demand requirement for Abu Dhabi, the requirements for pump station has been cancelled and the line was connected on the exiting Lot F pump station as a result of value engineering to save CAPEX for a new station and optimize Lot F pump station.

However the current requirements at LOT M is steadily rising as per the latest planning statement and will be more due to the UAN E and W retirement. In lieu of this, the transmission strategy is to again revive the proposed pump station at Mussafah which will be



used not only for Abu Dhabi city but also to reinforced the system in Central region specifically Unit IV. The alarming event at Unit IV pump station is now under consideration in planning the future transmission system which was before was planned in building the ring main.

Scope of Works: The scope of work of the projects includes the following:

1. Installation of 3 + 1 – 15.20 MIGD (45.60 MIGD) Pump Station at Mussafah tank farm.
2. Installation of Installation of 1.40 kms. of DN1600 transmission line from Mussafah to the existing DN1600 transmission line from Mirfa to Unit IV Pump Station.
3. Installation of DN1400 valve on the existing DN1600 transmission line.
4. Surge analysis/Vessels, civil works, instrumentation, control & automation and associated electro-mechanical works.

Key Date: The scheme is planned for completion by May 2027.

### 7.1.2.1.2 SYSTEMS TOPOLOGY OF AL DHAFRA (WESTERN) REGION

- Project ID: Budget Code N-W-21-0002-MA-Cons. & Works  
Project Name: New Storage Tanks at New Muzairah Pump Station

Investment Driver: Security of Supply.

Strategy: The Project scheme was developed in compliance with the Reservoir/Tank requirements of the Security Standards and Water Transmission Code at the New Muzairah PS due to forecasted growth in demand requirements of the coverage Areas.

Scope of Works: The major works are:

- a. Construction of 2x3.25 MIG Concrete tanks at the New Muzairah Pumping Stations.
- b. Civil works, instrumentation, control & automation and associated electro-mechanical works.

Key Date: The scheme is planned for completion by December 2024.

### 7.1.2.2 PLANNED PROJECTS RELATED TO NETWORK EXPANSION (NEW based on 2019 7 YPS)

No new Projects are envisioned to be implemented related to network expansion based on this planning horizon.

### 7.1.2.3 PLANNED PROJECT RELATED TO PRODUCTION EXPANSION

As noted above, in view of the absence of a firm Production Expansion Plan commitment from EWEC especially the utilization of the additional 200.0 MIGD RO Plant at Taweelah including the relevant de-coupling\dispatch strategy which must be submitted and finalized by EWEC for use by the Sector, the following water transmission schemes related to production expansion and evacuation Projects generated in the previous 2018 7 YPS were put On-Hold:

- Project ID: N-16306 \ Budget Code N-W-19-0004-MA-Work1 & Work 2  
Project Name: Taweelah Water Transmission Scheme to Ajban & Unit III
  1. Lot A: Taweelah Water Transmission Scheme to Ajban & Unit III
  2. Lot B: Water Transmission Scheme of Ajban and Sweihan

### 7.1.3 MEGA Developments

Since 2007, when the Government launched the Abu Dhabi Master Plan 2030, TRANSCO in its effort to aligned itself with the 2030 Vision has embark in the development, improvement and/or upgrading of its transmission network to meet the anticipated water demand requirements of the identified Mega Developments throughout all the Regions of the Abu Dhabi Emirates. As mentioned similarly in Section 5.2.4 above of this Statement, the Locations of these Mega Developments are as illustrated in Drawings Nos. 8, 9 and 10 as attached in Appendix A through the kind courtesy of ADDC and AADC respectively.

From transmission perspective, the network development plans and schemes as detailed in the Regional Topologies above represents the conceived strategies to cater the EWEC's demand forecast for the normal growth of the existing distribution customers and mainly driven by the identified Mega Developments spreading within the pinpointed residential, entertainment, commercial, business and industrial growth centers or clusters as planned by UPC in line with the Abu Dhabi 2030 Plan.

The mega development oriented development Projects identified in Abu Dhabi Region like the completed Water Transmission Scheme from Unit III PS to Sadiyat are meant to address the Sadiyat, Al Reem, Mina Area, Lulu Island and other internal developments in Abu Dhabi Island that will be supplied from Taweelah Plant. The completion of the Lot M, Water Transmission Scheme from Mussafah PS will further address and secure the growth anticipated in the Island with the available supply emanating from Shuweihat or Mirfa Plants.

The planned strategic scheme from Unit III-Unit V-Mussafah PS-Umm Al Nar, otherwise known as the Transmission Ring Main (TRM), has been conceptualized and studied to cater the forecasted population growth and water demand requirements of the bulk of the new Mega Developments of the Abu Dhabi Mainland Region like the Capital District, Al Raha Area, Airport Developments, Masdar, Shakbout City, Al Falah, Shamka, North Wathba, Baniyas, etc. This envisioned Project shall initially be implemented to address the required capacity to supply these developments and in the future the planned network reinforcements at Mussafah PS intended to augment supply for all these developments inclusive of the requirements of the ICAD and other new developments within the Mussafah Area itself.

In Al Dhafra Region, the committed and planned transmission network improvements from Mirfa to Madinat Zayed up to Liwa will satisfy the demand growth in particular the industrial requirements of ADNOC and other VIP's of these Areas.

Similarly, all the recently implemented and completed Projects in Al Ain for the distribution system are aimed of supplying the growth in demand generated from the Major Developments and population increase in the Region.

## 7.2 Business Opportunities

To meet its strategic plans and objectives in catering both the forecasted demands and the planned additional production capacity from the existing, under construction and future desalination plants, TRANSCO's Water Transmission system is undergoing major expansion activities. This Section presents the potential opportunities for Users or any entity seeking the use of the transmission system to identify and evaluate the opportunities available for their required connections. These opportunities lie from the production driven Projects and from transmission expansions where it provides the distribution and other prospective users the forward vision to upgrade or reinforce their distribution network and/or study and plan for possible interconnections with the transmission system.

### 7.2.1 Connection Opportunities

The other main objectives of the 7 YPS is to enable the Users or any entity seeking the use of the transmission system, to identify and evaluate the opportunities available for their required connections. The potential opportunities lie from the production driven Projects and from transmission expansions where it provides the distribution and other prospective users the outlook to upgrade or reinforce their distribution network and/or study and plan for possible interconnections with the transmission system.

