Developing Flood Discharge Capacity of Kmait River

Riyadh Z. Al Zubaidy[1], Hayder A. Al Thamiry[2], Mahmoud S. Al Khafaji[3]

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Abstract

Kmait River is a flood escape that was constructed to divert water during flood season from Tigris River to Al Huwayza Marsh through AsSanna'f Marsh. Water stored in Al Huwayza Marsh is then discharged to Tigris River, through Al Kassara River, and to Shatt Al Arab River, through AsSuwayb River.

Kmait River, AsSanna'f Marsh, and Al Huwayza Marsh form one hydrological system. Therefore, the capacity of AsSanna'f Marsh and the capacity and operation schedule of Al Huwayza Marsh were taken into consideration when developing the capacity of Kmait River.

It was found, by using a one dimensional flow simulation model, that the present discharge capacity of Kmait flood escape does not exceed $80m^3$/sec, and this discharge can't be diverted completely into Al Huwayza Marsh during January and February months of a wet year unless the discharge capacity of AsSanna'f Marsh outlet is increased from its current capacity of $402m^3$/sec to $468m^3$/sec.

It was found that the contraction in last part of Kmait River is throttling the discharge. If this part is reshaped, the capacity of Kmait river will increased to $250m^3$/sec, which could be diverted into Al Huwayza Marsh if AsSanna'f Marsh outlet reshaped and its capacity increased to $569m^3$/sec.

Depending on the maximum allowable monthly inflow of Al Huwayza Marsh incase of replacing its present outlets control structures by new ones with a capacity of $500m^3$/sec, Al Huwayza Marsh will absorb floods diverted from Tigris River at design capacity of the control structure of Kmait River of $400m^3$/sec after reshaping the river cross sections and increasing the discharge capacity of AsSanna'f Marsh outlet to $744m^3$/sec.

الخلاصة

تم انشاء نهر كميت ليعمل كمهرب فيضاني يستخدم لتحويل جزء من مياه نهر دجلة في موسم الفيضان عبر هور السناف الى هور الحويزة. ومن ثم تصرف مياه هور الحويزة الى نهر دجلة عبر نهر الكسارة والى نهر شط العرب عبر نهر السويب.

يشكل نهر كميت وهور السناف وهور الحويزة منظومة هيدرولوجية واحدة. لذا تم الاخـذ بنظر الاعتبار استيعاب هور السناف واستيعاب وجدولة تشغيل هور الحويزة عند دراسة تطـوير قابلية نهر كميت لاستيعاب التصاريف الفيضانية.

وجد من خلال تشغيل نموذج تمثيل الجريان احادي البعد بان القدرة الاستيعابية لنهر كميت في وضعه الحالي في تصريف مياه الفيضات لاتتجاوز 80م^3/ثا وان هـذا التصـريف لايمكـن تحويله كاملا الى هور الحويزة خلال شهري كانون الثاني وشباط من السنة الفيضانية الا في حالة

رفع القدرة الاستيعابية الحالية لمصب هور السناف في هور الحـويزة مـن 402م^3/ثـا الـى 468م^3/ثا.

وجد بان ضيق مقاطع الجزء الاخير من نهر كميت سبب اختناق التصـريف الـى هـور السناف واذ ما تم تهذيبها يمكن رفع تصريف نهر كميت الى 250م^3/ثا ويمكن تصريف كامل هذا التصريف الى هور الحويزة خلال موسم الفيضان في حالة رفع القدرة الاستعابية لمصب هـور السناف الى 569م^3/ثا.

وباعتماد التغذية الشهرية القصوى لهور الحويزة في حالة تنفيذ منشاءات سـيطرة علـى مصبات هور الحويزة بقدرة 500م^3/ثا بدل الحالية وجد بان هنالك قابلية لهذا الهور في استيعاب كامل القدرة التصميمية لمنشاء السيطرة على ماخذ نهر كميت في تحويل 400م3/ ثا مـن ميـاه فيضان نهر دجلة بعد تهذيب مقاطع النهر وزيادة سعة مصب هور السناف الى 744م^3/ثا.

