



## منطقة تقييم بركاء

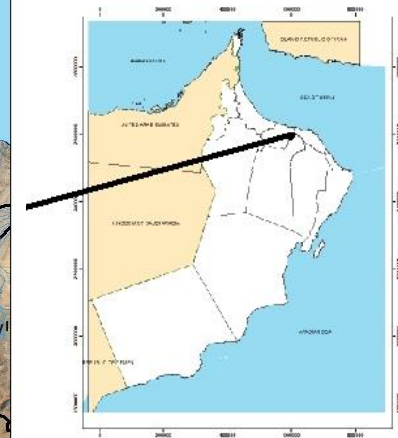
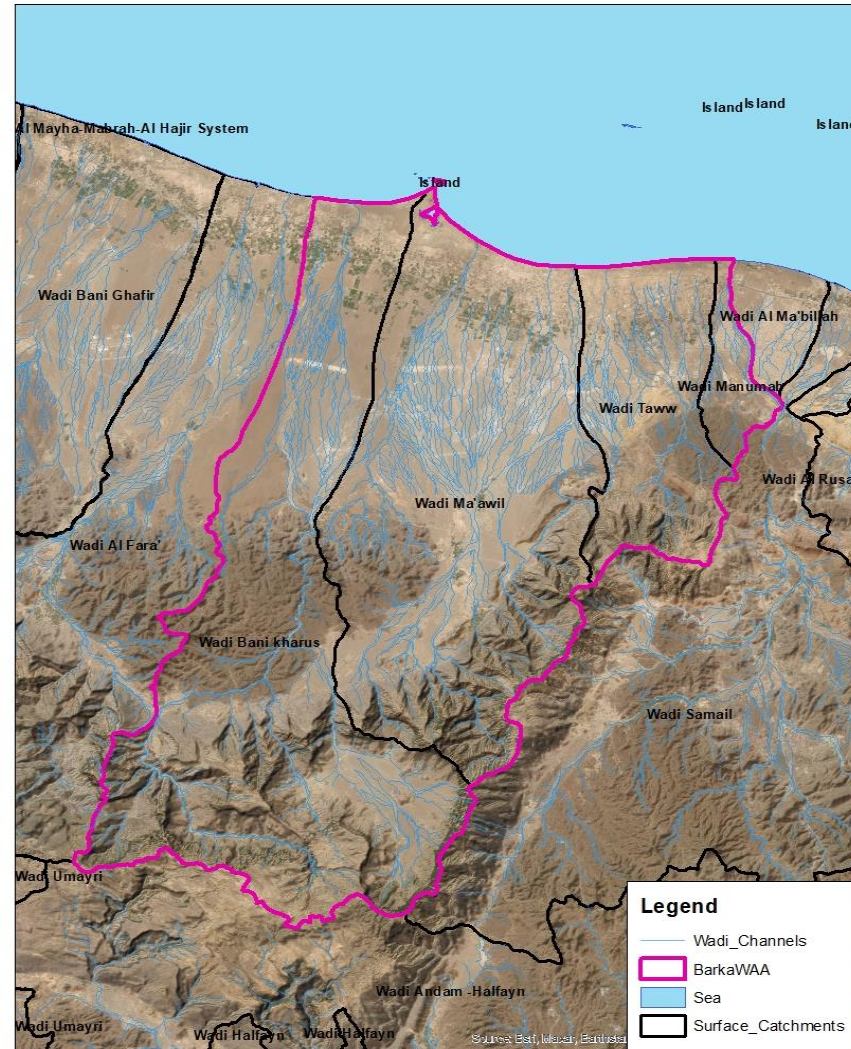
# Agenda

- **Introduction**
- **Significance of problem**
- **Geology and Hydrogeology**
- **Surface catchment**
- **Climate and Water resources in the Area**
- **Groundwater Levels**
- **Agriculture in South Al Batinah**
- **Salinity**
- **Monitoring Network**



# Barka Water Assessment Area (Barka WAA)

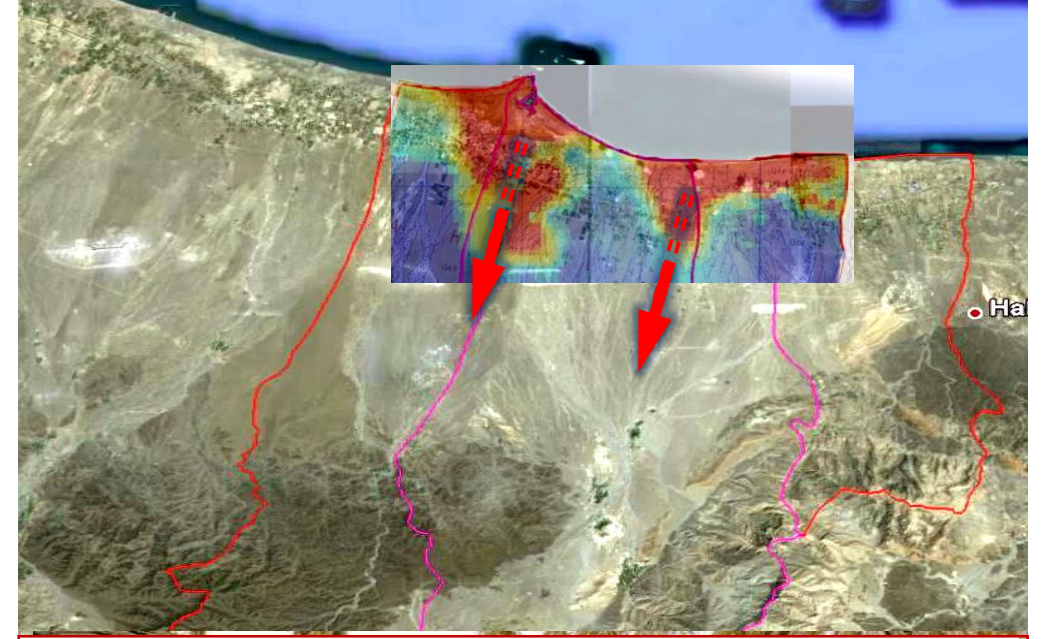
- **Location:** North of the Northern Oman Mountains, extending to the Sea of Oman
- **Total land area:** 2,728 km<sup>2</sup>
- **Represents** one of the most promising areas for sustainable development especially for agricultural activities and animal production
- **Consist of (4) surface Water catchments**
- **Consist of (11) Water Assessments unit Area (WAuA)**
- **Catchments:** Wadis Manumah, Taww, Ma'awil, and Bani Kharus
- **Population:** 545,449 people in South Al Batinah (NCSI, 2023)



# التحديات التي تواجه الموارد المائية

- خلال السبعينيات والثمانينيات ومع ادخال أنظمة الضخ الحديثة، زاد ضخ المياه الجوفية من طبقة المياه الجوفية الساحلية في منطقة الباطنة بشكل كبير جدا. وأدى ذلك إلى انخفاض كبير في مستوى سطح المياه وما يرتبط به من آثار بيئية (تدهور التربة والزراعة)، بما في ذلك تدهور في نوعية المياه الجوفية نتيجة تسرب مياه البحر. ويعتبر قطاع الزراعة المستهلك الأكبر في السلطنة، إذ يشكل 84% من إجمالي استخدام المياه.