### 7.2.2 Production Connection Opportunities

The details of the existing and committed Production Expansion Plan as discussed in Section 5.4 and the TRANSCO analysed Option for additional production to despatch and balance the system in Section 5.5.4 provides an indication of opportunity for the eminent transmission connection to these Plants and accordingly plans the implementation of suitable schemes to adequately evacuate these additional water capacities to where it is required.

The Appendix B (Tables) Drawings of the Production Expansion Plan illustrates the location of the committed production expansion in relation to the transmission network. According to the studied and evaluated production expansion scenario, in the absence of the EWEC firm production plan, new production connection opportunities is concentrated from the proposed New additional 200.0 MIGD RO Plant capacity at Taweelah considering the 2020 to 2026 planning period.

### 7.2.3 Transmission Connection Opportunities

Similarly, the above presented Regional topology of the of the existing, under execution and planned transmission network developments individually detailed to include the driver, strategy, scope of work and implementation schedules represents TRANSCO's window of opportunity for potential transmission user's to plan accordingly in conjunction with the purpose or objectives of these Projects.

The Regional Topology Drawings No. 5 (Sets) spread accordingly to the established Supply Zones of Abu Dhabi, Abu Dhabi Mainland, Al Dhafra, Al Ain and Northern Emirates are attached under Appendix A, Regional Water Transmission Network Topology (Years 2019-2026) shows the locations and coverage of these Projects for information and reference of the users.

### 7.3 Asset Replacement Plans

Transmission system infrastructure development is based upon water system planning studies, which determine the level of reinforcement required to meet demand growth and the optimum configuration for that reinforcement. The bulk of the infrastructure work presently on-going, and that planned for the near future, is based on water demand growth and water production requirements. However, in the future it is expected that asset replacement works will increase as the asset base ages, in order to maintain the average asset age at an acceptable value.

While majority of the transmission network is comparatively young, there will be requirements for assets approaching the end of their useful lives to be managed and replaced at an appropriate time. Asset Management process improvements will be required to capture the “knowledge to build only what is needed”. Integrated outage management and risk assessment need to be considered for improved operational efficiency. Maintenance practices and resource management processes shall be programmed and managed innovatively to better position the transmission network for next 20 years of operation and maintenance. All these improvements will enable reduction in the utility investment costs (CAPEX and OPEX) resulting in optimized asset utilization and efficient operation.

The function of formulating development works driven by assets for replacement is the responsibility of Water Asset Strategy and Performance Department (WASPD) in close coordination with WNPDD and other responsible stakeholders within TRANSCO.

There have been quite a number of Projects that were already considered and/or initiated based on the previous year’s planning statements, however, new asset replacement Projects are continuously being studied and identified based on WASPD’s exhaustive assessment of the conditions of the existing facilities. For this planning horizon 2020-2026, Table 7.4 below enumerates the major Projects identified of this nature as proposed in the WASPD’s “7 Years Asset Replacement Plans 2020-2026” submitted for consideration in this year’s 7 YPS.

The implementations of these planned asset replacements shall be based on the respective “Business Case \ Need Statements” to be provided by WASPD to substantiate and justify the conditions of these assets and to guarantee their eventual removal from the system.

### 7.4 De-commissioning Plans

#### 7.4.1 Pumping Stations

Presented below are the planned de-commissioning of some TRANSCO pumping stations based on the successful implementation of various conceived under execution and planned Project schemes whose key objective is to facilitate their by-passing operations that would ultimately render their decommissioning. De-commissioning entails cost savings on both OPEX and CAPEX. The Table 7.5 below represents TRANSCO’s decommissioning plans and strategy which contains the expected year of decommissioning these transmission facilities, wherein it is envisioned that their total de-commissioning shall be implemented after an effective or proven trial period of one year and after under-going the prescribed DoE procedural requirements and approval of asset disposals.

Table 7.4: List of Planned Projects Related to Asset Replacements

Serial No.	Projects Status	Region	Type of Work	Project ID	Contract Title	Current Expected Start Date	Current Expected Finish Date	Justification (WASPD)	REMARKS
A	PLANNED PROJECTS RELATED TO ASSET REPLACEMENT								
1	Planned Projects	DR (WR)	Consultancy/ Construction	7YP-WASPD-AR-19-0001	Installation of By-pass at IPS 1 & IPS 2 and Installation of New Tanks at Madinat Zayed			This is in line with the Plan to By-pass the WTS from Mirfa to IPS1, IPS 2 until Madinat Zayed Area whose main objective is to reduce operational cost by utilizing the full capacity of the new 1200 mm pipe from NMPS to MDZ.	Issue still subject to further study and approval about the techno-economic feasibility of this proposal.  After a joint consensus, the required work can be included in an on-going Project in the Region.
2	Planned Projects	AM (ER)	Consultancy/ Construction	7YP-WASPD-AR-19-0002	Replacement of 1000 mm GRP Pipeline from Sweihan steel tanks to Al Adlah (Approx. Length of 60 Km)			Repeated Major failures. Extreme repair difficulties. High maintenance cost . Constructed not as per ADPC Specs.  Pipe always suffers from water quality problems, pipe size is over the current requirements. No appreciable demand foreseen within the current planning horizon.	Case study and justification provided by WASPD.  Under further consideration from techno-economic feasibility of their recommendation.  Alternative supply Option to the service Area is considered under the "Unit III to Unit V-Unit IV" Transmission Scheme.

\* Source: Asset Department Development (WASPD) 7 Year Asset Replacement Plans (2020-2026).

