

DEPARTMENT OF MUNICIPAL AFFAIRS
ABU DHABI CITY MUNICIPALITY



دائرة الشؤون البلدية
بلدية مدينة أبوظبي

Optimization of Treated Sewage Effluent Utilization for Landscape Irrigation



Municipal Infrastructure & Assets Sector
Parks & Recreational Facilities Division
2-6 June, 2014

- Introduction
- Background-Current Situation
- Goals & Objectives
- Expected Outcomes
- Ongoing Project Activities up to 2030
- Scope
- Project Aspects to date
- Way forward

Guiding Principles

- Fostering a distinctive, vibrant, aesthetically pleasing network of open space and public realm that offers landscaped environments to work, live and play while ensuring sustainable use of natural resources including water, energy and plantings.
- Landscape irrigation shall be built on Estidama guidelines to produce an irrigation design and management strategy which promotes low water demand through efficient irrigation networks.
- Irrigation infrastructure development/improvement to meet ADM's landscape irrigation water requirements up to the year 2030, in line with the UPC Abu Dhabi Plan 2030, Abu Dhabi City Landscape Master Plan, Estidama Guidelines, EAD's Environmental Strategy 2030, and ADSSC TSE-Master Plan.
- Optimize use of Recycled Water (TSE) and minimize /eliminate use of desalinated and ground water.

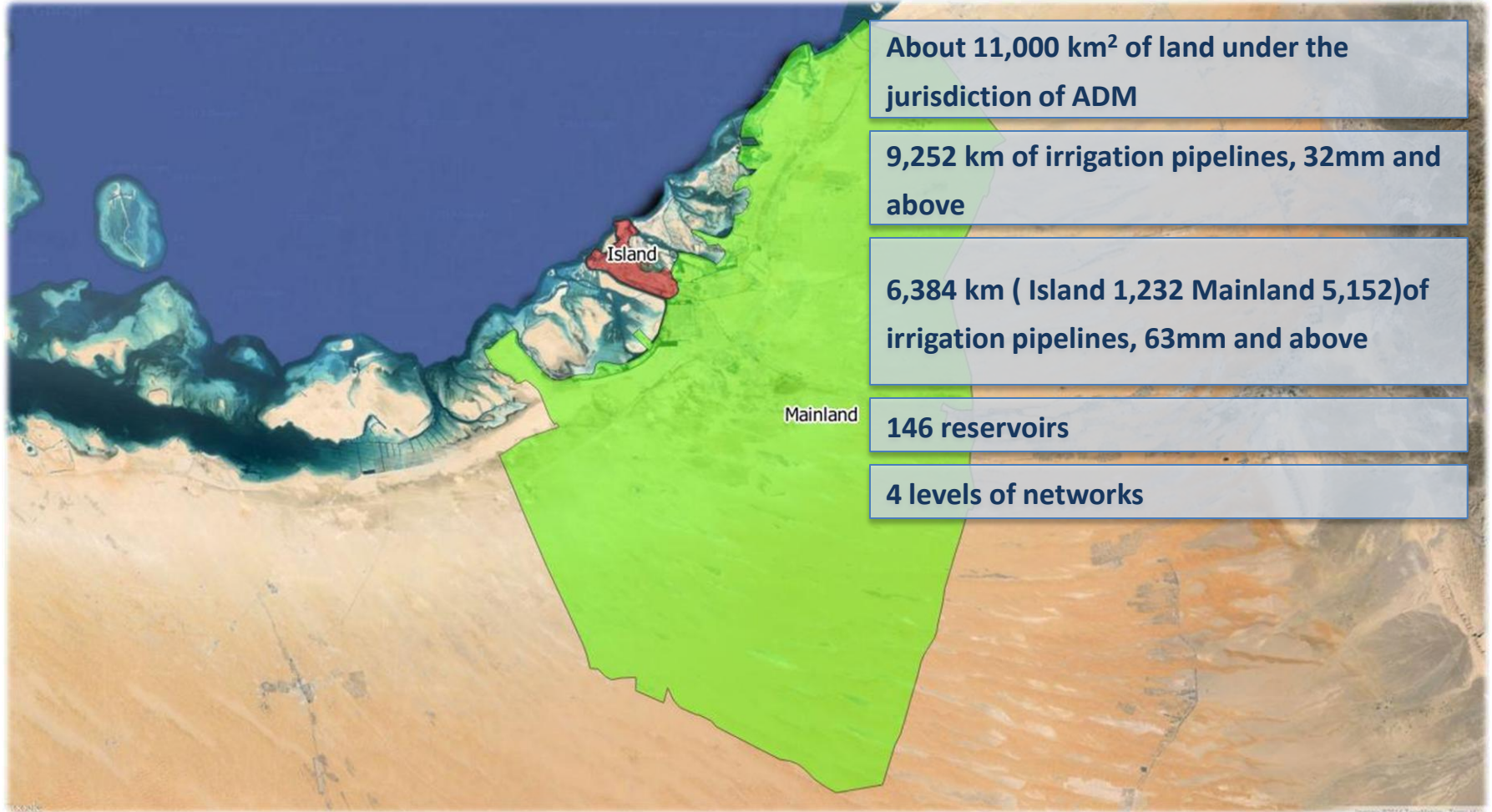


- In line with the ADM's vision to be recognized as an efficient world class Municipal System ensuring sustainable development and enhancing the quality of life Criteria for the Emirate of Abu Dhabi, PRFD-MIAS has launched the IMP in February 2013.
- The overall objective of the project is to develop a plan for improvement and the development of the present PRFD irrigation infrastructure to meet irrigation water requirements up to the year 2030.



Pocket Park in Abu Dhabi Island

Project Area Map and Characteristics





ISSUES

Infrastructure Expansion

Losses from leaks, inefficiencies

Asset Management

Planning/Network connections

Increased demands to meet future development requirements

Forecasting capital expenditure

REQUIRED ACTIONS

Enhance Infrastructure capacity to maximize TSE and minimize fresh water

Locate and repair leaks and rehabilitate old sections

Prepare and implement an Asset Management Framework

Build Hydraulic Model and use as a powerful planning tool

**Balance supply and demand
Integrate ADSSC & ADM efforts**

Prepare Investment Program and Phased projects

Goals & Objectives

- Optimise use of Recycled Water (TSE)
- Minimise / eliminate use of potable water
- Minimise /eliminate wastage and leaks.
- Test solutions using hydraulic model
- Identify & eliminate existing shortcomings in TSE system
- Protect the environment and the public.
- Incorporate an Irrig Asset Management Framework
- Develop proposals, with time frame and budgets, for enhancement/ development of the PRFD assets.



Level 1

- *Comprehensive Plan for Development & Improvement of Irrigation Systems*
- *Prioritisation Plan based on short, medium and long term Objectives.*