South Al Batinah agricultural area



Saline intrusion in coastal areas

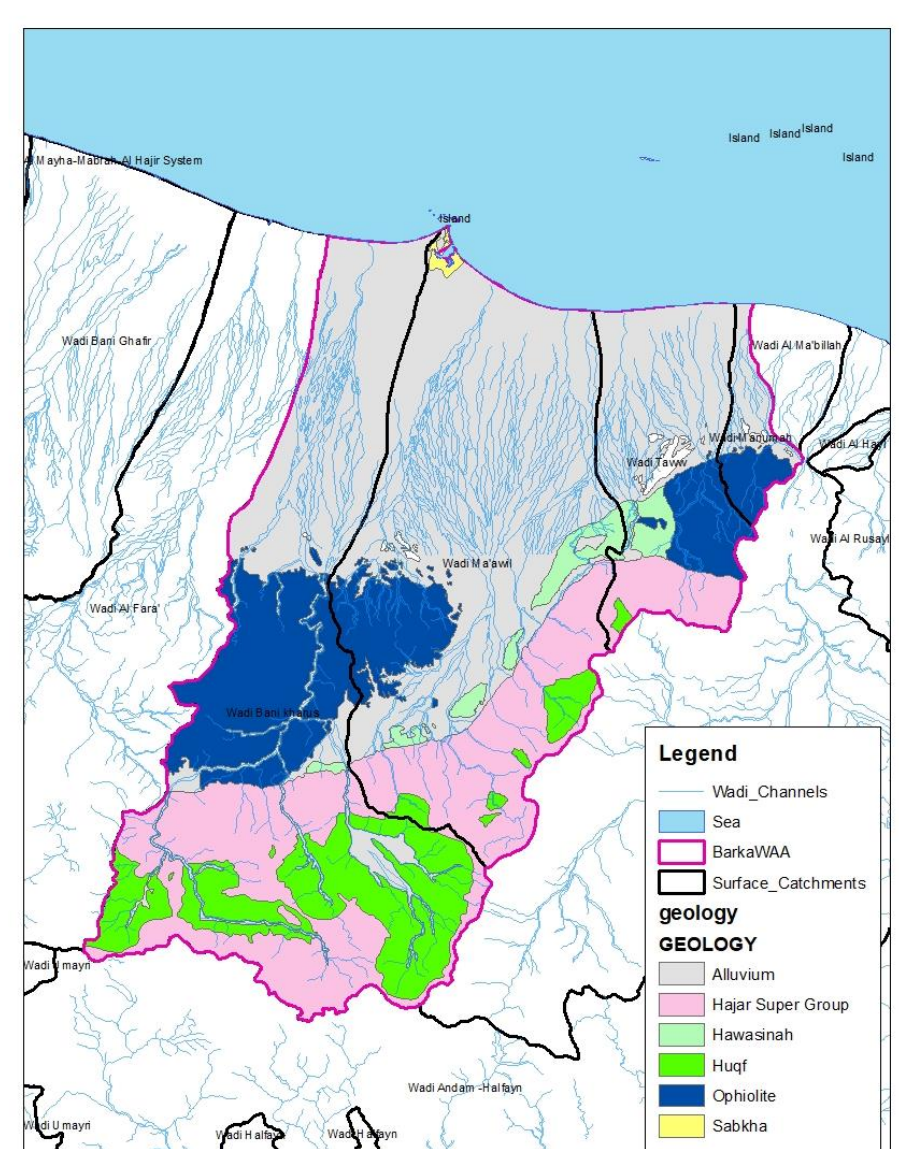


# The change of vegetation and urban during 30 years



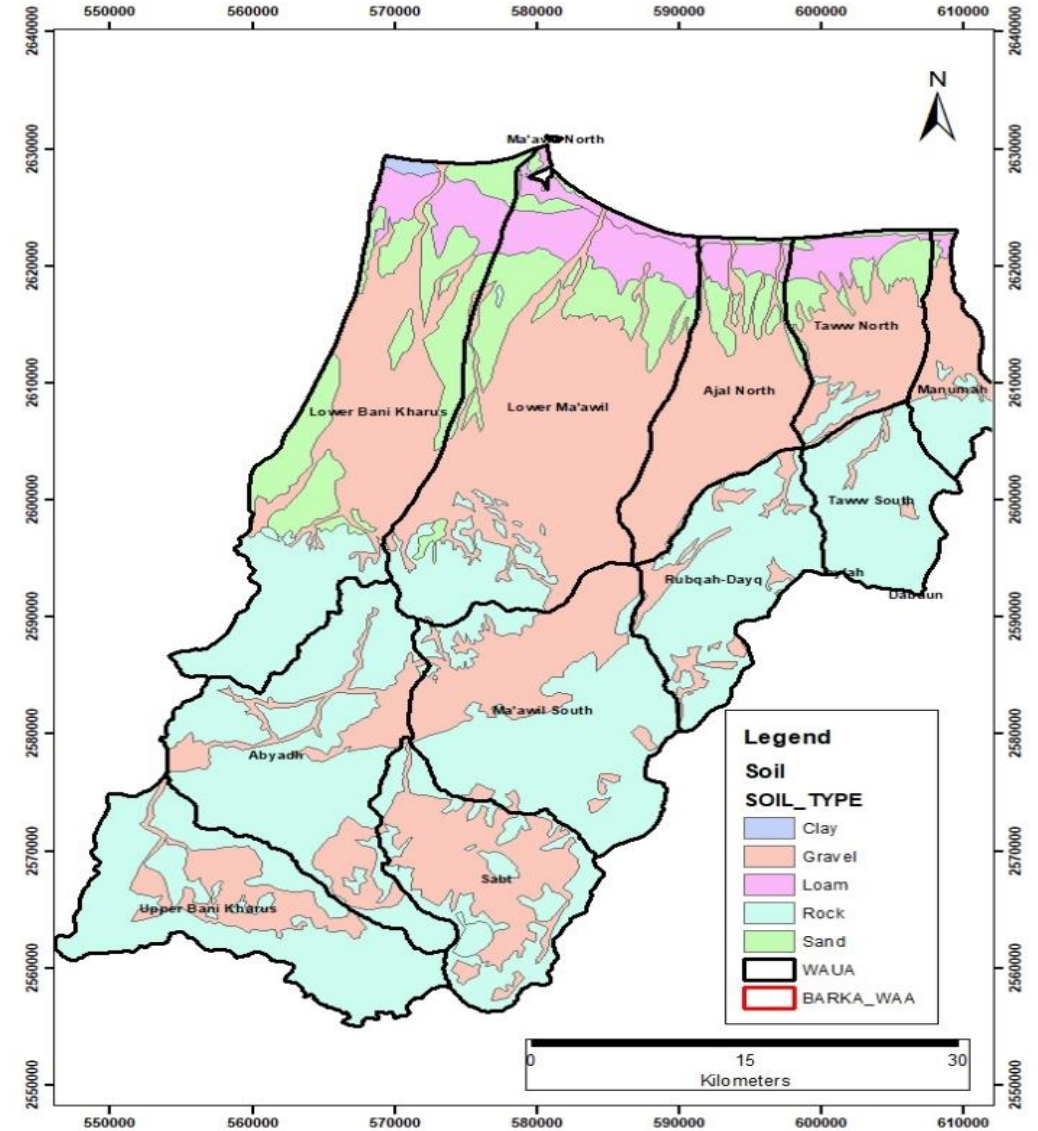
# Geology and Hydrogeology

formation	Lithology	Aquifer Characteristics
<b>HSG. Mahil&amp;Saiq Formation (fractures)</b>	Dolomite and Limestone	Fractures Zones of Dolomite. The most zones were encountered within the first 300 meters. One borehole has a rest water level of a 20 m.bgl, which indicates a freshwater thickness of at least 640m, with a base at 110 m.bs. This evidence suggests that Saiq & Mahil Formations receive considerable recharge and hold a substantial storage of good quality water. Seepage from these bedrock units is believed to provide significant input to alluvial aquifers of coastal plain.
<b>Hawasinah</b>	Chert, volcanics & limestone	Not an aquifer & act as major barriers to groundwater flow
<b>Ophiolite</b>	Mantle & crustal sequence	Mantle is subjected to a greater pressure release leading to increased fracturing & allows the throughflow of groundwater to coastal alluvial aquifer & source of number of (hyper-alkaline) springs. Whereas the crustal sequence is more likely act as a barrier.
<b>AlluviumLayer 1</b>	Recent alluvium: clean sand & gravels, cemented in places. Sub recent alluvium: better sorted and bedded than Ancient alluvium, particle size decrease from piedmont to coast (from conglomerate to silt & clay)	Hydraulic conductivity is high around 20 m/d. For recent alluvium resistivity is ranging from 70m to 200 $\Omega$ . For sub-recent alluvium resistivity ranging from 40 to 80 $\Omega$ . Average thickness is around = 200m. The thickness is ranging = 119-500m. Unconfined aquifer T = 2494 m <sup>2</sup> /day , K = 60 m/day , S = 0.0013 , Sy = 0.067
<b>AlluviumLayer 2</b>	Ancient alluvium: conglomerate with a sandy and clayey matrix-Mioceneto Pliocene age	Resistivity ranges from 10-30 $\Omega$ . Lower conductivity & porosity contains good quality & storage of water. The thickness of layer 2 is ranging from 91m to 400m. Average thickness around = 180m. Hydraulic conductivity is about 1m/d. Hydraulic gradient = 0.01. These estimates indicate that groundwater flow in layer 1 could be supplied by seepage from layer 2 Leaky aquifer T = 108 m <sup>2</sup> /day K = 1.8 m/day ,S = 0.0008 , Sy = 0.007