Table 7.5: TRANSCO Pumping Stations De-commissioning Plans

Region/Locations	Expected Year	Stations	Implemented Scheme/Project/Status
A. Abu Dhabi Island	2023	Unit I and Unit II PS	Project N-4383.1, Water Network Developments in Abu Dhabi Island. In the 2012 7 YPS, it was declared that these Pumping Stations can be de-commissioned in year 2012 and completely out of the system in 2013 in line with the completion of Project N-4383.1. From Transmission point of view, this was achieved. But from ADDC's end, the full commissioning of the TRANSCO Project cannot be fulfilled due to the concerns raised by ADDC and requested the deferment of the planned de-commissioning due to Distribution network constraints, that is until the upgrading of their Abu Dhabi distribution's PRM's are completed.  After undergoing extensive technical consultations, ADDC finally granted their approval to proceed for a trial test. The trial test proceeded accordingly, both ADDC and TRANSCO performed Six (6) Scenarios out of Seven (7) agreed operational Scenarios. BUT unfortunately, the trial test was not completed since the activity was stopped by ADDC O&M due to concerns regarding the by-pass after a recent breakage in their PRM. For this reason, to avoid the damaging consequences and further risk on their network ADDC recommends the implementation of their Project "Replacement of the AD Island PRM" thereby deferring the by-passing of Units I and II PS. The expected completion of the ADDC Project is in year 2022.
	2019	Lulu PS	The decommissioning of this station was based on a joint decision between ADDC and TRANSCO following an extensive consultation\coordination about the current condition of the major facilities especially the internal quality of the tanks and the alarming water quality results after an exhausted investigations. Aside from the low demand, the current operational arrangement is not advisable and the operational expenditure does not justify operating and maintaining the station. After a successful trial test of all the developed supply scenarios, the station is currently in by-passed mode of operation.
	2019	Umm Al Nar East and West Pumping Stations	The planned de-commissioning of these pumping stations is in line with the planned retirement of UAN East and West Production Plants owned and operated by the IWPP-APC which was previously by Year 2020; BUT based on recent Management decision these pumping stations has been de-commissioned earlier than expected which is by this year 2019 vide an EWEC letter. These pumping station needs to be de-commissioned due to age related condition and high operating costs.
B. Al Ain Region	2023	Hilli	Project N-4381.A, EPC Contract for Al Ain Water Transmission Scheme (AWTS)-Tap Off 9A (FWTS) Pipe Line to Al Hayer Tank (Lot P1); Project N-4381.B, Al Hayer to Hilli (Lot P2). By-passing scheme for the PS is already commissioned and is currently in operation.

Region/Locations	Expected Year	Stations	Implemented Scheme/Project/Status
	2023	Zoo, Sarouj, Power House, Military	Project N-4381.B, Al Ain Water Transmission Scheme (AWTS) Pipelines from Power House to IP131 Area (Lot P2) and pipeline from Zakher Pump Station to Mezyad (Lot P3). All of the pump stations are now bypassed.
	2023	Al Dhama, Al Maquam, Zakher	Project N-7894 A & B, Al Ain Water Distribution Network Pipelines from AARC-Dhama-Al Maquam to Zakher PS, Al Maquam Palace, Jebel Hafeet Base and GIC. Project is completed and bypassing of the involved PS are implemented except at Dhama PS.
	2022	Jebel Hafeet Base PS	Contract N-15063 (Consultancy)/Budget Code N-W-16-0001-MA (Construction), Replacement Works at Jebel Hafeet Pumping Station. The Project is planned to be completed by November 2021.  As per WASPD asset condition & performance analysis, it is found that, the failure rate, downtime, CM/PM ratio, and maintenance cost values had increased considerably for the past years, i.e. the performance and technical condition of the main assets at the station are in bad condition, therefore, needs urgent replacement.
C. Abu Dhabi Mainland (Eastern) Region	2022	Unit IV	In the previous 7 YPS's, this PS was planned to be de-commissioned with the implementation of the following strategic Schemes to facilitate its by-passing operation:  1. Water Transmission Scheme at Unit III PS for the Mega Projects & Supply to Unit IV. 2. Water Transmission Scheme from Mussafah Pumping Station to supply ring main and Abu Dhabi Island.  But based on the water demand planning data of the years 2014, 2015 & 2016 7YPS, these Project schemes were further evaluated and found that both Schemes above are deferred or cancelled for implementation, therefore the PS de-commissioning is not covered within the above specified planning periods.  For this Year and the previous 2018 7 YPS, the planned bypassing and decommissioning of Unit IV is considered in line with the New 200 MIGD RO Plant at Taweelah for the establishment of the "Transmission Ring Main" within the Unit II-New Unit V-Mussafah-Umm Al Nar axis of the transmission network. The function of Unit IV as a transmission focal supply point to Al Ain shall be transferred at the New Unit V PS.
	-	Unit V	In the previous 7 YPS's, this PS was planned to be totally de-commissioned in year 2017 and be replaced by a totally new pumping station with the implementation of the strategic Scheme "Water Transmission Scheme Unit V Pumping Stations and Distribution Network". However, based on a then Executive Council's (EC) decision cancelling, transferring, etc. most of the major developments inside the Al Faya area; and along the Abu Dhabi-Al Ain Road where an EC instruction was likewise issued that these forest and farms shall be supplied by TSE water instead. This leads to the cancellation of the proposed scheme of a new Unit V PS.  This existing old PS is currently not in operation anymore. TRANSCO already sought DoE's approval to dispose this PS from the TRANSCO water network, which has not been utilized for Seven (7) years now.  With the proposed 200.00 MIGD at Taweelah, the existing pump station was revived with a new pump station that will transport water to Shobaishi pump station and to the existing Unit V local network. Project is scheduled to be in service by 2022 in line with the retirement of Unit IV and will be used to evacuate the flow to Shobaishi including its local network.
	-	Samieh PS	This existing PS is currently not in operation and is on the stand-by status. TRANSCO already sought DoE's approval to dispose this PS from the TRANSCO water network, which has not been utilized for nine (9) years now.
	2022	Taweelah E1 & E2 PS	As justified by TRANSCO O&M, these pumping Stations are planned for retirement based on their poor condition due to age and are not serving the operational requirements efficiency and safely anymore. Recently, TRANSCO already sought DoE's approval to dispose this PS from the TRANSCO water network.  It is planned to remove these Stations and replaced them with a new pump at Taweelah A2 pump group where an available space exists for one (1) additional new pump (similar to the existing) that can cover the same operational utilization and function of the Taweelah E1 and E2 (i.e. as stand-by & assist). The replacement is under consideration in line with the requirements of the 200.0 MIGD RO Plant at Taweelah, if required.



## 7.4.2 Pipelines

### 7.4.2.1 Strategy for the Utilization and De-commissioning of the Existing Twin DN1400 and DN1000 GRP Pipelines in Al Ain Region

The existing newly constructed twin DN1600 CS Pipelines from TO-12 to AAR, which was primarily intended to replace the 2xDN1400, has now been in operation for a long time and its reliability is satisfactory, this would justify the immediate removal of the twin DN1400 lines which is already planned.

Similarly, the newly constructed DN1600 transmission line from Al Ain reception to Umn Ghaffa and to GIC are now in operation and currently supplying directly a number of terminal stations in Al Ain including the areas supplied by the existing twin DN1000 GRP line.