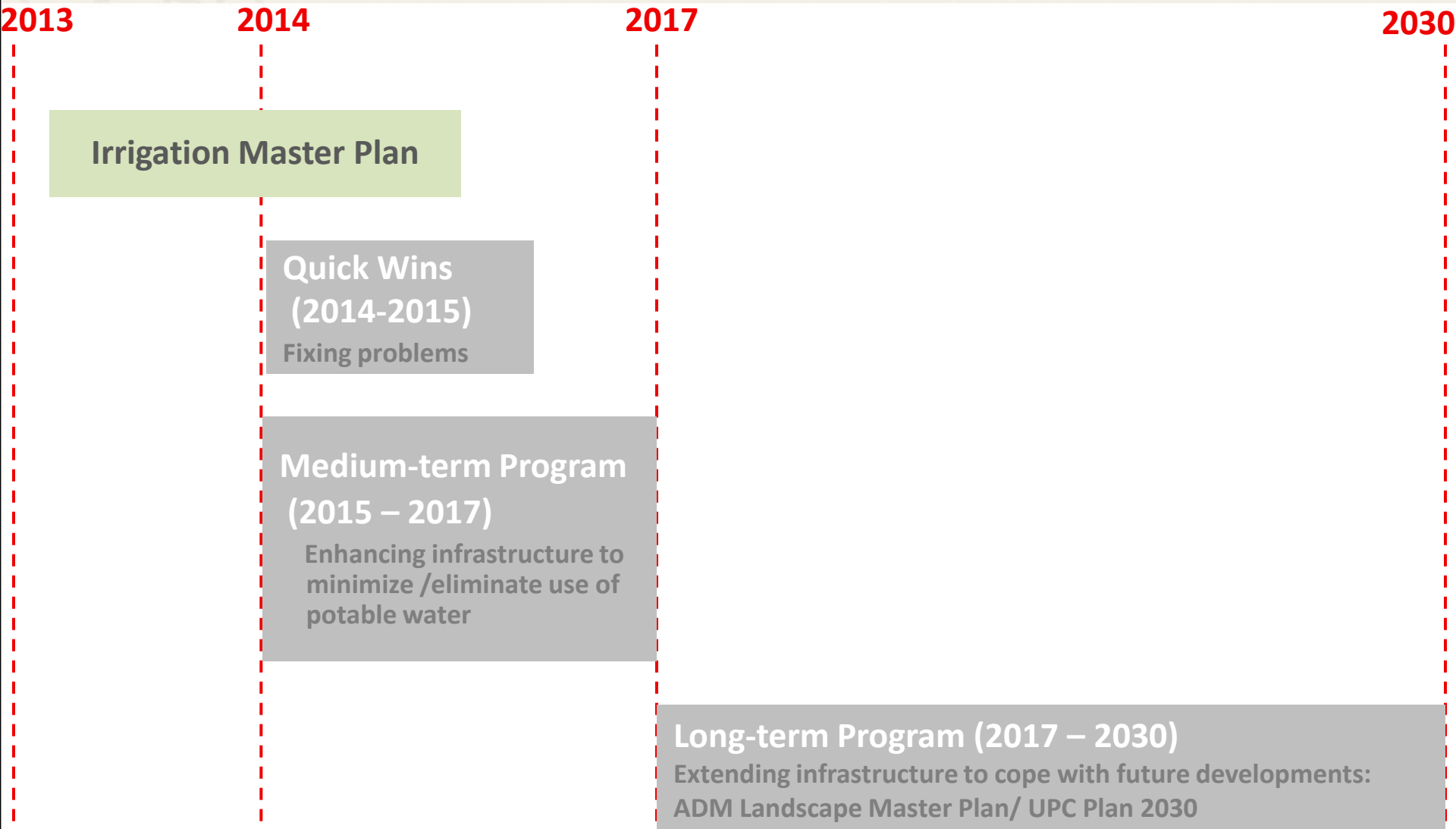
Level 2

- *Action, Phasing & Implementation Plans including Quick Wins*
- *Investment Plan, including Investment Programming & Funding.*
- *Review and Monitor Processes.*

Level 3

- *Irrigation Asset Management Framework*
- *Standards & Guidelines*

Ongoing Activities up to 2030



- Establish existing situation in terms of irrigation assets, water demands and system operation
- Establish a complete water balance i.e. sources vs. demands
- Build a complete hydraulic model representing actual and future situation
- Run the model and identify any limitations and propose remedial measures to cater for the current and future demands

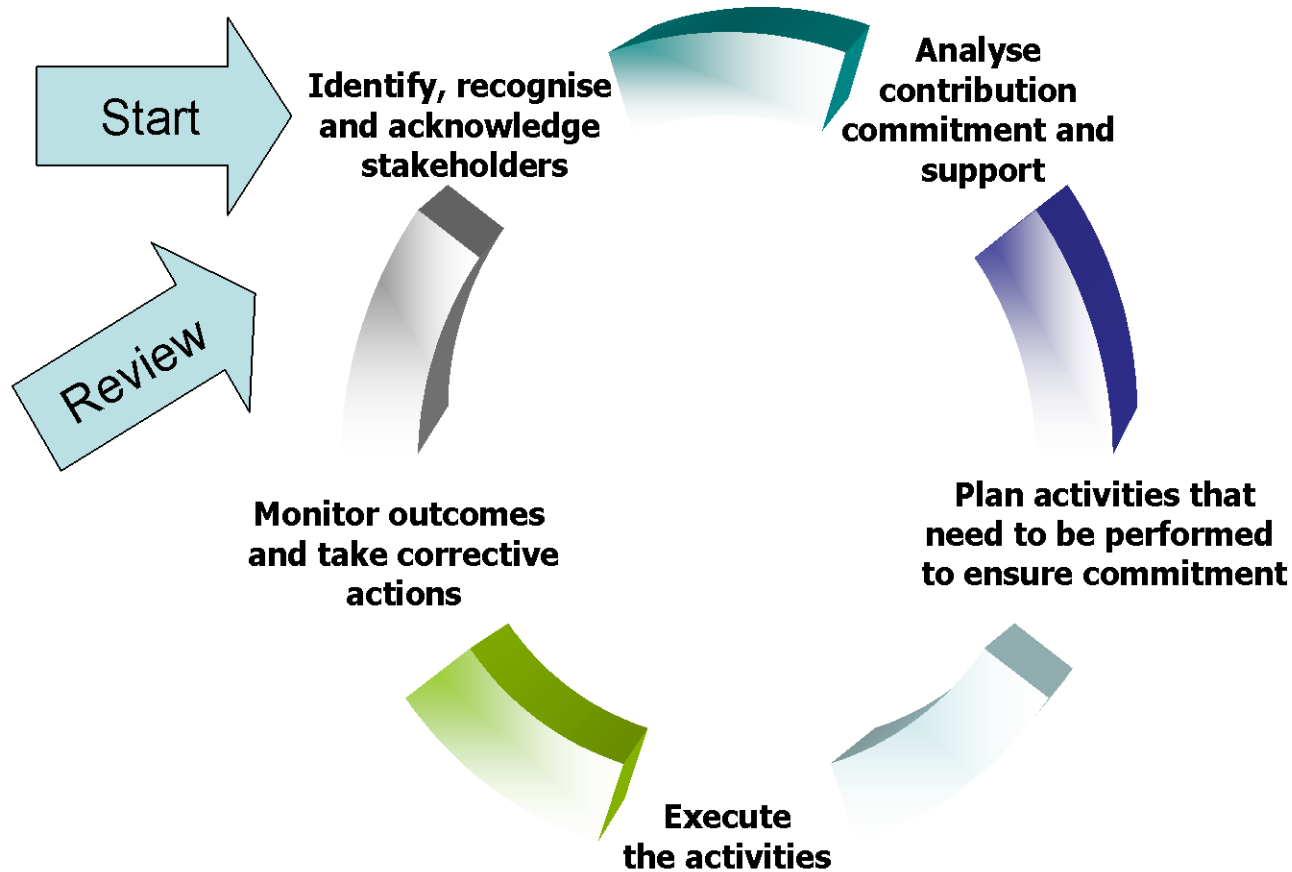
- Develop future strategy for use of TSE
- Incorporate Irrigation Asset Management Framework
- Implementation and capital expenditure programme
- Review and update manuals, technical specification and standard drawings

PROJECT ASPECTS TO DATE

PHASE 1 - INCEPTION

- Identify all stakeholders and make initial contacts
- Appreciate the Mapping Project scope
- Initial review of data available with stakeholders
- Firm up project methodology