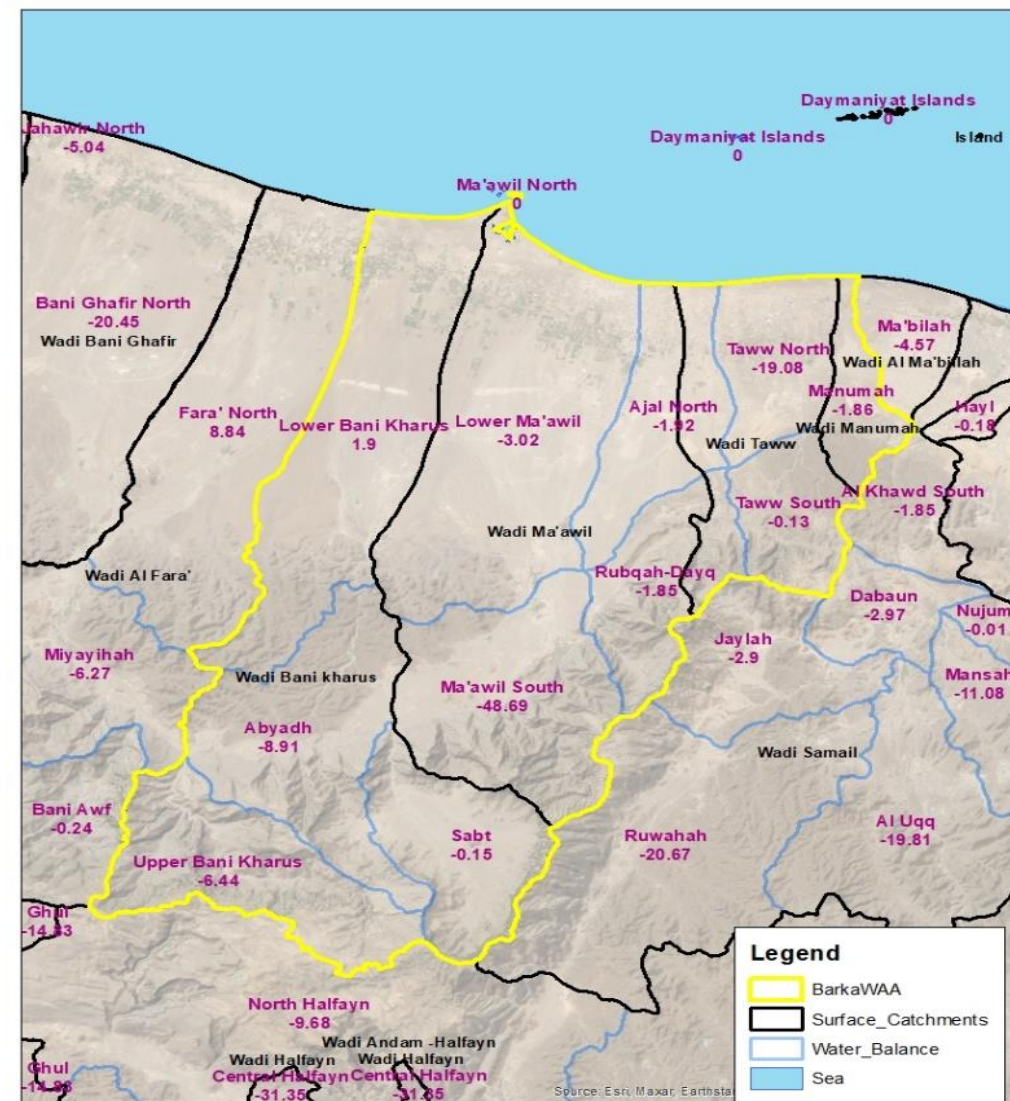
# التربة

معظم أنواع التربة في سلطنة عمان، وخاصة في ساحل الباطنة (منطقة الدراسة) هي من التربة متوسطة الخشونة وتتكون من الرمال والرمال الطميية والطفلية الرملية. يتراوح عمق التربة من 30 إلى 100 سم في معظم المناطق. المواد العضوية التي تحتوي على النيتروجين والفوسفات قليلة الكمية. ارتفاع الحجر الجيري في جبال منطقة الباطنة. وتبلغ نسبة كربونات الكالسيوم في التربة حوالي 35% في ساحل الباطنة. أما في الباطنة فإن نقص المغذيات الدقيقة أقل. درجة حموضة التربة معتدلة إلى قلوية قوي.



# Surface catchment

Catchment	Water Assessment Unit area (WAUA)	Rainfall regime	Geomorph- ological regime	Dominant Bedrock lithology
Wadi Bani Kharus	<ul style="list-style-type: none"> <li>Sabt</li> <li>Upper Bani Kharus</li> <li>Abyadh</li> <li>Lower Bani Kharus</li> </ul>	<ul style="list-style-type: none"> <li>Moderate</li> <li>High</li> <li>Moderate</li> <li>Moderate</li> </ul>	<ul style="list-style-type: none"> <li>Mountain/piedmont</li> <li>Mountain/piedmont</li> <li>Mountain/piedmont</li> <li>Alluvial fan/plain</li> </ul>	<ul style="list-style-type: none"> <li>Huqf/HS</li> <li>HSG/Huf</li> <li>Ophiolite</li> <li>NA</li> </ul>
Wadi Al Ma'awil	<ul style="list-style-type: none"> <li>Ma'awil South</li> <li>Lower Ma'awil</li> </ul>	<ul style="list-style-type: none"> <li>Moderate</li> <li>Low</li> </ul>	<ul style="list-style-type: none"> <li>Mountain/piedmont</li> <li>Alluvial fan/plain</li> </ul>	<ul style="list-style-type: none"> <li>HSG</li> <li>NA</li> </ul>
Wadi Manumah	<ul style="list-style-type: none"> <li>Manumah</li> </ul>	<ul style="list-style-type: none"> <li>Low</li> </ul>	<ul style="list-style-type: none"> <li>Alluvial fan/plain</li> </ul>	<ul style="list-style-type: none"> <li>Ophiolite</li> </ul>
Wadi Taww	<ul style="list-style-type: none"> <li>Taww South</li> <li>Taww North</li> <li>Rubqah-Dayq</li> <li>Ajal North</li> </ul>	<ul style="list-style-type: none"> <li>Moderate</li> <li>Low</li> <li>Moderate</li> <li>Low</li> </ul>	<ul style="list-style-type: none"> <li>Mountain/piedmont</li> <li>Alluvial fan/plain</li> <li>Mountain/piedmont</li> <li>Alluvial fan/plain</li> </ul>	<ul style="list-style-type: none"> <li>HSG/Hawassin</li> <li>NA</li> <li>HSG</li> <li>NA</li> </ul>



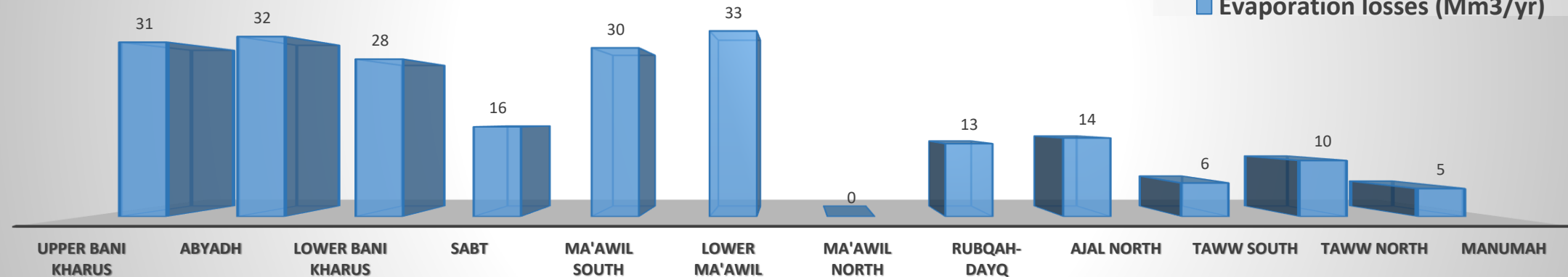


# Climate and Water resources in the Area

- The weather in South Al Batinah is hot during summer season but lower temperatures occur at higher altitudes.
- **Climate:** In South Al Batinah, the average winter temperatures at the coast range between 20-28 °C, at As Seeb, and 17-23°C at Saiq on Al Jabal Al Akhdar Mountains. While the summer temperatures tend to lie between 27 and 37°C. Potential evaporation in Al Batinah coast is estimated to be 2,100mm.