The system has already been tested reliable within its year of operation and TRANSCO is now in the planning stage for the removal of the existing twin DN1000 GRP line. The twin DN1000 line as stated before will not work reliably with the new system due to the following reasons, to avoid repetitive burst of the system which is affecting the transmission operation of TRANSCO and the pressure rating of the system which will not work in parallel with the new system (High pressurized system with PN 25 pipe rating). The future requirement of DISCO in terms of pressure will be much higher than the line can handle and failure is unavoidable for the system if pipe will be used continuously. Repairing as an option is not possible as the pipe is already old and is deemed to retire after all. Lastly, APD recommends the replacement of the pipe due to its occurring problem and high maintenance costs.

### 7.4.2.2 Decommissioning of Other Existing GRP Pipelines

Below are TRANSCO's stand on the future utilization of some existing GRP pipelines currently supplying the transmission networks:

- a. DN800 GRP line to Al Maquam Palace through Al Maquam PS.

The existing DN800 GRP line supplying Al Maquam Palace through Maquam PS from a connection point coming from the twin DN1000 GRP line will not be used in the future due to shifting of the system from low pressure zone to high pressure zone as a result of bypassing a number of Terminal Stations and the eventual de-commissioning of the twin DN1000 GRP Line. Accordingly, this line technically cannot be utilized.

- b. DN1000 GRP line from Sweihan Tanks to Al Adlah Farms.

The existing transmission line is currently supplying Al Adlah farms and is satisfying the requirement of the farm. However, removal of the transmission line is not technically feasible at the short term as there is no alternative supply from TRANSCO except the existing connection from ADDC line. TRANSCO has raised the issue with ADDC for long-term solution to shift the supply back to ADDC network but supply cannot be guaranteed due to constraints in both ADDC and TRANSCO line.

ADDC again sought TRANSCO's approval for another new VIP farm connection to this pipeline and even proposed linking it to their existing network being the only source of supply within the area, which could force TRANSCO to maximize the utilization of the GRP with the supply emanating from the Fujairah system. The replacement and utilization of this pipeline is under assessment by APD as endorsed in their 2020-2026 Asset Replacement Plans and this proposal was further reviewed by APD and the conclusion is for WNDD to review and recommend the best approach for the sector.

In view of the above, the existing DN1000 transmission line will still be utilized and TRANSCO long term plan is to include the areas served by DN1000 GRP to the proposed DN1200 Unit III to Unit V transmission line which is expected to be in service by year 2022. This will provide flow and pressure requirement for Al Adlah and further avoiding the costly replacement of the existing DN1000 GRP line.

- c. DN900 GRP from Madinat Zayed to Summit Tank and to Muzeirah PS.

The newly installed DN1200 transmission line from Madinat Zayed to Summit and the proposed DN1200 transmission line from Summit to Muzeirah can supply the total demand of local network from Summit to Muzeirah for long term; however, the existing DN900 GRP line will be required to satisfy the security standard level of service.

#### 7.4.2.3 Decommissioning of Existing Transmission Lines and Reservoirs

With the completion of all transmission projects inside Al Ain Region and the continuous operation of the newly installed Pump station at Al Ain reception (PS-1 and PS-2) and the DN1600 transmission line to Umm Ghaffa and GIC, the following transmission assets are planned for retirements, which are summarized hereunder:

Table 7.6: Transmission Assets Planned for De-commissioning in Al Ain Region

Pipelines	Length (kms)	Expected Year
DN1400 GRP line TO-12 to AAR	50.32 kms	2023
DN1000 GRP line from AAR to various locations	21.10 kms	2023
DN800 GRP line to Al Maquam Palace	0.82 kms	2023
DN 1200 DI (AAR to Maquam)	9.75 kms	2023
DN 800 DI (Maquam - Zakher PS)	9.54 kms	2023
DN 500 DI (Maquam - Zakher PS)	8.42 kms	2023
DN 500 DI (Sarouj - Military)	8.46 kms	2023
DN 800 DI (Junction A - Sarouj)	5.07 kms	2023
DN 800 DI (Junction A - Zoo)	1.24 kms	2023
DN 800 DI (Hilli PS – Junction A)	15.29 kms	2023
DN 400 DI (Valve House to Powerhouse)	0.79 kms	2023
DN 600 DI (Junction A - Zoo)	2.48 kms	2023
DN 400 DI (Zoo - Zakher)	5.76 kms	2023

Pump Station	Capacity (MIGD)	Expected Year
2 x 3.04MGD, 2 x 2.35MGD, 2 x 0.69MGD , 2 x 2.81 MGD (Military)	17.78 MIGD	2023
2 x 3.43MGD, 4 x 2.35 MGD, 2 x 0.69 MGD (ZOO)	17.64 MIGD	2023
2 x 3.04MIGD, 2 x 1.53 MIGD, 2 x 0.69 MIGD (Zakher)	10.52 MIGD	2023
2 x 3.04MGD, 2 x 1.53MGD, 4 x 2.35 MGD (Power House)	18.54 MIGD	2023
3 x 3.99 MIGD, 2 x 2.08 MIGD, 4 x 4.56 MIGD, 3 x 2.64 MIGD, 2 x 1.32 MIGD (Hilli)	44.93 MIGD	2023
2 x 3.43MGD, 4 x 2.46MGD, 1 x 1.53MGD (Sarouj)	18.23 MIGD	2023
2 x 1.53 MIGD, 4 x 3.04 MIGD, 2 x 6.60 MIGD (Dhama)	28.42 MIGD	2023
6 x 6.65 MIGD, 2 x 2.35 MIGD (Maquam PS)	44.60 MIGD	2023
2 x 6.65MGD (Sarouj)	13.30 MIGD	2023
4 x 7.13 MIGD (AAR-Hilli)	28.52 MIGD	2023
4 x 6.62 MIGD (AAR-Khabisi)	26.48 MIGD	2023
4 x 20.78 MIGD (AAR-Maquam)	83.12 MIGD	2023
4 x 5.45 MIGD (AAR-Sarouj)	21.80 MIGD	2023
3 x 0.53 MIGD, 1 x 0.32 MIGD, 2 x 0.67 MIGD (Jebel Hafeet Base)	3.25 MIGD	2022

Reservoir	Capacity (MIG)	Expected Year
2-2.50 MIG (MIL)	5.00 MIG	2023
2-2.50 MIG (ZOO)	5.00 MIG	2023
2-2.50 MIG (PH)	5.00 MIG	2023
2-2.50 MIG, 2-3.30 MIG (Hilli)	11.60 MIG	2023
2-2.50 MIG (DHAMA)	5.00 MIG	2023
4-2.50 MIG, 1-4.00 MIG(Maquam PS)	14.00 MIG	2023
2-2.50 MIG, 2-2.50 MIG (Sarouj PS)	10.00 MIG	2023
2-2.50 MIG (Zakher)	5.00 MIG	2023

Removal of these assets directly translates to reduction of OPEX of the transmission system. TRANSCO as for the meantime is studying whether some of the lines can be used to provide more flexibility and security to the system; however, connecting it directly to the system is not viable due to pressure class of the existing transmission lines versus the pressure rating of the new system.