THE ENGAGEMENT CYCLE



INTERNAL

DMA

PRFD Consultants

PRFD O&M Contractors

PRFD AIMS

PRFD SCADA Section

ADM TPD/SDD

IRI

Other Divisions in ADM

EXTERNAL

ADSSC

ADDC

EAD

RSB

UPC

DoT

QCC

ADFCA

Developers

Others

Integration with ADSSC TSE Master Plan

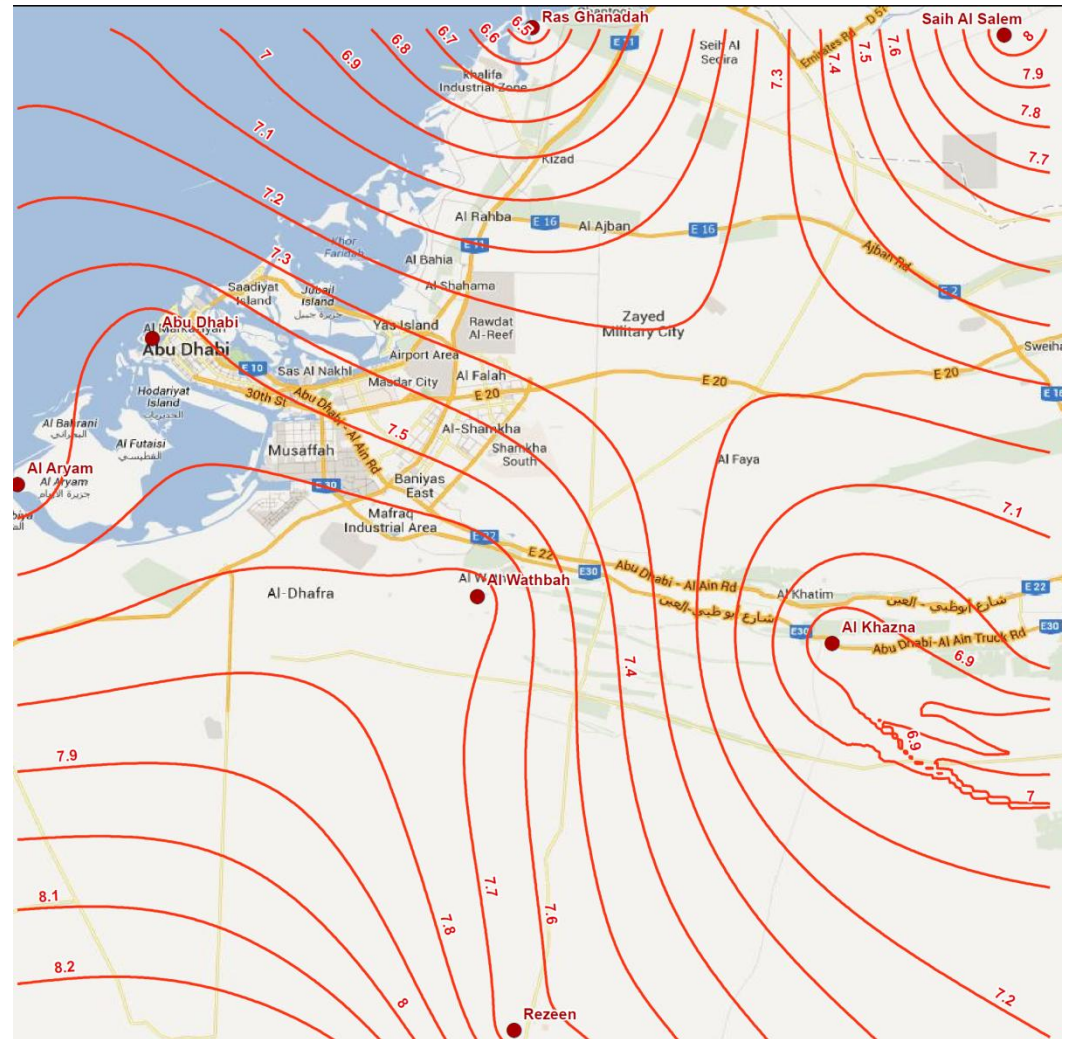
- PRFD remains by far the largest customer of ADSSC. There is a need for close coordinate between both parties
- Irrigation Master Plan will take into consideration the future availability of Recycled Water and the existing and planned infrastructure by ADSSC
- Irrigation Master Plan will firm up the Recycled Water demands by PRFD system and will identify any enhancements required to the distribution systems to fully utilize the Recycled Water within the limits of TSE Master Plan

PHASE 2 – DATA COLLECTION

- To store all the collected information in a common data base, the Mapping Project Geo-database
- Integrate ADSSC's TSE Master Plan information, any development plans and other related information
- Assess information gaps and prepare scope and specifications for enabling works

Data Collection

Evapotranspiration Contours developed



Legend



Climatic Stations ETo



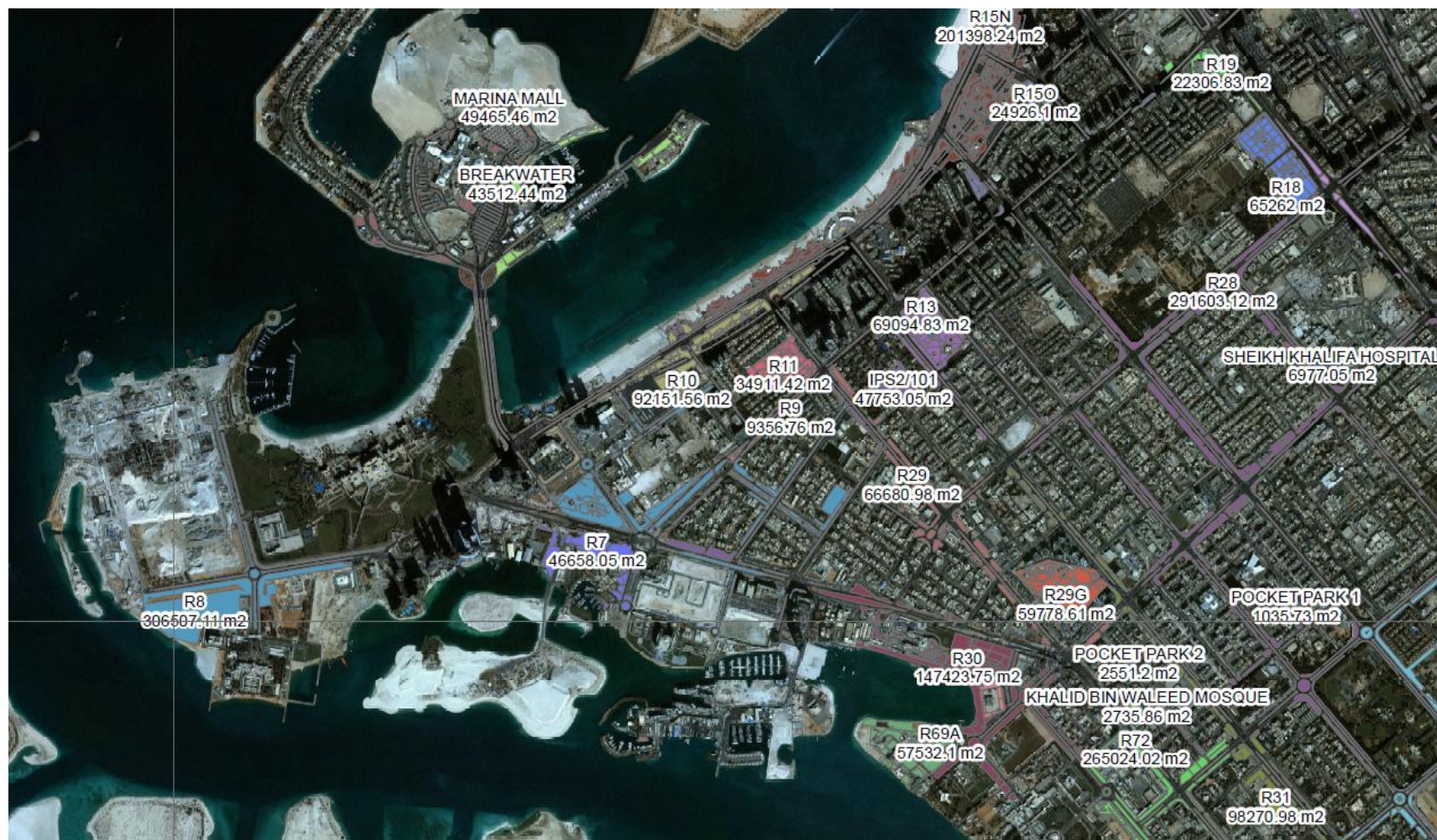
Yearly Average ETo Contours (mm/day)

- **Establish preliminary water balance:** Preliminary water consumption of PRFD (High Level) established by source (TSE, ADDC, wells), O&M Contract and Use (Landscape, Farms, Green Belt / Forest).
- **Enabling works:** Site survey of possible location of new instruments done (113 locations surveyed). 63 locations selected, 56 in Island, 7 in Mainland. Specifications and costs assessed

Phase 3 - System Verification

- Verification of mapping data and GIS data base
- Field verification through O&M Consultants / Contractors
- Determination of current irrigation water usage
- TSE quality inspection and conductivity testing
- Verified total water balance

System Verification



System Verification – Existing Network



Drawings

System Verification – Reservoirs/Pump Stations

- Verified pump
- Verified
- Created into
- Assisted and
- Performed salinity test in reservoirs

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11-MUS-ST-PS-R161



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System Verification – ADDC flow meters