1- Introduction

Figure 1 shows Kmait River layout that was designed as a flood escape. This river, with its control structures at Tigris River, Protects Al Am'arah city, Al-Qadissya, Hour Auda, Al-Wadiya, Adel and Al-Izz River irrigation projects from flooding during flood seasons. Tigris River excess water is diverted through this river to Al Huwayza Marsh. Diverted water is stored in Al Huwayza Marsh and discharged to Tigris River through Al Kassara River and to Shatt Al Arab River through AsSuwayb River

Kmait River intake structure is located at just 5km north of Kmait Village. The design capacity of this structure is 400m^3/sec, [1]. The crest level of the escape is 8m amsl. The escape structure consists of 27 gates each has a width of 3.5m. The upstream and downstream sill levels are 8 and 6m amsl, respectively.. The total length of Kmait River from its intake to AsSanna'f marsh is 36Km. The river's flood dikes elevations vary between 10.5 and 11m amsl. No studies are available to show whether this river can discharge the design discharge of the control structure or not.

Water delivered by Kmait River is discharged into AsSanna'f Marsh and then to Al Huwayza Marsh. The minimum level of the dykes surrounding the southern part of Al Huwayza Marsh, between the marsh outlets, is 7.5m amsl. The maximum surface area of Al Huwayza Marsh is 1800km^2 with storage capacity of 5900 million cubic meters and the maximum discharge capacity of its outlet is 325m^3/sec. The maximum surface area of AsSanna'f Marsh is 360km^2 with storage capacity of 750 million m^3. The present maximum discharge capacity of its outlet is 402m^3/sec.

The minimum level of the dykes surrounding the southern part of AsSanna'f Marsh, near Al Msharah River is 9m amsl. Hydrological routing of AsSanna'f Marsh shows that the minimum level of the dykes surrounding the marsh must be11 m amsl to prevent the flood which occurs during the wet years and the maximum storage and surface area of the marsh will be 1480 million cubic meters 426Km^2, respectively [4].

In addition to Kmait River, AtTeeb River, Dwayreach River, and the surface runoff of Ashmasher area are the main feeders of AsSanna'f Marsh. Table 1 shows the monthly discharge of these feeders and that at the outlet of AsSanna'f Marsh during a wet year, and the discharge at outlet of AsSanna'f Marsh required to

normally operating Al Huwayza Marsh [3].

2- Present Capacity of Kmait River

To examine the hydraulic performance of Kmait River under various flow rates, a steady one dimensional flow routing hydraulic model was prepared using HEC-RAC software, [5], and was used to simulate the flow along Kmait River.

Fifty seven cross sections were used in the model [6]. The upstream boundary condition is a constant discharge while the downstream boundary condition is a normal depth.

Due to the nature of Kmait River, a varying Manning roughness coefficient was used along the river, starting with 0.03 and is increased to 0.045 at the end of the river. Discharge value at the upstream end was varied from 10 to 150m^3/sec to check the present capacity of this river. The resulting longitudinal water surface profiles for these discharges are shown in Figure 2. It is clear from this Figure that the maximum capacity of the river under the present condition is 80m^3/sec, otherwise the water level will exceeds the level of the river flood dykes. This limitation in the capacity of Kmait River is due to the contraction at its end, as shown in Figure 3, causing a throttling to the discharge and rising the water level.