The option of Asset transfer to AADC is also one to be considered for the existing assets and TRANSCO will be in discussion with AADC regarding this subject.

## 7.5 Constraints

Removal of Transmission constraint is one of the main objectives in the preparation of TRANSCO Planning Statement. The types of constraints considered in this statement are production or generation, transmission and connection constraints which are all associated with the current systems as well as the future operational arrangements affecting the capability and flexibility of transmitting or delivering water to the network or intended users. From planning perspective, the assessment is done within the Capacity Planning Analysis wherein each station are analyzed independently based on the expected water transmitted and distributed at TRANSCO intermediate

and terminal stations. Main criteria used are based on Water Security Standards and Water Transmission Code minimum requirements (velocity, number of pumps, tanks, etc.) for efficient dispatch of water and distribution of supply to customer level. A second level assessment is done on the system by then considering the risk associated with the transportation of water to customer level. All transmission constraints with respect to the above Standards will be identified and shall be mitigated, where appropriate, in the 7YPS.

### 7.5.1 Generation/Production Constraints

According to the latest water demand forecast from EWEC by simply comparing with their latest existing and production plan, it can be easily concluded that from Year 2019 to 2021 there are surplus water to compensate the requirements of the Abu Dhabi including the requirement for Northern Emirates. This even includes the reduction of production by 50.00 MIGD by 2019 based on the decision of the management.

If Taweelah A2 will be retired by 2022 and the additional 200.00 MIGD RO will be added to the system, then there will be surplus of water from 2022 until 2026 by approximately 191.00 MIGD. More interestingly is that the total production is even enough to cover the requirements up to year 2030 with approximate surplus of around 154.00 MIGD. With this bulk of surplus, it will now be the decisions of EWEC on how to despatch this quantity base on the most techno economical approach. As for TRANSCO, despatch will be based on the most techno economic approach as per transmission system, its availability and in reference to Water Transmission Code and Water Security Standard. Apparently, there is no transmission constraints based on the results of Volume 1 of this report which are all based on TRANSCO assumption of production flow profile.

### 7.5.2 Transmission Network Constraints

Currently, only one transmission constraints is present in the transmission system and that is from Al Dhafra Region which is the axis from Mirfa to Madinat Zayed to Muzeirah. The Project to mitigate this constraints is:

- a. Contract N12192: Water Transmission Scheme from Mirfa to Madinat Zayed, Liwa and Presidential Palace in Qeshawira (2021).

Further transmission constraints removal will be planned accordingly, if the case arises, which are all dependent on the forecasted demand for the Emirates.

### 7.5.3 Connection Constraints

At the connections level, the demand forecast and network operational arrangement in the seven year planning horizon will form the basis for the identification of future potential constraints at the demand supply or interface connections. Where a constraint is identified requiring a reinforcement at these connections, the DISCO will be advised of the need to mitigate the constraints. Where the DISCO cannot mitigate against these constraints internally within their system, the DISCO shall request an upstream reinforcement from TRANSCO.

The major potential constraints of this type is expected in Al Dhafra Region between the Shuweihat and Mirfa segment of the transmission network wherein due to the increase in demand requirement

of TAKREER, Chemaweeyat, ADNOC and ENEC accommodations, Al Manaief Residential Complex, etc. all located at Ruwais area, the existing interface points cannot supply the required quantity. Therefore TRANSCO is bound to provide additional supply points to the substantial demand of these developments.

This type of constraints is also anticipated to occur in the Abu Dhabi Mainland (Eastern) Region between the areas supplied by Unit III, Unit IV and UAN pumping stations where the majority of the Major Developments like Zayed City, Khalifa City, Al Raha Area Developments, Airport Developments, North Wathba, South Shamka, etc. are located thereby new interface connection have to be established to accommodate and supply them from the transmission network.

Most of the above new connections will be treated as “direct supply connections” which will be all subject to compliance with the established TRANSCO protection, operational and control requirements prior to approval. All new such connections will be subject to the terms and conditions of the “Statement of Connection Charging Methodology” document lately distributed by TRANSCO to the DISCO’s and other User’s for implementation.

Beginning of the 2018 7 YPS, TRANSCO started monitoring the status of all the new interface points classified as “direct connections” which are being requested by the Distribution Companies and the concerned Authorities in the Northern Emirates to be interconnected and supplied directly from the TRANSCO water network. The Figures 7.1 and 7.2 below represents the breakdown of the numbers and the percentages respectively based from the developed work status categories of these newly requested interfaces.