## Evaporation losses

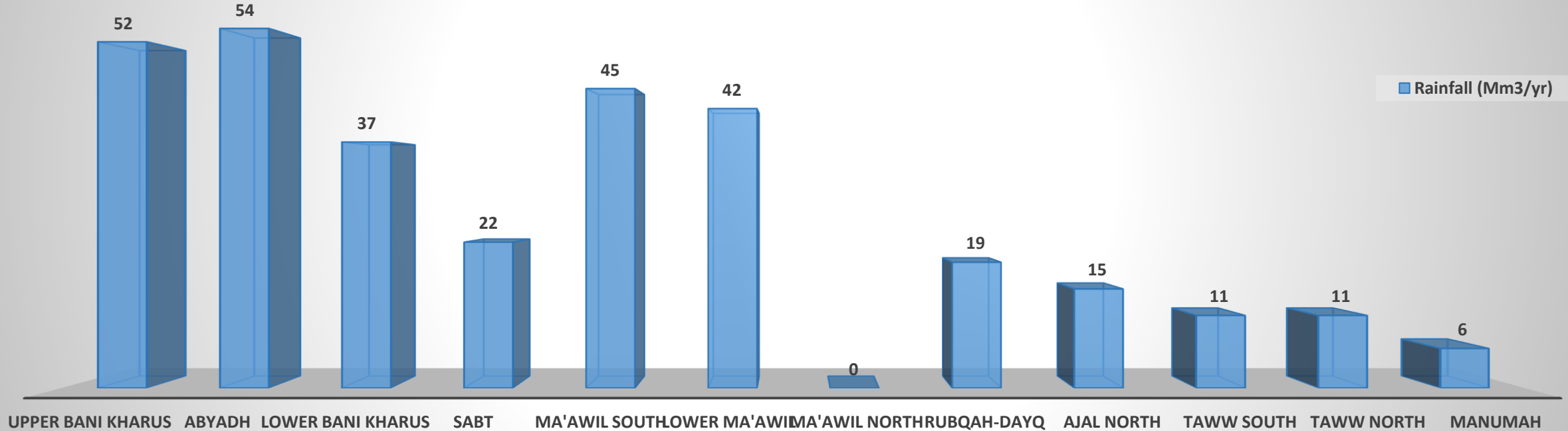
■ Evaporation losses (Mm<sup>3</sup>/yr)



# Climate and Water resources in the Area

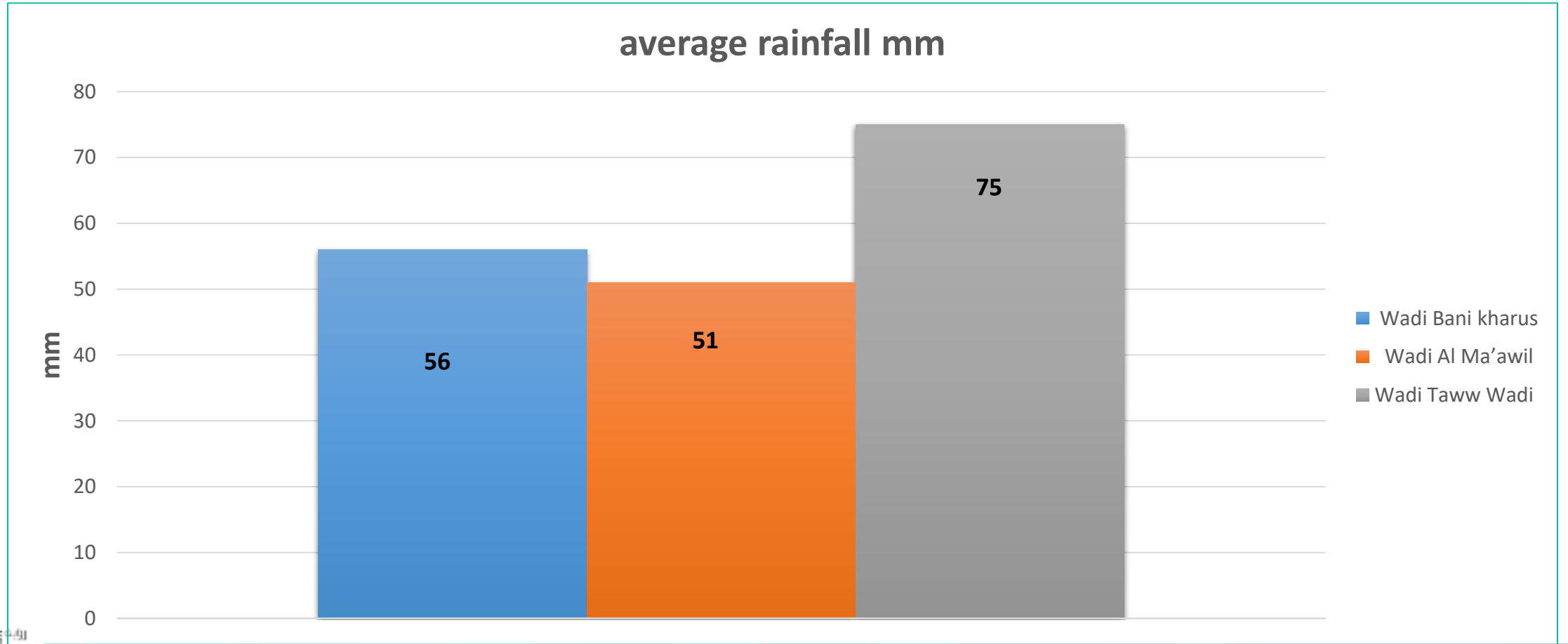
هطول الأمطار: على الرغم من جفاف الطقس خلال فصل الشتاء، إلا أن هطول الأمطار يحدث أحيانًا بالتزامن مع أنظمة الضغط المنخفض. وتقدر كميات الأمطار في منطقة جبل الحجر بحوالي 350 ملم/ السنة إلى 50 ملم/ السنة. على طول الساحل مع اختلافات واسعة. أظهرت دراسة حديثة (موت، 2013) أن متوسط هطول الأمطار السنوي لمدة 25 عامًا من عام 1985 إلى عام 2007 في منطقة الدراسة يبلغ 115 ملم/السنة، وكان متوسط فقدان التبخر 80 ملم/السنة.