- Cross-checked the information from AIMS, O&M Consultants /

Contract

- Verified the

irrigation

- Verified a

- Assigned

- Assigned

- Updated the water balance accordingly

ABU DHABI CITY-IRRIGATION MASTER PLAN 966				
Parks and Recreation Facilities Division				
ADDC FLOWMETERS SURVEY				
CONTRACT No 71/2012 SH				
ADDC Flowmeter 002				
Area	Existing	230001.9327	Date: 15/07/2013	
Sector	W36	Northing	2707840.347	
Location	Near R-9	Picture	2013-07-15_101623	
Hyder flow meter No.	2			
O&M Contract	1016C			
Service area	N/A			
DN (mm)				
Account ID	3061575625			
Badge No	M07A001359			
Serial No	M07A001359			
From Consultants				
Account ID	Badge No	Serial No	DN (mm)	Status
1	M07A001359	M07A001359		
Existing	230001.933	Northing	2707840.347	
From ADDC				
Account ID	Badge No	Serial No	DN (mm)	m3/day
4519900000	M07A001359	M07A001359		
Existing	230001.933	Northing	2707840.347	0.65
ENABLING WORKS				
Equipment to be installed				
Remarks				
Irrigation Flow meter				
Map				

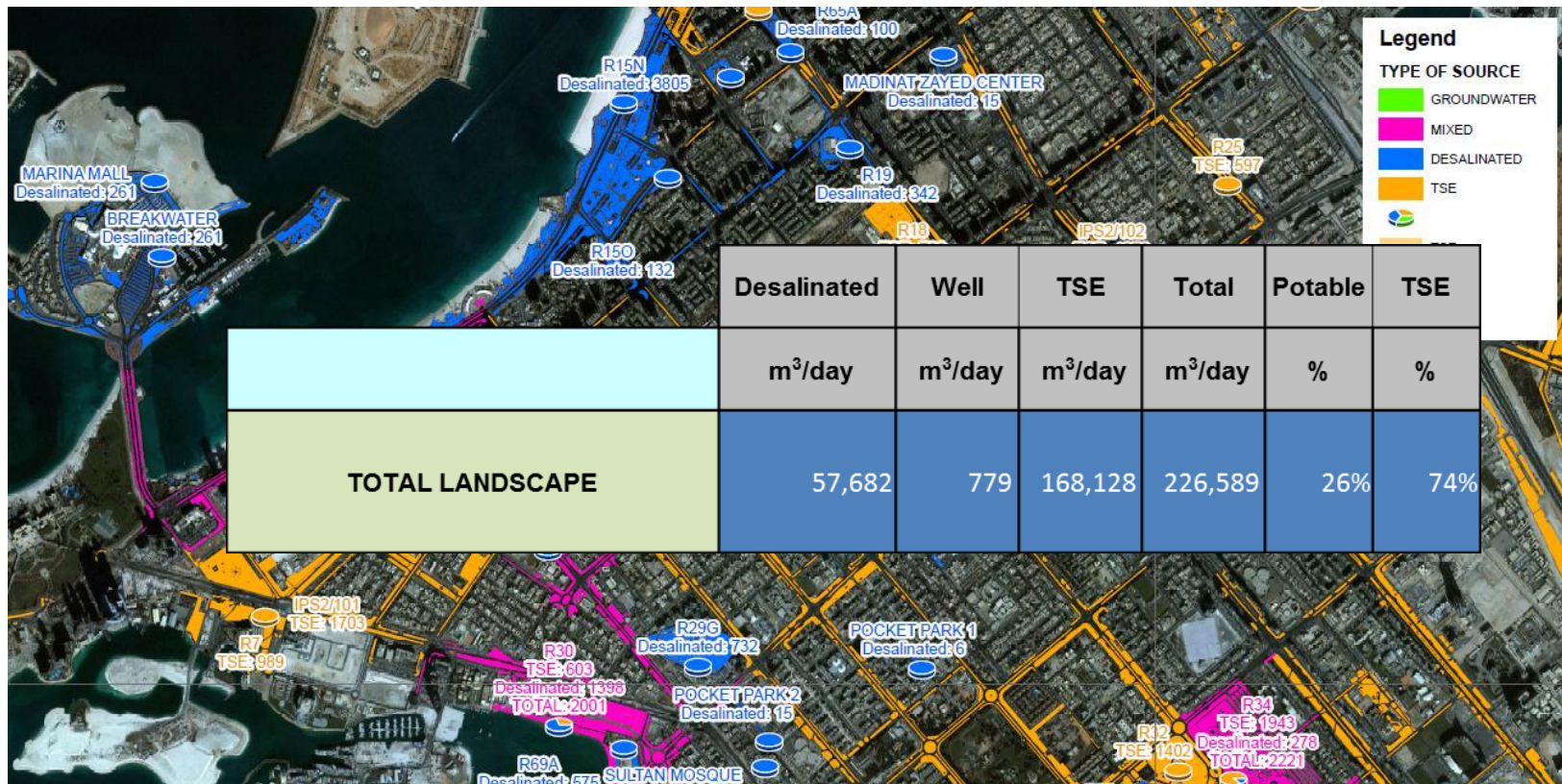
and

was

for

ABU DHABI CITY-IRRIGATION MASTER PLAN 966				
Parks and Recreation Facilities Division				
ADDC FLOWMETERS SURVEY				
CONTRACT No 71/2012 SH				
ADDC Flowmeter 002				
PICTURES				
				
Picture_2013-07-15_101623				

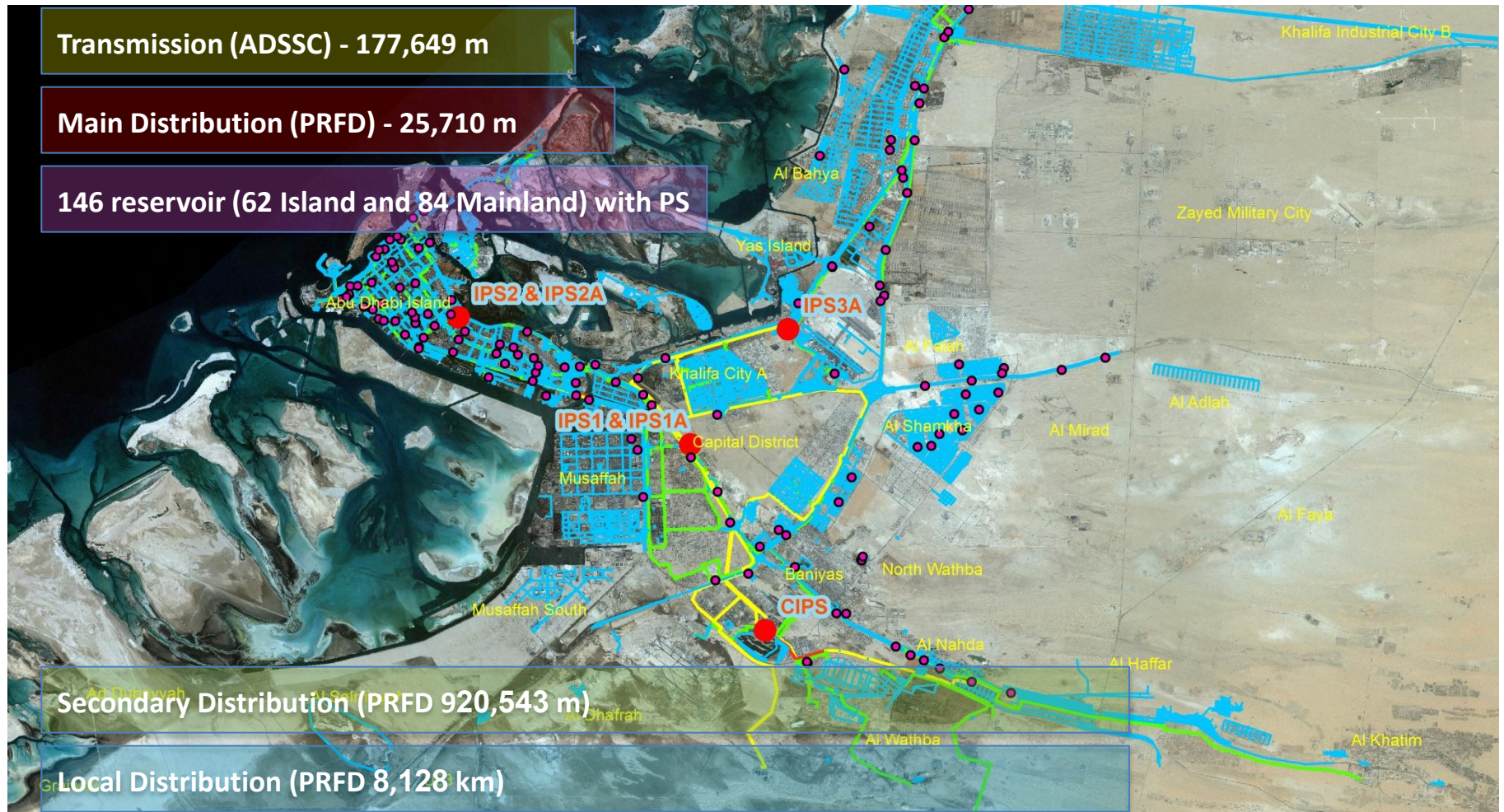
- Assigned current and theoretical demands to each service area