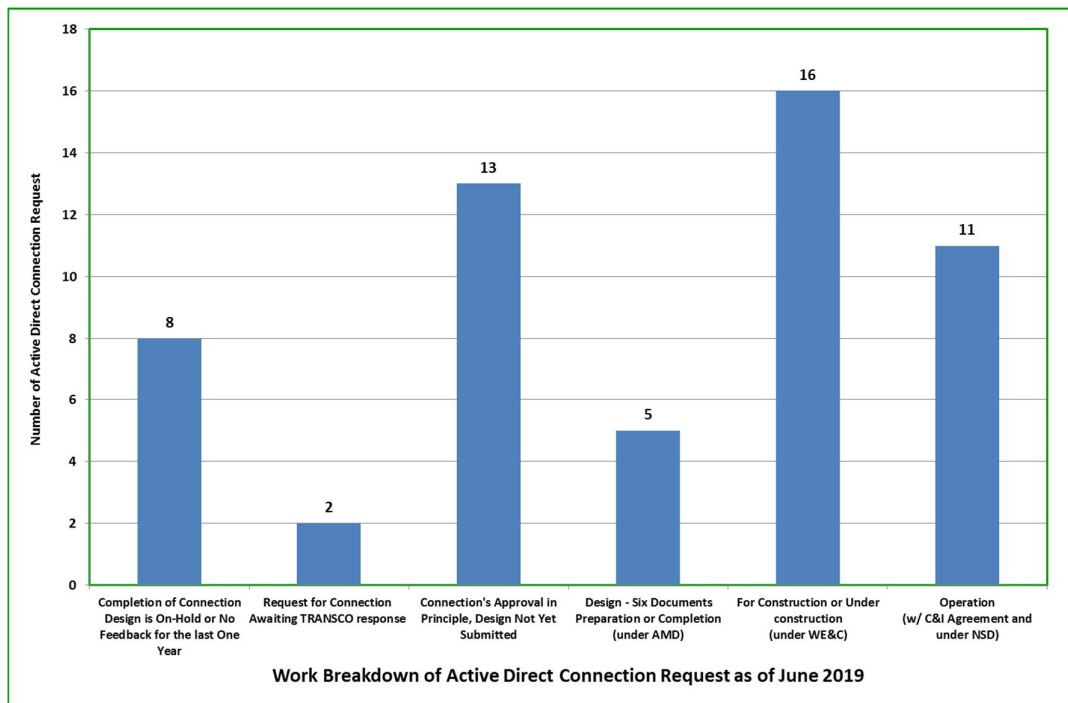


Figure 7.1: Work Breakdown Status of Active Direct Connection Request ( According to Numbers)

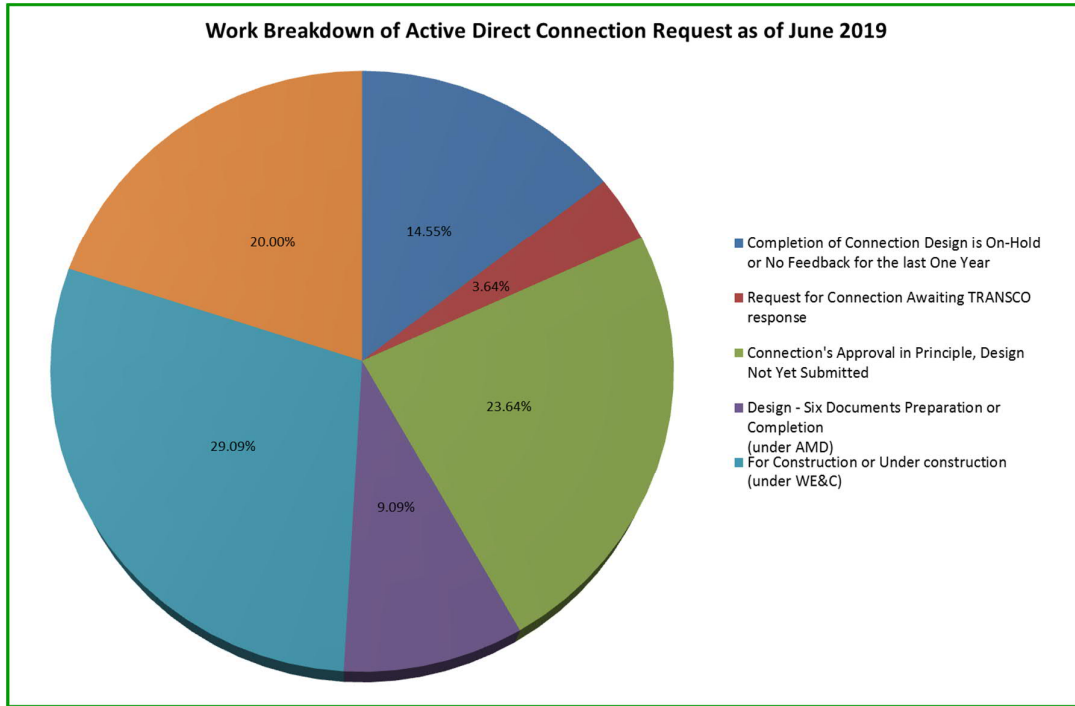


Figure 7.2: Work Breakdown Status of Active Direct Connection Request (According to Percentage)

## 7.6 Network Risk Analysis Results

A new pragmatic approach to security of supply is now taken into consideration by adopting resiliency resilience evaluation. As with disaster preparedness and planning, an outage is treated as being expected at some instance during the lifetime of the asset. Resilience evaluation studies define consequence of failure, and allow mitigation plans to be prioritised based on greatest impact and most economical solutions.

The historic reliability of water supply trunk main systems masks the vulnerability of customers to the failure of these large diameter pipelines. Although likelihood of failure is low, in comparison to distribution system burst rates, the consequence of major supply system failures can be great.

The resilience approach examines criticality of network features at a higher level than that of individual assets. The key question governing resilience is whether the network is capable of maintaining normal (or reduced) supplies to water company customers during a hazard event. Resilience is not primarily concerned with the mechanism of failure. For this reason the assessment of resilience can concentrate on evaluating the scale of service impact (customers affected) without being overly concerned with the statistical probability of failure of individual assets.

Network models provide a much better evaluation of the impact of a mains failure. They are able to account for alternative (albeit perhaps reduced) supply from adjacent sources in calculating reservoir survival times, and determining the actual number of customers impacted for any given attendance and repair time interval.

The result of N-12414: "Calibration of Security Standards", have resulted to a new risk graph which can be used for this current network risk evaluation. In the study, the Consultant have contrasted two Level of Service (LoS) curves, as listed below. Note that the figure in parentheses is the proportion of customers (measured as percentage of daily flow not supplied to DISCOs) interrupted for 12 hours or more in any year.



- The existing LoS curve (2.63%);
- A curve based on past TRANSCO performance (2.0%).

Considering the resiliency evaluation included in the analysis, the system was tested for the existing and new LoS curve in last Year's 2018 7 Year Planning Statement as presented in Table 7.7 below.