## Rainfall

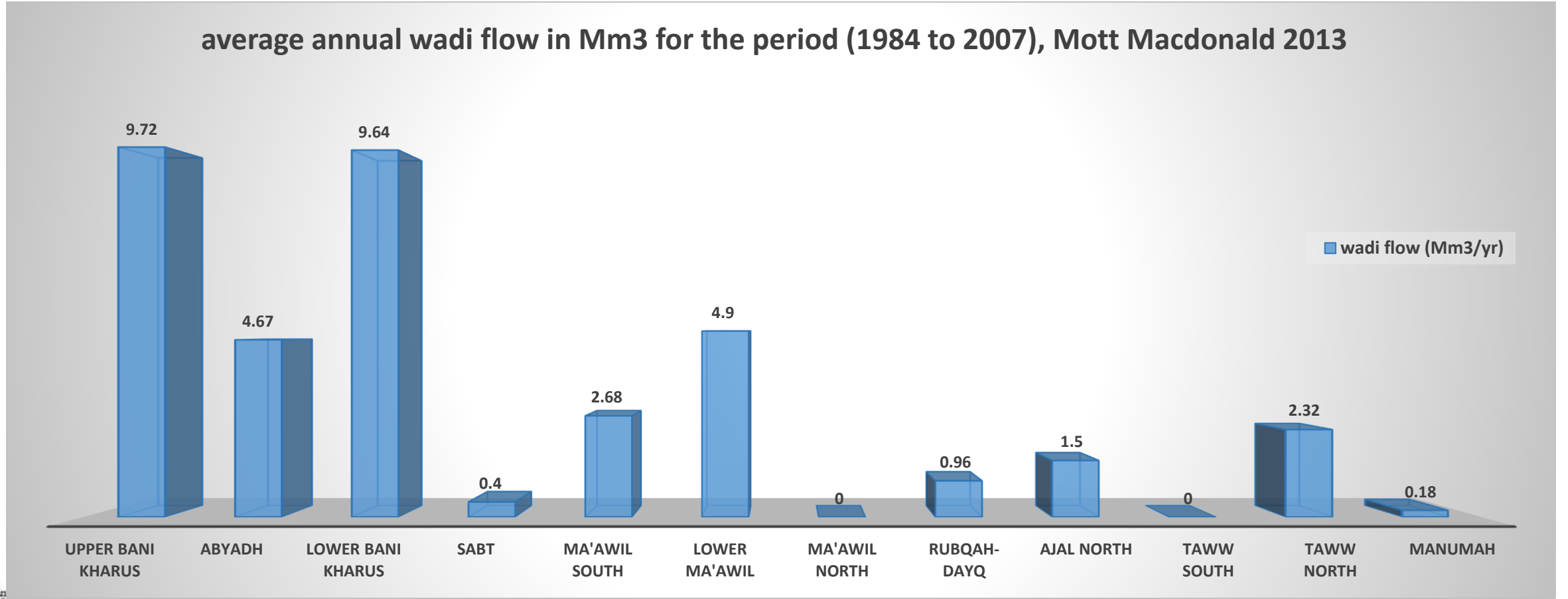


# Climate and Water resources in the Area

## Average rainfall for 2023

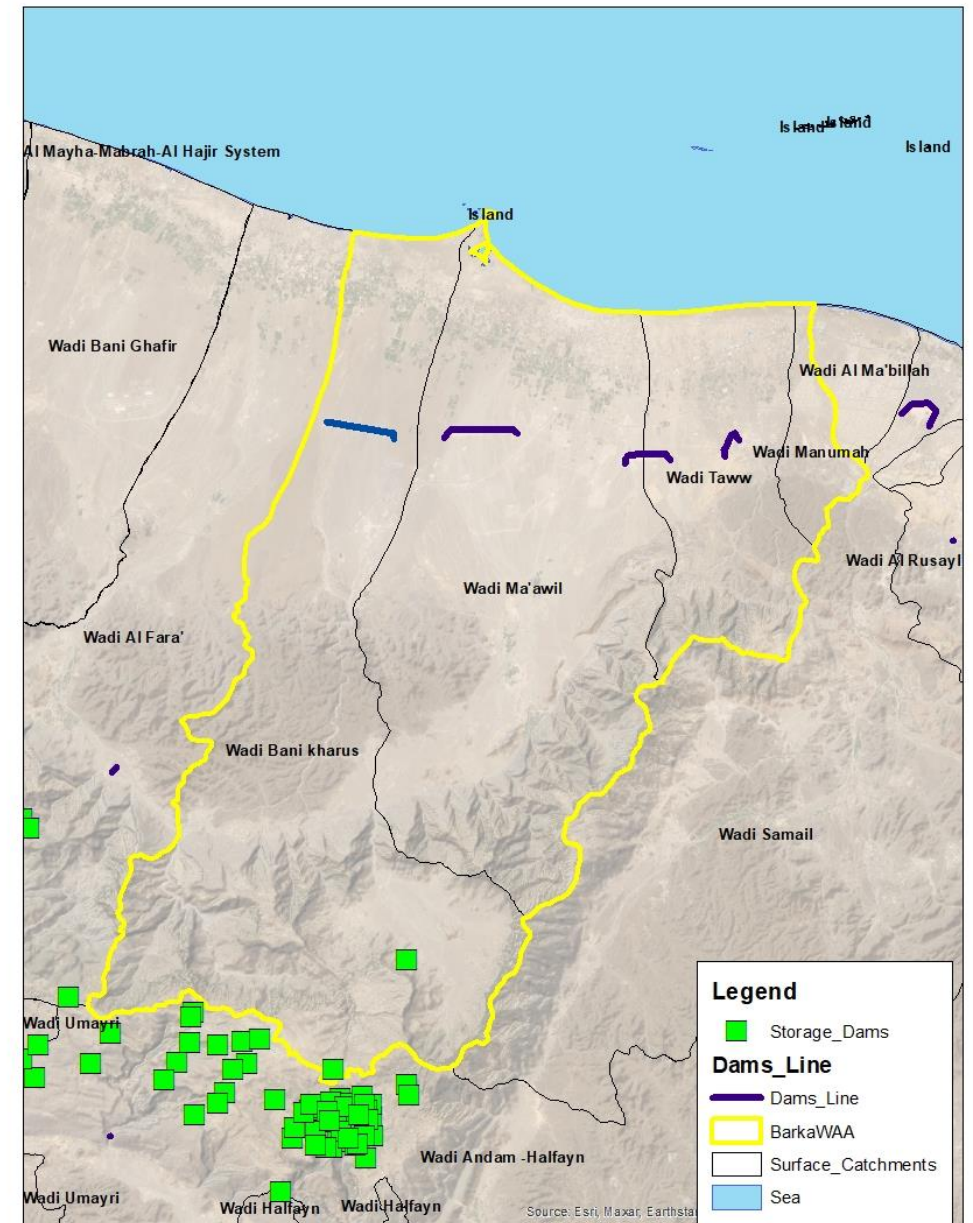


- **Wadi flows:** Average annual recorded flows for (22) years from (1985) to (2007) were calculated by Mott MacDonald, (2013), Wadi Bani Kharus range from (4.67) Mm<sup>3</sup> at Hajar near Abyadh to (9.64) Mm<sup>3</sup> at the lower catchment (north of highway).



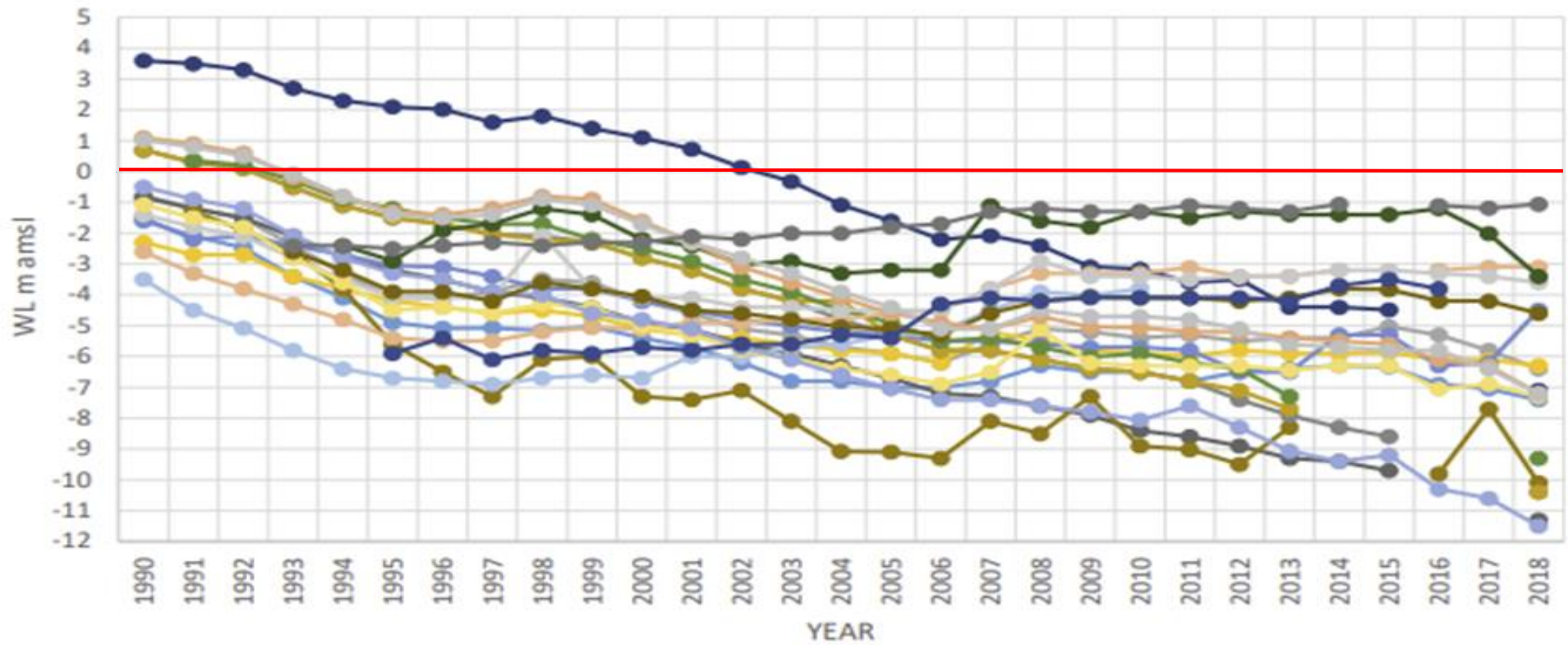
**Dams:** There are (7) recharge dams constructed in South Al Batinah since (1985). The largest (2) are located in Wadi Bani Kharus (with a storage capacity of (5) Mm<sup>3</sup>) and Wadi Ma'awil (with a storage capacity of (10) Mm<sup>3</sup>).