- Schedule the irrigation on climatic data and type of plants
- Install new instruments (enabling works) for monitoring the upstream network. It will allow accurate benchmarking of irrigation efficiency, leakage assessment and water balance
- Implement Reservoir Filling Philosophy defining a desired filling flow into the reservoirs to avoid low pressures and surges in the upstream network
- Assess the performance of the downstream networks (irrigation audit).
Use the audit to fix the problems and create a baseline irrigation schedule

Irrigation Geo-database

Network breakdown and ownership

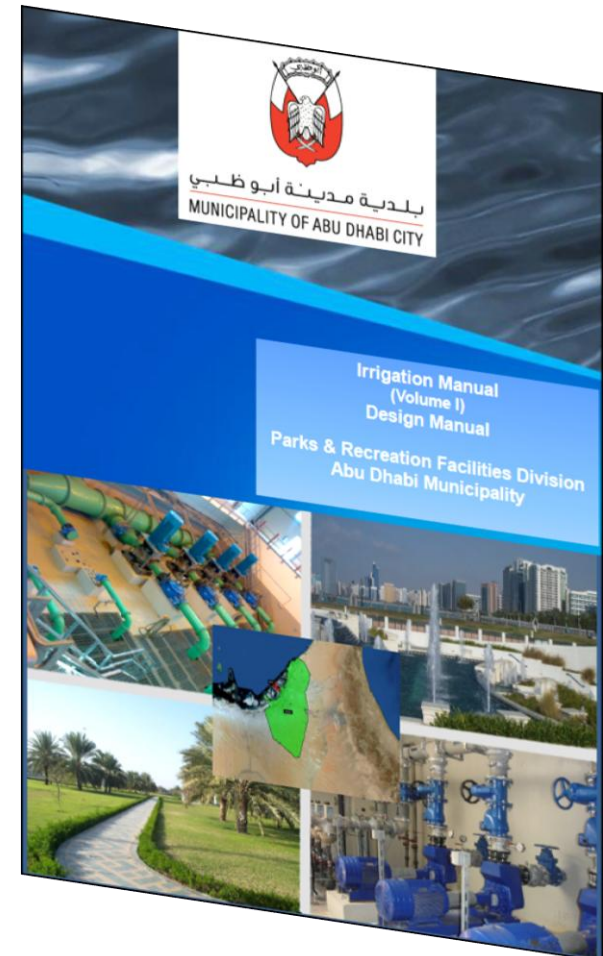


UPDATE IRRIGATION MANUAL



General

- A rebuilt “Irrigation Manual” that incorporates and upgrades the previous manuals, technical specifications and standard drawings, and includes an O&M manual.
- The Irrigation Manual will be the foundation for future design, construction, operation and maintenance of irrigation systems.