Table 7.7: Network Risk Analysis Results

S/N	Segment	Segment Criticality based on DoE Security Standard	
		2018	2025
1	Al Taweelah PS to Ajban PS	Passed	Passed
2	Ajban PS to Al Maha Forest Tank	Passed	Passed
3	Ajban PS to Sweihan PS	Passed	Passed
4	Sweihan PS to Al Ain Reception PS	Passed	Passed
5	Sweihan PS to DN1000 Bypass Line	Passed	Passed
6	Sweihan Reception Tank to Al Maha Forest Tank	Passed	Passed
7	Al Taweelah PS to Unit III PS (DN1200 L1)	Passed	Passed
8	Al Taweelah PS to Unit III PS (DN1200 L3)	Passed	Passed
9	Al Taweelah PS to Unit III PS (DN1600 L4)	Passed	Passed
10	Unit III PS to Unit IV PS	Passed	Passed
11	Unit III PS to Sadiyat Island Tank (DN1600)	Passed	Passed
12	Umm Al Nar PS to AD P.R.M (DN900 3A)	Passed	Passed
13	Umm Al Nar PS to AD P.R.M (DN900 3B)	Passed	Passed
14	Umm Al Nar PS to Al Reem Island (DN1200 L2)	Passed	Passed
15	Umm Al Nar PS to IP43a (DN1200 L2)	Passed	Passed
16	Umm Al Nar PS to Unit 1 PS (DN1200 L1)	Passed	Passed
17	Umm Al Nar PS to Unit 2 PS (DN900 U2)	Passed	Passed
18	Umm Al Nar PS to Unit IV PS	Passed	Passed
19	Unit IV PS to Shobaisi PS	Passed	Passed
20	Shuweihat PS to Sila PS	Failed	Passed
21	Shuweihat PS to New Mirfa PS	Passed	Passed
22	New Mirfa PS to Mussafah PS	Passed	Passed
23	New Mirfa PS to Unit IV PS	Passed	Passed
24	Mussafah PS to Abu Dhabi Island (DN1600)	Passed	Passed
25	Mussafah PS to Mussafah Local Network (DN1200 L1)	Passed	Passed
26	Mussafah PS to Mussafah Local Network (DN1200 L2)	Passed	Passed
27	Mirfa PS to Madinat Zayed PS (DN900 DI)	Passed	Passed
28	Mirfa PS to Madinat Zayed PS (DN800 CS)	Passed	Passed
29	Madinat Zayed PS to Summit Tank	Passed	Passed
30	Summit Tank to Old Mazirah PS	Failed	Passed
31	Summit Tank to New Mazirah PS	Passed	Passed
32	Fujairah Intermediate RS to TO-9A	Passed	Passed
33	TO-9A to Al Ain Reception PS	Passed	Passed
34	TO-12 to Sweihan Reception	Passed	Passed
35	Al Ain Distribution System PS-01 and PS-02	Passed	Passed

For this year Planning Statement, risk analysis were not done as the Security Standard stipulates that Risk Analysis will only be done every after three years or if a new project is conceived.

In addition, the above table was prepared based on last year forecast which is comparably higher than this year's demand forecast, and as Risk Analysis is calculated based on the flow from transmission system with reference to the demand forecast, it can be concluded that the above results is technically acceptable. Furthermore, there is no major transmission projects proposed for this year other than those projects propose in last year planning statement.

## 8. *Capital Investment and Implementation Plans*

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### 8.1 Introduction

The transmission development works identified in this year's 7 YPS and in the previous reports represents the short-medium term TRANSCO capital business investment plan and programmes. This provides an overview list of all under execution and planned projects identified according to investment drivers as detailed in Sections 7.1.1 and 7.1.2 (Existing and Planned Network Developments) above. These plans are further classified and quantified below according to load or non-load projects categories as briefly defined. Please refer to the Table 7.1 of Section 7.0 above for the list of the all the on-going and committed Projects while Table 7.3 of Section 7.0 above enumerates the planned Projects indicating the respective classification and drivers of each.

### 8.2 Classifications of Investments\Developments

#### 8.2.1 Load-Related Projects (New Growth)

- a. Production Expansion Driven: These are under execution or planned Projects conceptualized due to the implementation of schemes associated with the evacuation of water from committed or planned Production Plants triggered by growth in water demand.
- b. Demand Growth Driven: All Projects driven by the increase of water demand requirements due to forecasted growth in population as well as the implementation of new residential, industrial, business, commercial, etc. development projects.
- c. Government Initiatives: Projects initiated based on Government directives to allocate and supply water to support the growth and developments of priority areas or projects of the government.
- d. Compliance to Security Standards: Project conceived in compliance with the design criteria and security of supply as stipulated in the WTC and Security Standards.

#### 8.2.2 Non-Load Related Projects

- a. Replacement/Refurbishment/Reinforcement Projects: These are projects that are end-product of the assets or facilities assessments that are required to be replaced or refurbished due to poor performance, age, deterioration, etc.
- b. System Improvement Projects: Projects generated based on water network development strategy of considering techno-economic schemes and operational scenarios to come up with a revitalised, efficient, safe and flexible network.

Based in this Year's 7 YPS Status (as of End of May 2019) of the development Projects, the Figures 8.1 and 8.2 below represents the summary of the load and non-load related projects according to their numbers as listed in both the Under Tendering/Award/Execution and Planned Project stages of the capital investment plans.

Figure 8.1: Summary of Running and Committed Projects Classified According to Drivers