#	Dam Name	Catchment	Dam type	storage capacity Mm <sup>3</sup>
1	Wadi Bani Kharus	Wadi Bani Kharus	Recharge dam	5
2	AlAwabi	Wadi Bani Kharus	Recharge dam	0.288
3	Mistal 1	Wadi Bani Kharus	Recharge dam	0.18
4	Mistal 2	Wadi Bani Kharus	Recharge dam	0.668
5	Wadi Ma'awil	Wadi Ma'awil	Recharge dam	10
6	Al-Taww	Wadi Taww	Recharge dam	5.1
7	Fulayj( Halban)	Wadi Manumah	Recharge dam	3.7



# Groundwater Levels

HYDROGRAPH OF SOME MONITORING WELLS

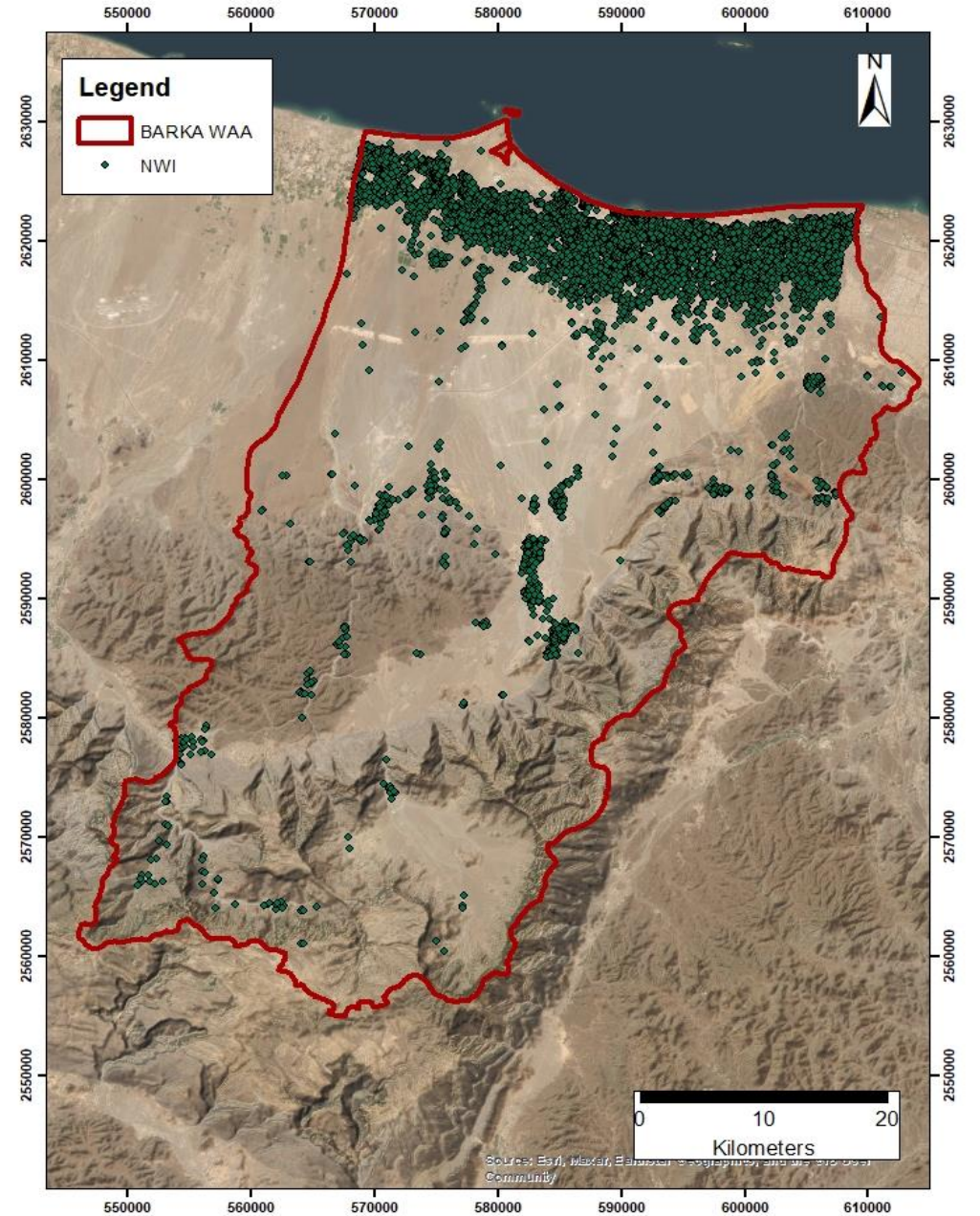


- ADG-17
- ADW-7
- BM-1
- DW-4
- F-2532
- JT-10
- JT-70
- MD-2
- MD-4
- MD-8
- NC-2
- NC-3
- NC-4
- NC-5
- NC-6
- RD-6
- RD-8
- RE-4
- RE-4P
- TD-8
- TD-11