Structure

Irrigation Manual

VOLUME 1 Design Manual

VOLUME 2 O&M Manual

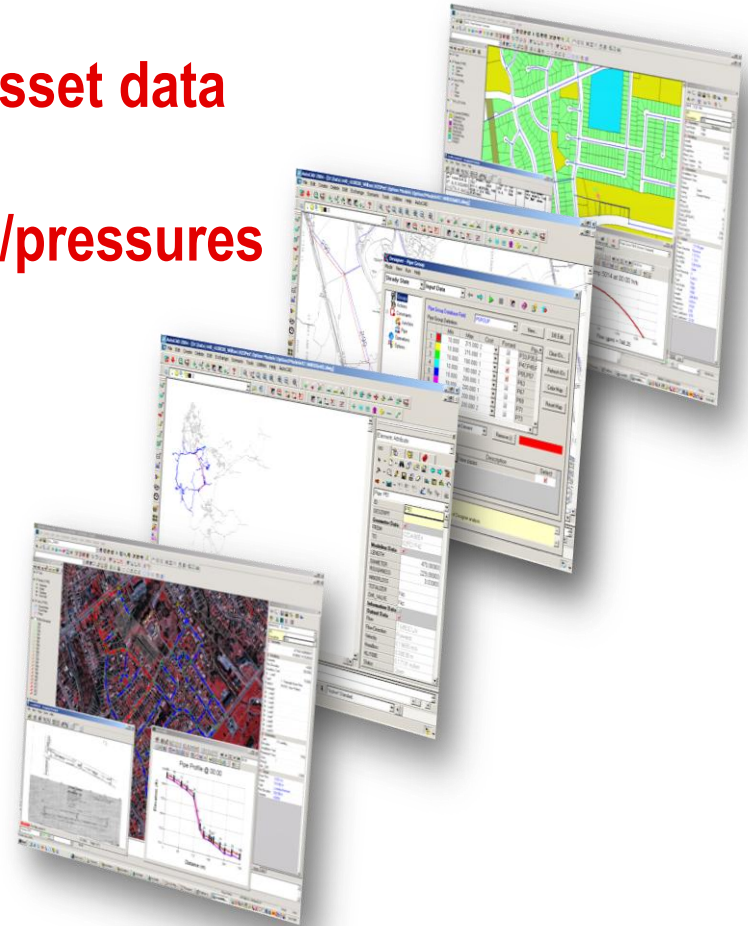
VOLUME 3 Technical Specifications

VOLUME 4 Standard Drawings



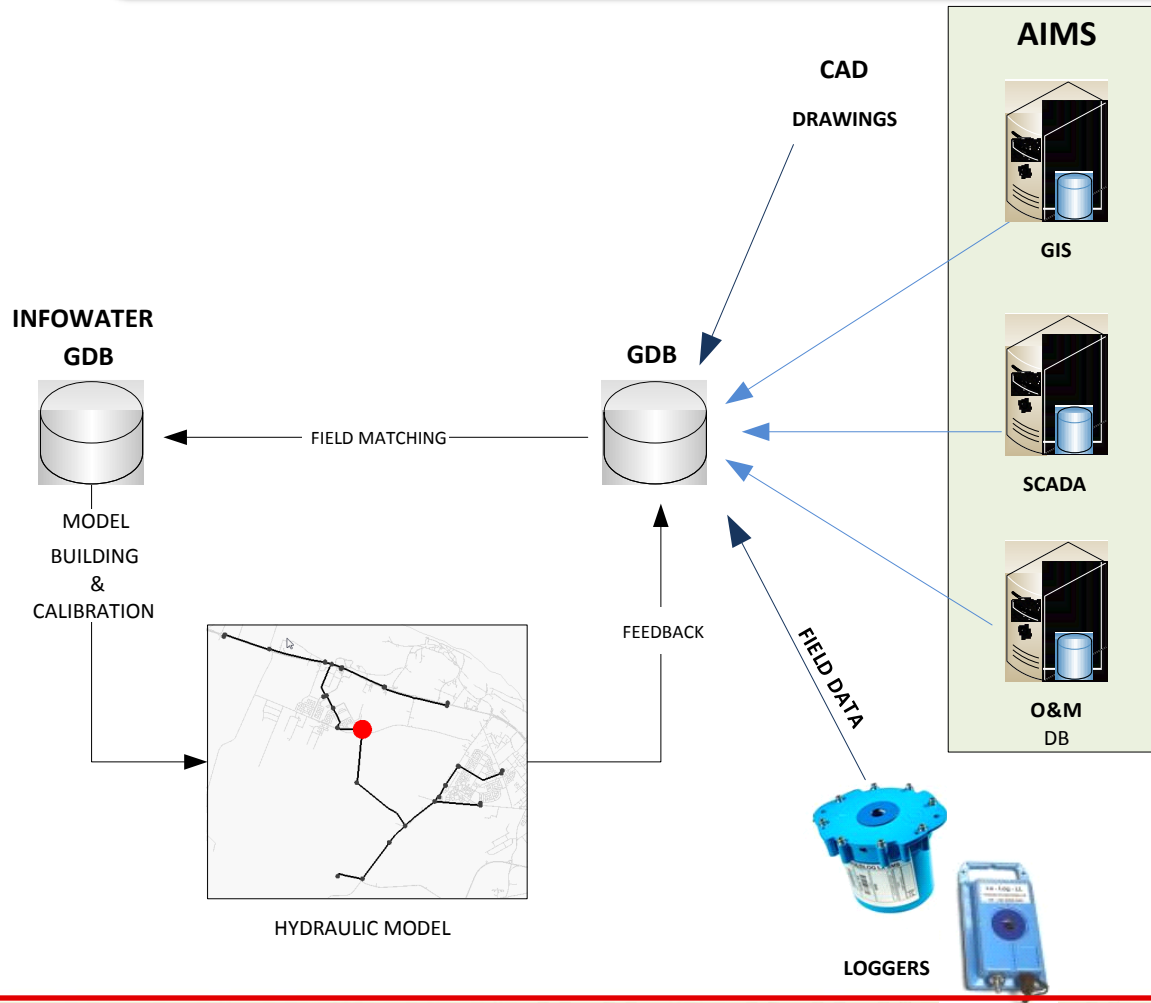
Phase 4-Hydraulic Model

- **Model construction using verified asset data**
- **Calibration against measured flows/pressures**
- **Initial leakage assessment**
- **Surge checks for critical areas**
- **Recommendations**





Hydraulic Model Build Process



Hydraulic Model



SCADA Data download and conversion to DAT file

	A	B	C	D	E	F	G	H	I	J	K	L
1	*Exported on Tue Mar 18 10:31:16 GST 2014											
2	* Bar IPS2 Delivery?											
3	Depth in (m)	IPS2 RES2	IPS2 RES3	IPS2 RES5	IPS2 RES6	IPS2 RES7	LL Main Dist Chamber	IPS2 RES8	IPS2 RES9			
4		1	2	3	4	5	6	7	8	9	10	11
5	[Data]	IPS2_LT02	IPS2_LT03	IPS2_LT05	IPS2_LT06	IPS2_LT07	IPS2_LT10	IPS2_LT13	IPS2A_LT01	IPS2A_LT02	IPS2A_LT03	IPS2N_LT01
6	timestamp	PRFD.IPS2_LT02	PRFD.IPS2_LT03	PRFD.IPS2_LT05	PRFD.IPS2_LT06	PRFD.IPS2_LT07	PRFD.IPS2_LT10	PRFD.IPS2_LT13	PRFD.IPS2A_LT01	PRFD.IPS2A_LT02	PRFD.IPS2A_LT03	PRFD.IPS2N_LT01
7	11/4/2013 0:15	4.588214	3.81386	4.695127	4.507714	4.410298	0.1762244	2.99645	4.206378	4.138902	13.76219	4.060862
8	11/4/2013 0:30	4.593026	3.823236	4.696814	4.512526	4.415986	0.1801844	2.996525	4.19	4.120187	13.85531	4.05007
9	11/4/2013 0:45	4.597839	3.83261	4.698502	4.517339	4.421673	0.1841444	2.9966	4.186863	4.127189	13.94844	4.054578
10	11/4/2013 1:00	4.602651	3.841985	4.700189	4.522151	4.427361	0.1881044	2.996675	4.193939	4.13445	14.04156	4.059085
11	11/4/2013 1:15	4.607464	3.851361	4.701877	4.526964	4.433048	0.1920644	2.99675	4.201015	4.141712	14.13469	4.063592
12	11/4/2013 1:30	4.612276	3.860735	4.703564	4.531776	4.438735	0.1960244	2.996825	4.208091	4.148973	14.22781	4.068099
13	11/4/2013 1:45	4.617089	3.870111	4.705252	4.536589	4.444423	0.1999844	2.9969	4.215167	4.156235	14.32094	4.072607
14	11/4/2013 2:00	4.621902	3.879485	4.706939	4.541401	4.45011	0.2039444	2.996975	4.222242	4.163496	14.41406	4.077114
15	11/4/2013 2:15	4.626714	3.88886	4.708627	4.546214	4.455798	0.2079044	2.99705	4.229318	4.170757	14.50719	4.081621
16	11/4/2013 2:30	4.631526	3.898236	4.710314	4.551026	4.461485	0.2118644	2.997125	4.236394	4.178019	14.60031	4.086129
17	11/4/2013 2:45	4.636339	3.90761	4.712002	4.555839	4.467173	0.2158244	2.9972	4.24347	4.18528	14.69344	4.090636
18	11/4/2013 3:00	4.641151	3.916986	4.713689	4.560651	4.47286	0.2197844	2.997275	4.250546	4.192542	14.78656	4.095143
19	11/4/2013 3:15	4.645964	3.926361	4.715377	4.565464	4.478548	0.2237444	2.99735	4.257622	4.199803	14.87969	4.09965
20	11/4/2013 3:30	4.650776	3.935735	4.717064	4.570276	4.484235	0.2277044	2.997425	4.264698	4.207065	14.97281	4.104158
21	11/4/2013 3:45	4.655589	3.945111	4.718752	4.575089	4.489923	0.2316644	2.9975	4.271773	4.214326	15.06594	4.108665
22	11/4/2013 4:00	4.660401	3.954485	4.720439	4.579901	4.49561	0.2356244	2.997575	4.278849	4.221588	15.15906	4.113173
23	11/4/2013 4:15	4.660268	3.954879	4.720603	4.579685	4.495455	0.234819	2.9976	4.27987	4.222553	15.20746	4.113191
24	11/4/2013 4:30	4.657674	3.950804	4.72001	4.576966	4.492393	0.2316427	2.9976	4.277878	4.220386	15.23361	4.110977
25	11/4/2013 4:45	4.655081	3.946729	4.719416	4.574247	4.48933	0.2284665	2.9976	4.275887	4.218219	15.25975	4.108763