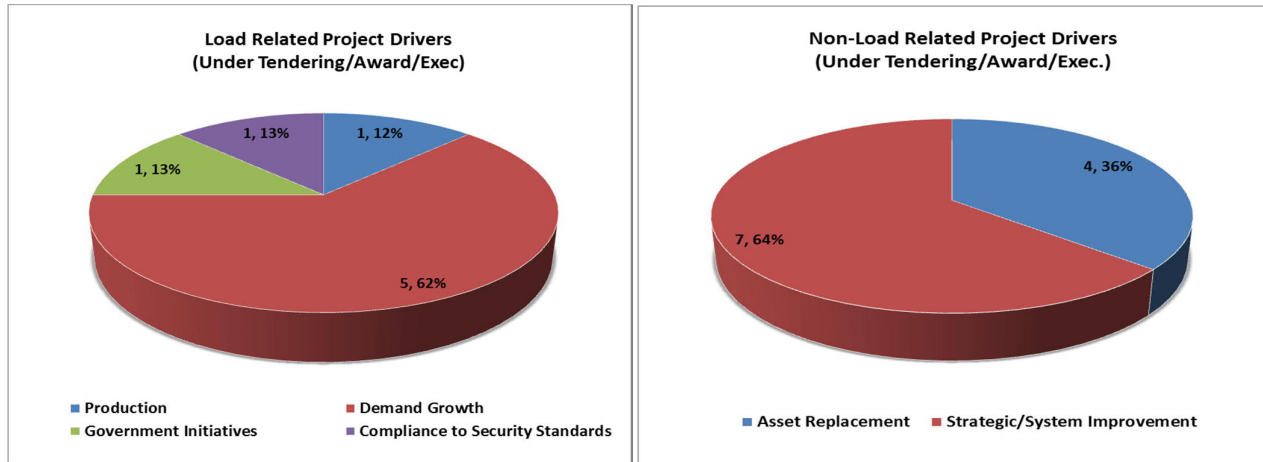
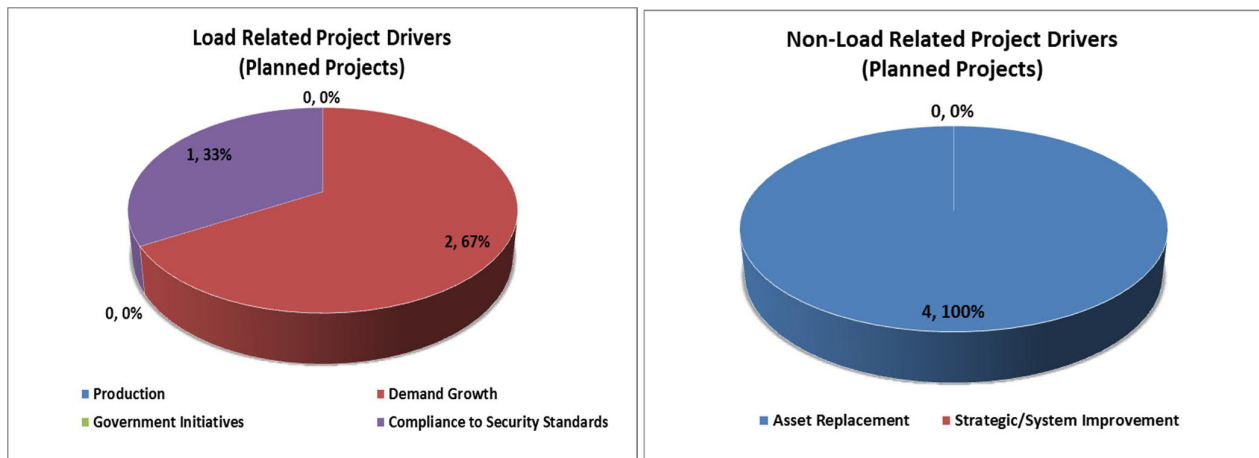


Figure 8.2: Summary of Planned Projects Classified According to Drivers



### 8.3 Capital Delivery\Implementation and Expenditure Forecast

In relation to the delivery and implementation of all the conceived network development Projects, TRANSCO would like to reiterate its strategy that, in view of an economic downturn and/or market turmoil coupled by the greater uncertainty in the major development requirements and implementation; some project proposals and schemes are evaluated with intent of optimizing the assets' utilization taking into account the potential risks. The risks could be if the demand does not materialize as expected or if the demand comes early, project delays and its impact on network performance, change of directions, market risks. Risk mitigation measures through various scenario/optioneering approaches are built into the planning proposals by engaging all stakeholder and Users early in order to achieve a consensus on the optimum balance of overall benefits/savings and risk trade-off. Considering any influential economic scenario and uncertainty factors, TRANSCO shall take into exhaustive consideration in delaying or deferring some planned assets or scheme proposals and even to the point of cancelling them if the contracts are already awarded. Hence, there is a likelihood of potential deviations of some project proposals and schemes that are included in this 7 YPS.

The cost estimate of the major scope of work that were identified for each individual scheme/s intended for the water transmission network development can be found in “Comprehensive Analysis of Abu Dhabi Water Transmission Network: Volumes 1 and 2, - Water Balance Analysis and Hydraulic & Risk Analysis” respectively. It also specifies and illustrates the implementation and investment schedules of each Project scheme in particular of the adopted capacity planning Scenario. The timeframe computation assumes from Initiation to Consultancy up to Letter of Award for Construction, a total of 24 months and a Construction period of two years (depending on the scope and magnitude of works) prior to the Year the proposed new system is required. It considers a warranty period of 12 months for Pipeline works only and 24 months for works with Mechanical and Electrical in nature. This is demonstrated in the developed PMD standard methodology of milestone computation being followed for any new and planned projects that is intended to oversee their status and monitor their life cycle progress.

The financial details of the capital investments plans are deemed to be of confidential in nature therefore are removed as part of this publicly available Statement.

The capital expenditure forecast of on-going and planned water projects necessary to ensure that the transmission system meet security standards, performance standards and future demands and a commentary note explaining the variance of approved CAPEX budget, if their exist, as compared to the actual forecast outturn until date will be reported to DoE in a separate document submittal. The delivery of this tasked is under the responsibility of the Program Management Department (PMD) of AMD termed as the “7 YPS – Financial Annexure”.

## Appendices

(Available as a Separate Document)

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- A.2 Existing Water Transmission System and Supply Zones / Unit Commitment Zones / Import & Export Supply Points
- A.3 Al Ain Region Supply Zones (Existing Configuration)
- A.4 Al Ain Region Supply Zones (Future Configuration)
- A.5 Water Transmission Network Topology (Years 2019-2026) – Regional Overall
  - Abu Dhabi Island Region Topology
  - Abu Dhabi Mainland Region Topology
  - Al Dhafra Region Topology
  - Al Ain Region Topology
  - Northern Emirates Topology
  - Overall View of Planned Projects Based on 2019 7YPS (2020-2026)
  - Overall View of Planned Asset Replacement Projects by WASPD Based on 2018 7YPS (2020-2026)
- A.6 Backbone of the Water Transmission System (Year 2019-2026) - Geographic Diagram
- A.7 Backbone of the Water Transmission System (Year 2019-2026) - Schematic Diagram / Simplified Water Transmission Network
- A.8 Major Developments Projects in Abu Dhabi-ADDC
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- A.10 Major Developments Projects in Al Ain Region-AADC

### B Tables

- B.1 EWEC Winter 2018/2019 Water Demand Forecast
  - Most Likely Demand Scenario
- B.2 EWEC Existing & Committed Production Plants 2019-2030
  - Drawing: EWEC Existing & Committed Production Plants
- B.3 EWEC Committed Desalination Plants and TRANSCO Recommended Additional Capacity
  - Drawing: EWEC Existing & Committed Production Plants with TRANSCO Recommended Additional Capacity

### C Water System Data and Capabilities

- C.1 Systems Data for Existing Pumps, Storage Tanks and Pipelines
- C.2 Water Transmission System Capacities Drawings
- C.3 Water Transmission Facilities Capacity Planning
- C.4 Water System Station Capacity vs. Demand Graphical Analysis



- D Water Balance Analysis – Existing Scenario up to year 2021
- E Water Balance Analysis – TRANSCO Recommended Scenario of Additional Production Capacity from 2022 to 2026, 2028 and 2030
- F Correspondences