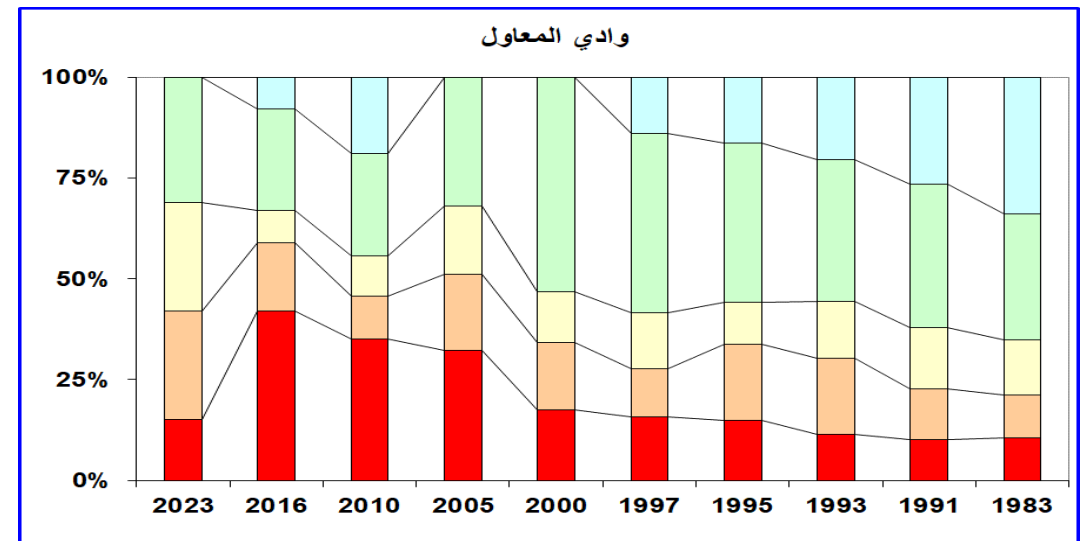
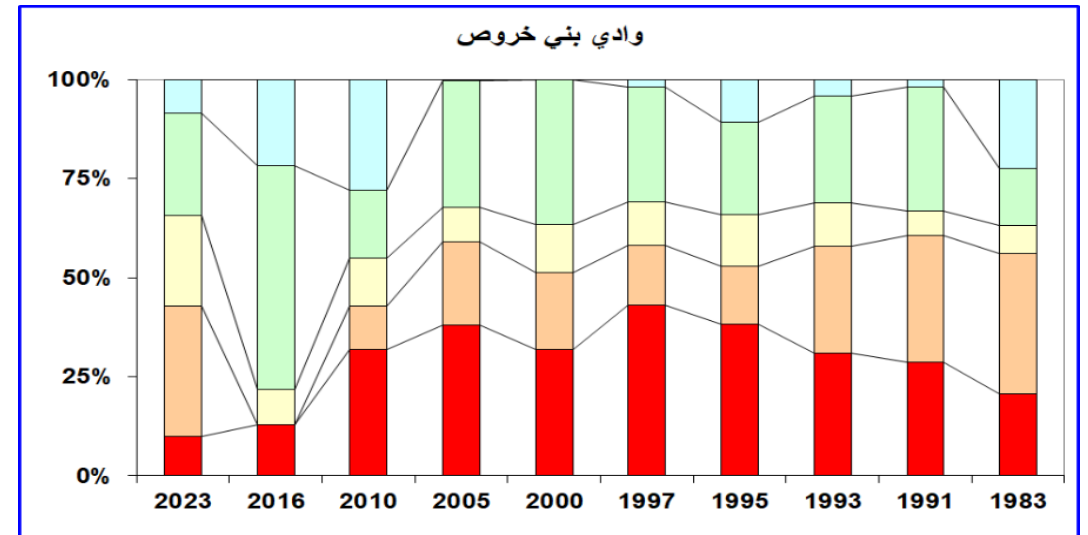
# Agriculture in South Al Batinah

- معظم المزارع في منطقة الدراسة هي مزارع صغيرة الحجم (عائلية) وتتراوح مساحتها بين أقل من 2 فدان إلى 30 فدان. معظم هذه المزارع (54%) تقع على بعد ما بين 1 إلى 5 كم فقط من البحر، و4% منها فقط تبعد عن البحر 15 كم فأكثر (الخاطري، 2018). وهذا يعني أن المزارع معرضة بدرجة كبيرة للتأثر بمشاكل الملوح.

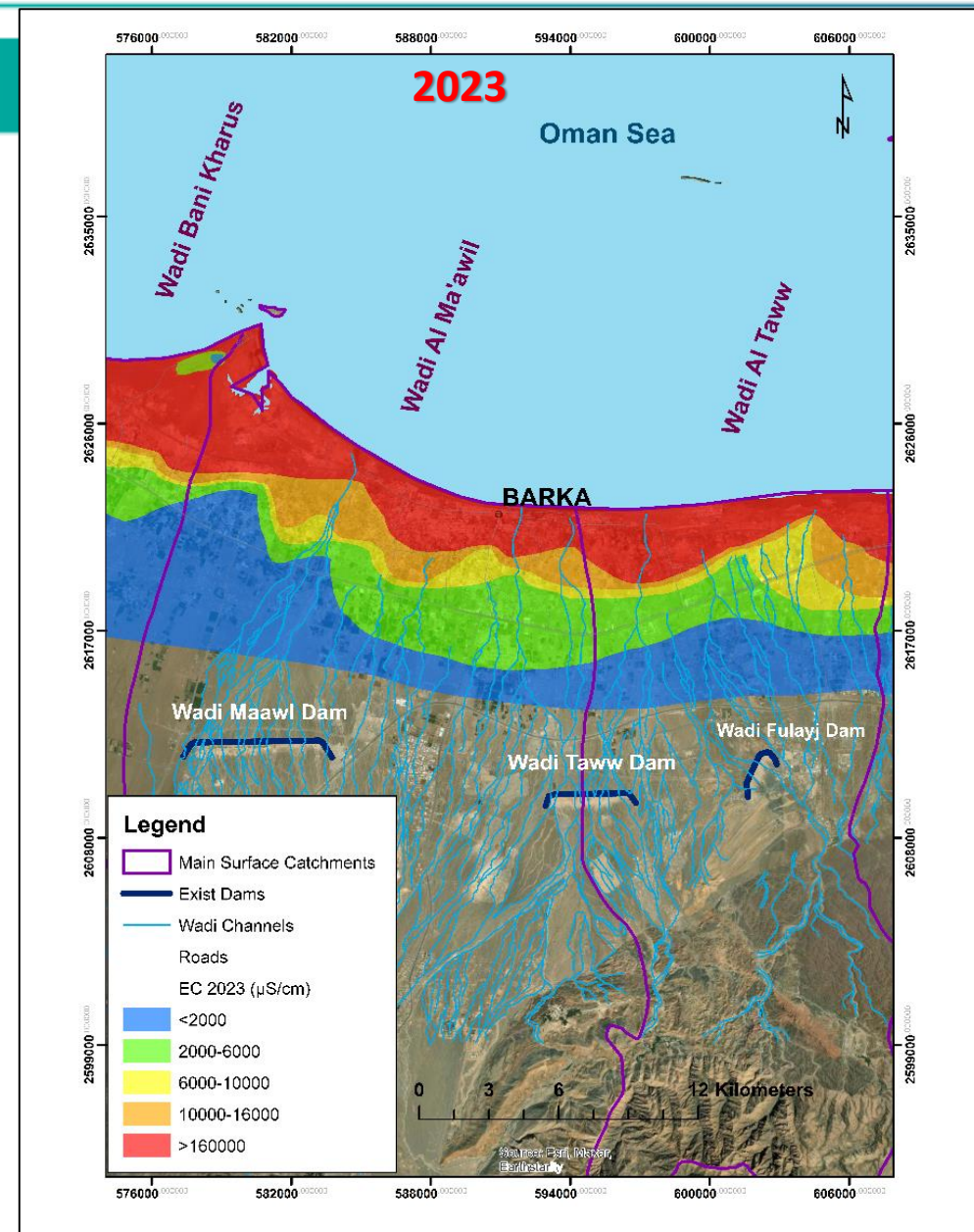
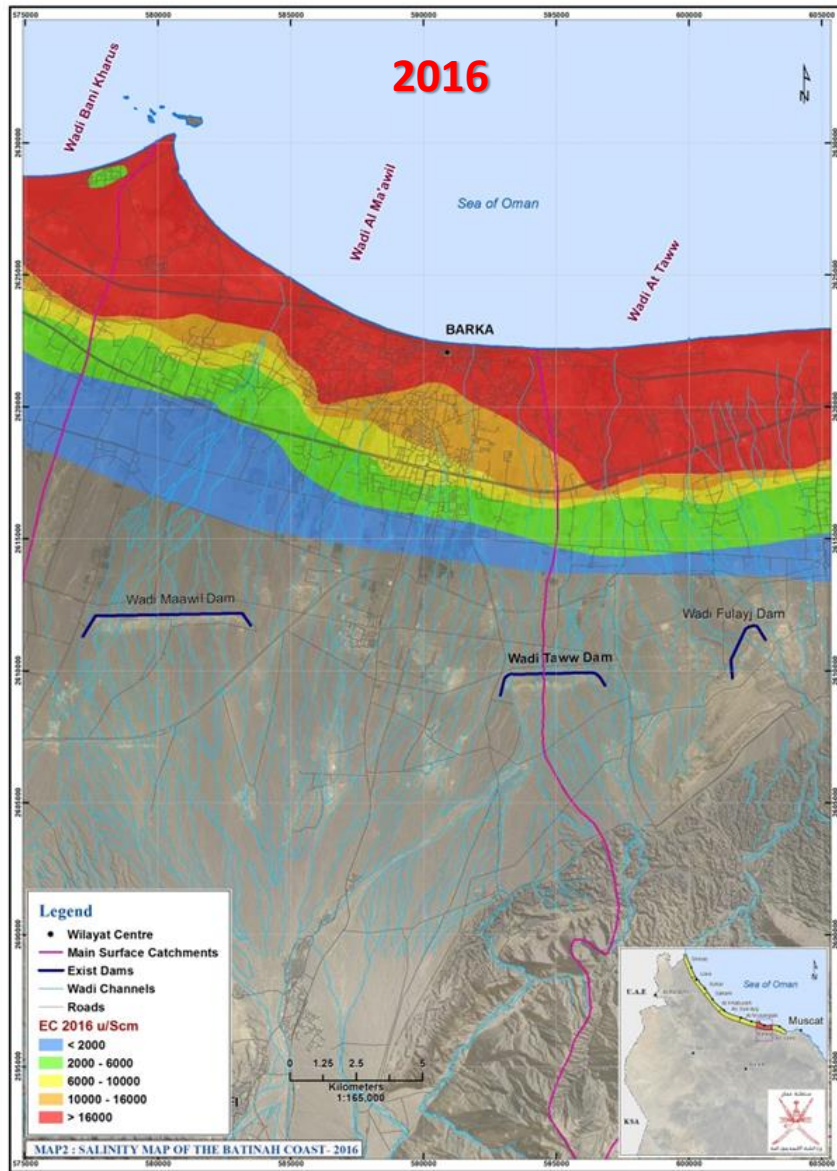