- SCADA Data connect to InfoWater Model

Real-Time Data Connection

Pipe: 152714 ID? < Save

Description: R34 Inlet Delete

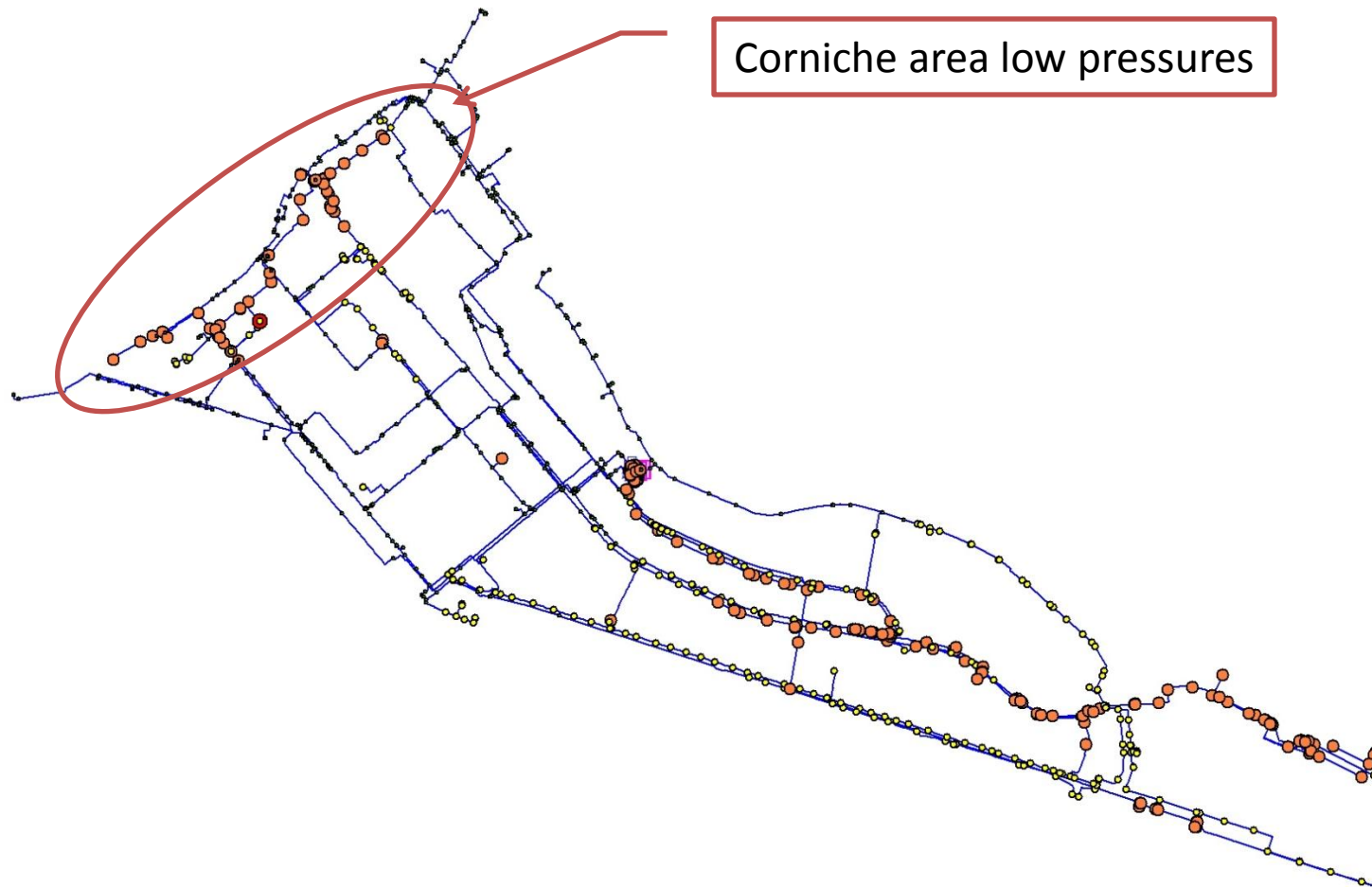
Log File: E:\Irrigation Master Plan Model\InfoWater DAT files\Flow\ ... Close

Model Date: Sunday, January 26, 2014

Log File Settings Content Snapshot

Meter Node	n/a
Description	IR34_FT02
Comment	
Data Channel	Flow
Start Date	Sunday, January 26, 2014, 00:15:00
End Date	Wednesday, January 29, 2014, 00:00:00
Recording Interval	900 sec
Total Records	287
Time Offset (Interval)	0
Value Unit	L/s
Value Offset	0.000000000
Value Scale	1.000000000

- Initial findings concur with O&M problem areas.



Phase 5-Options Evaluation

- To identify ways of maintaining TSE quality and ensuring health and safety
- To compare type of planting and their water demands
- To compare irrigation methods and their usefulness
- To consider benefits of telemetry, instrumentation and automation in the context of the Automation Project
- To identify options for improving the irrigation network and test on model

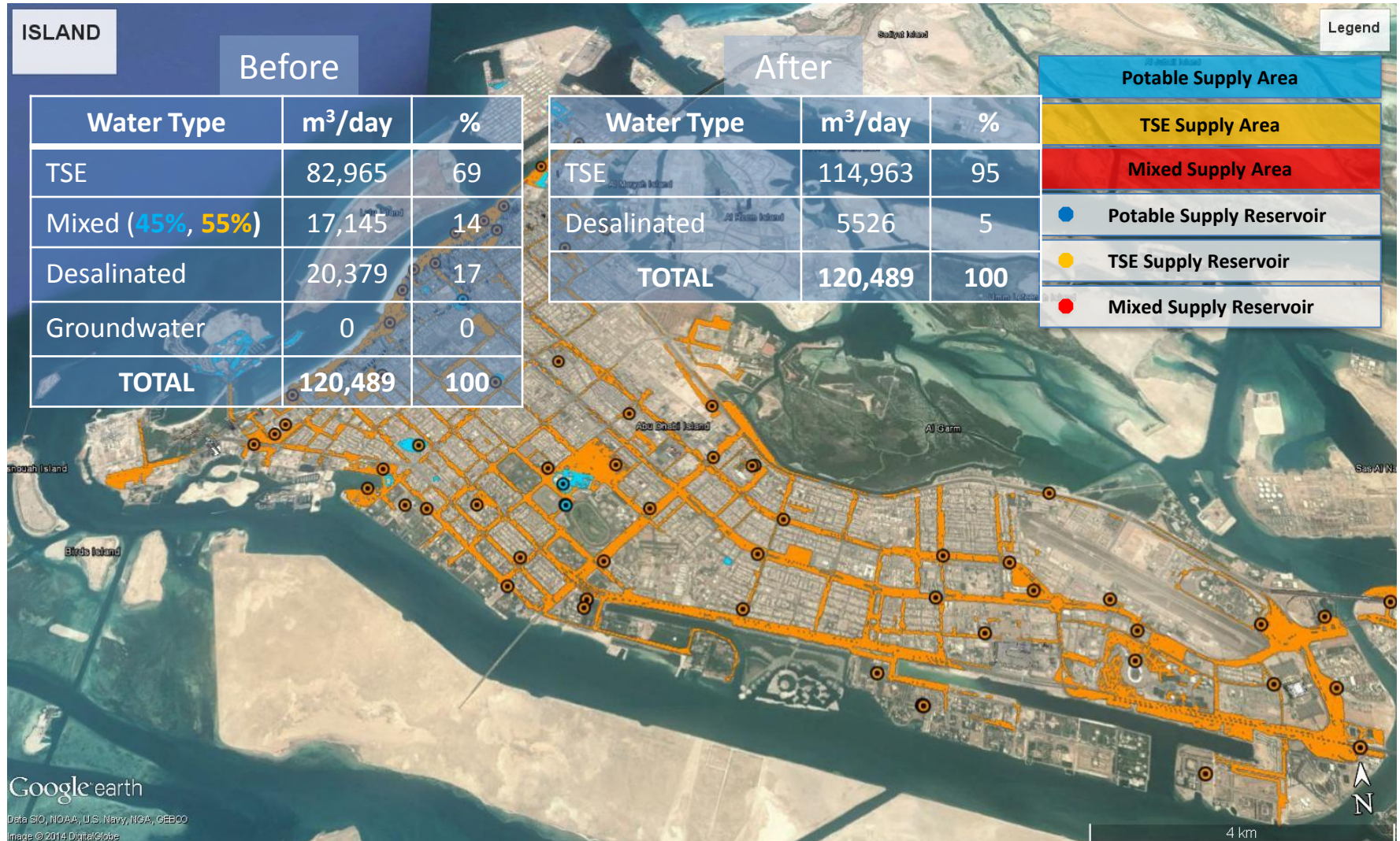
- Proposed Quick wins to maximize the use of TSE
- Assessing the future TSE water demands and production, as per draft Capital Plan 2030
- Locating the developers demands for future scenarios (up to 2030)
- Connecting the future demand points to the PRFD/ADSSC networks.
Assessing options to satisfy the demands
- Once connected, the future demands will be incorporated into the hydraulic model and the different scenarios will be analyzed
- CapPlan risk engine will be used to assess replacement of existing pipes according to future scenarios

QUICK WINS

Assess immediate short to mid-term schemes to reduce potable water supply to irrigation practice:

- Identify Quick-wins measures/works to enhance the existing irrigation network.

Options Evaluation – Quick Wins – Future Usage Island



- **Setting Objectives**

Best practice asset management calls for ...

*A clearly defined **Planning Objective** which can be used as a reference point for all asset management decisions.*

Proposed Objective:

To meet current and future level of service targets set by PRFD at least cost over the long term, where

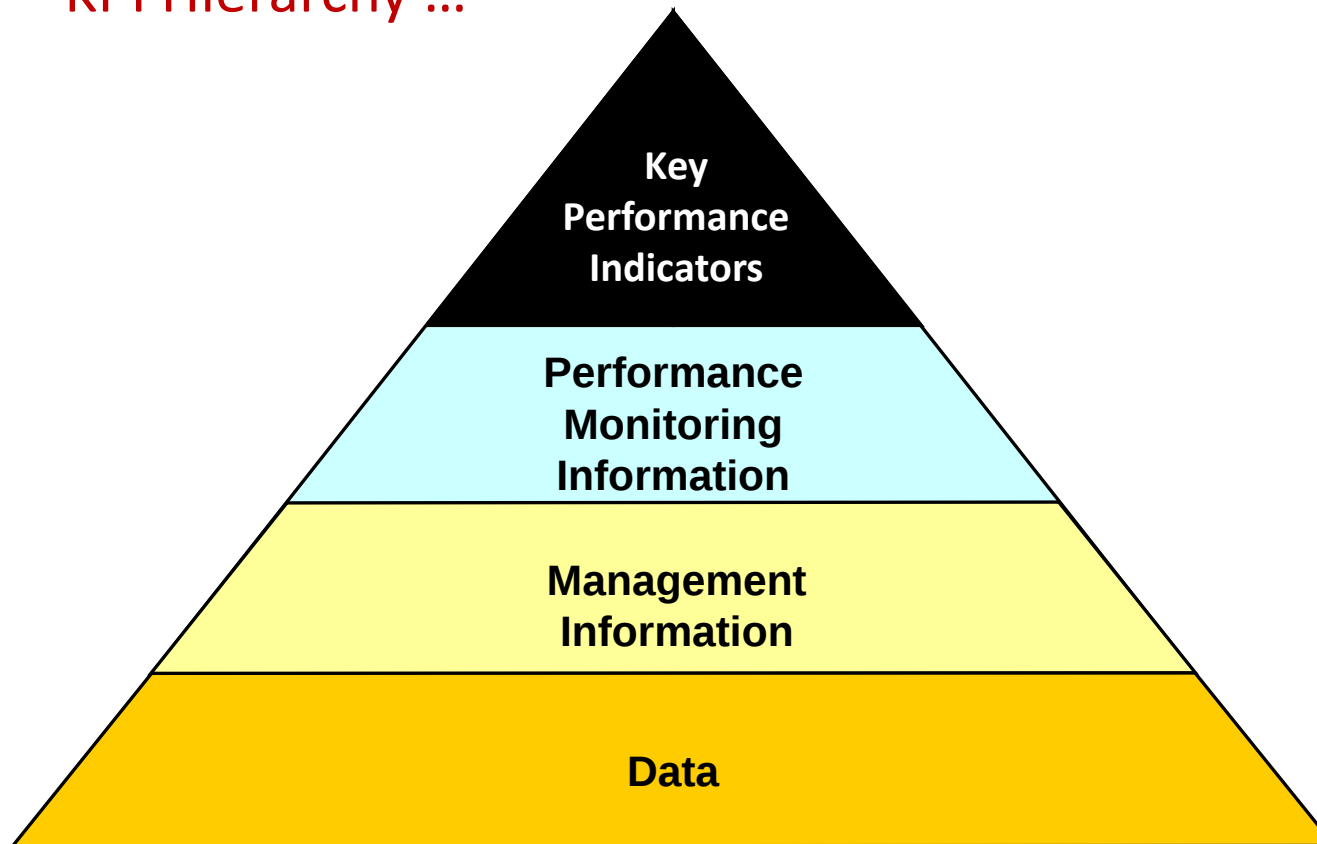
“level of service targets” are set for a basket of service indicators

“costs” include operational and capital costs incurred by PRFD

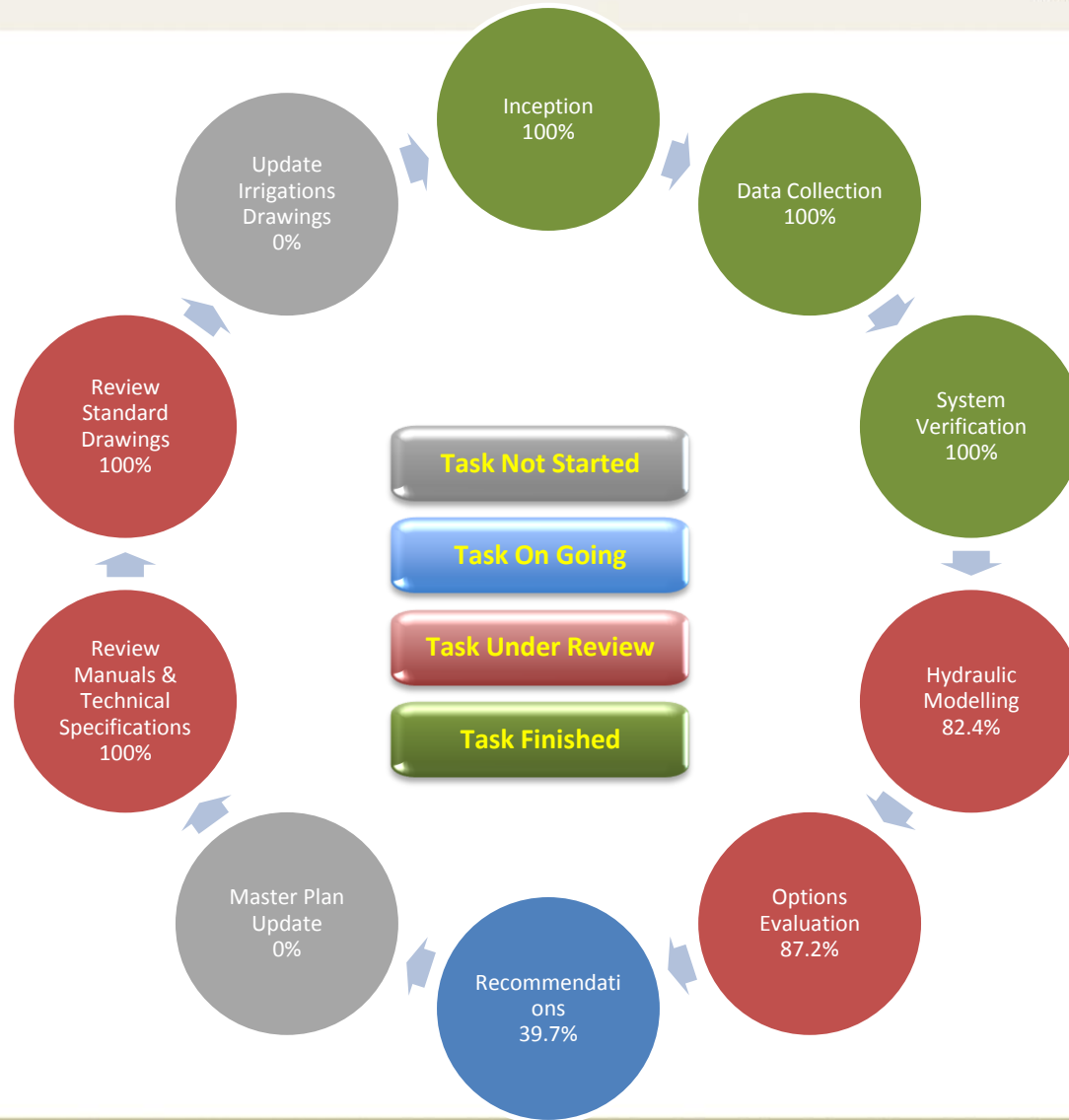
- A Suite of Metrics to Monitor Performance...



- KPI Hierarchy ...



Project Progress Update



WAY FORWARD

PHASE 6 – RECOMMENDATIONS

- **Final recommendations and cost estimates**
- **Time scale for implementation and capital expenditure programme**
- **Integration of proposed new capital works into the AMP**
- **Master Plan Report**

PHASE 7 – MASTER PLAN UPDATE

- **Collect outstanding/new information from Relevant Projects**
- **Update and recalibrate hydraulic model accordingly**
- **Update AMP accordingly**
- **Updated Master Plan Report**

THANK YOU

Hyperlink Slides

Transmission: Pipeline that connects the source of TSE (WWTP) with major pump stations (IPS1, IPS2, IPS3, CIPS), i.e. Mafrq to IPS1. Essentially are the pipelines owned by ADSSC.

Main distribution: Pipeline that connects major pump stations with other major pump stations (for its later distribution to irrigation reservoirs), i.e. emergency line from IPS1 to IPS2.

Secondary distribution: Pipeline that connects major pump stations with irrigation reservoirs and direct feeds, i.e. Island upstream network from IPS2 to R43.

Local distribution: Pipeline that connects irrigation reservoirs and direct feeds with solenoid valves, i.e. R43 to solenoids. Essentially is the downstream network from irrigation reservoirs.