# Salinity

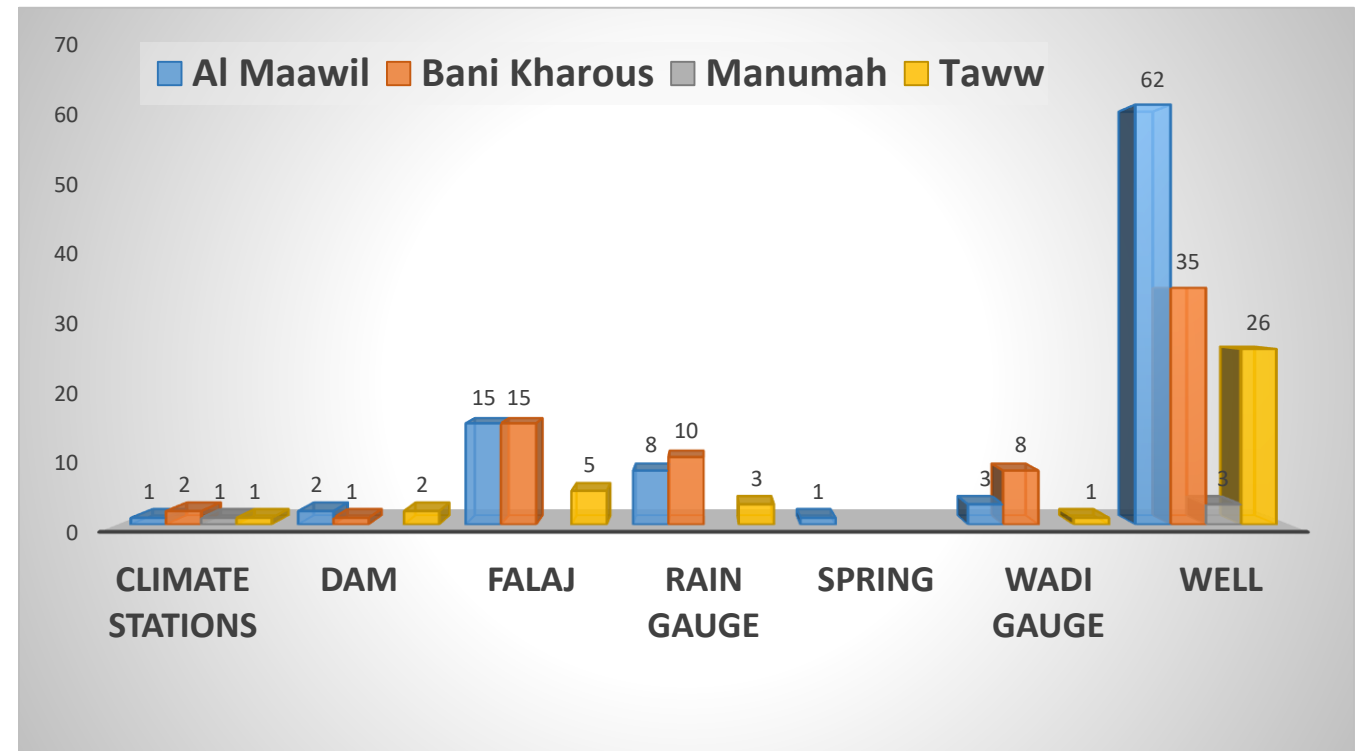
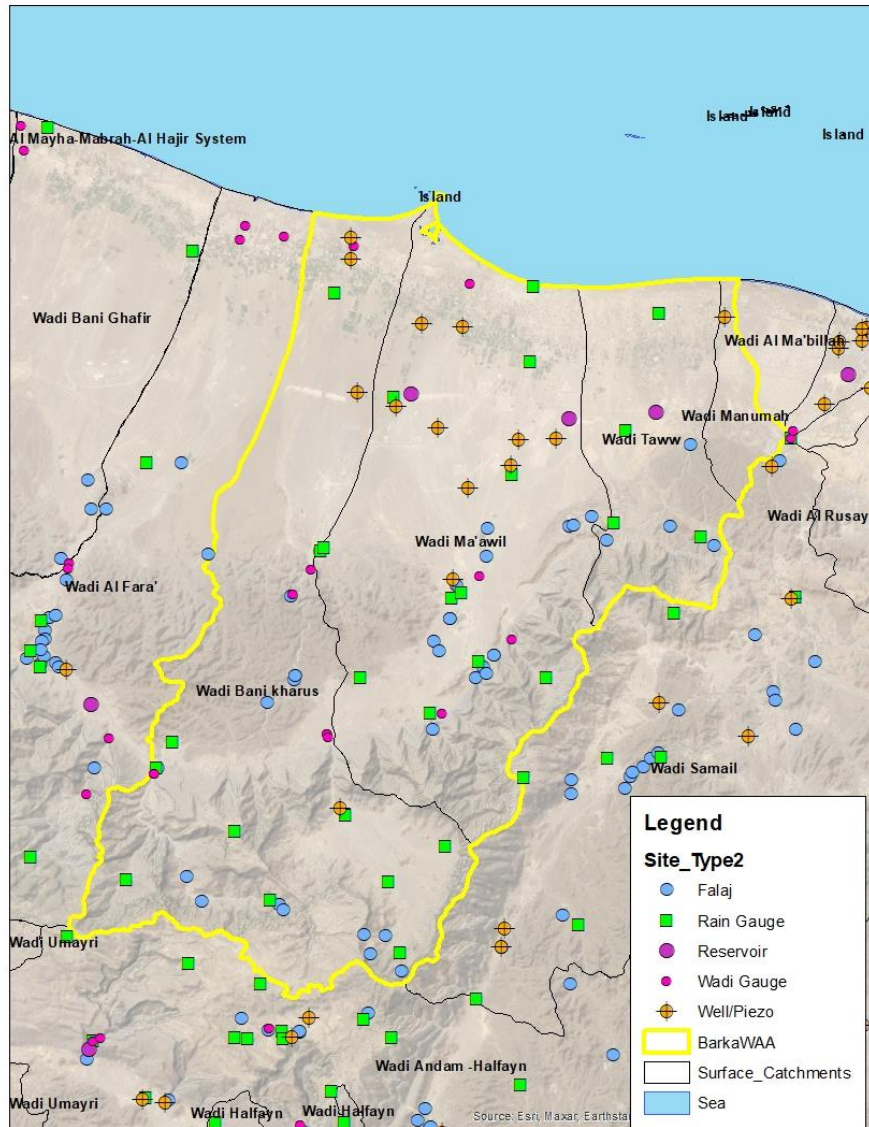
- There is a slight improvement in the Wadi Al-Ma'awal catchment, where highly salinized water (more than 16,000 microsiemens/cm) and represented in red has decreased by 27% compared to 2016. On the other hand, salty water (10,000-16,000 microsiemens/cm) and represented in orange has increased by 10% compared to In 2016.
- In Wadi Bani Kharous, water with high salinity (more than 10,000 microsiemens/cm), represented by red and orange, increased by 17% compared to 2016.







# Monitoring Network



# Thank you for listening