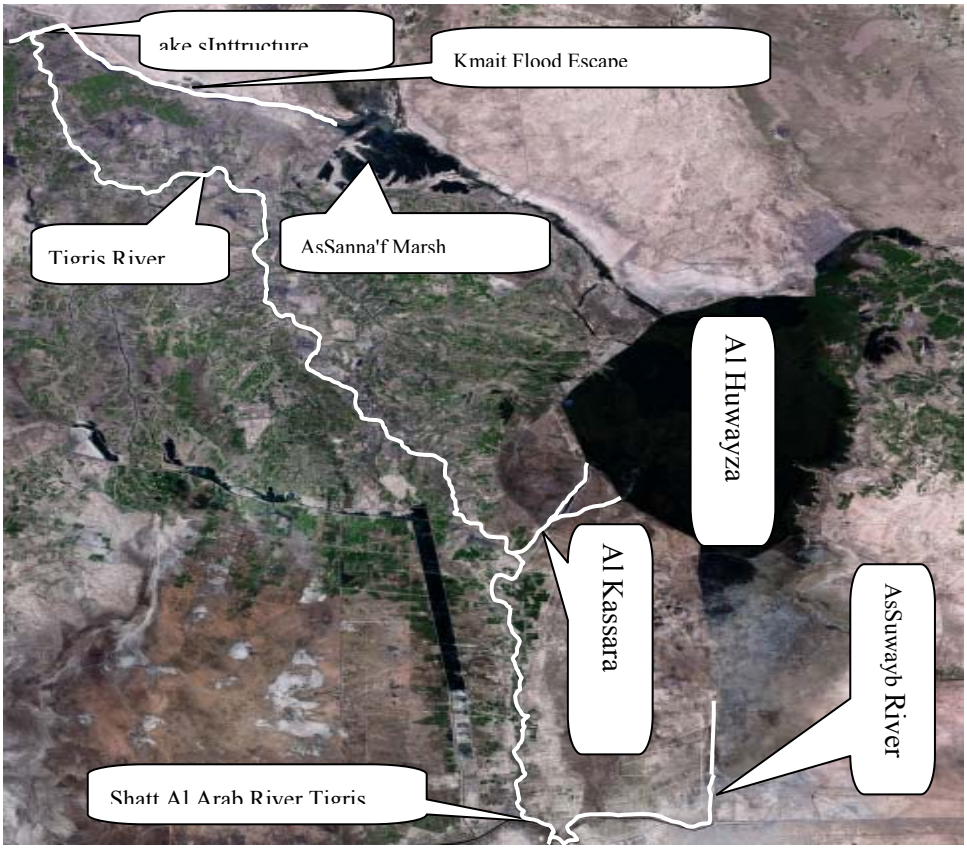


Figure 1 .Landsat Satellite Image of Kmait River and AsSanna'f and Al Huwayza Marshes.

Table 1. AsSanna'f Marsh feeders monthly discharge, in m^3/sec, during a wet year. After CRIM 2006 [4].

Month	Ashmasher Run off	Dwayreach River	AtTeeb River	Total Inflow	Total Outflow	Required Outflow[4]
Oct	0	0	1	1	0	0
Nov	0	0	1	1	0	0
Dec	0	0	1	1	0	0
Jan	154	384	293	831	388	264
Feb	68	171	100	339	367	170
Mar	0	0	2	2	240	33
Apr	0	0	2	2	103	33
May	0	0	1	1	67	8
Jun	0	0	1	1	0	6
Jul	0	0	1	1	0	0
Aug	0	0	1	1	0	0

3- Maximum Allowable Monthly inflow from Kmait Escape into Al Huwayza Marsh

Water which can be diverted from Tigris River by Kmait River into Al Huwayza Marsh thought AsSanna'f Marsh must be obtained depending on recommended inflow into Al Huwayza Marsh, [4], which is shown in Table 2, the present capacities of both AsSanna'f Marsh and Kmait River, and the possibility of modifying these capacities.

Maximum allowable monthly inflow from Kmait flood escape is limited by the maximum capacity of its inlet structure, the maximum capacity of the escape reach, the maximum capacity of

AsSanna'f Marsh outlet and the maximum allowable monthly inflow into Al Huwayza Marsh.

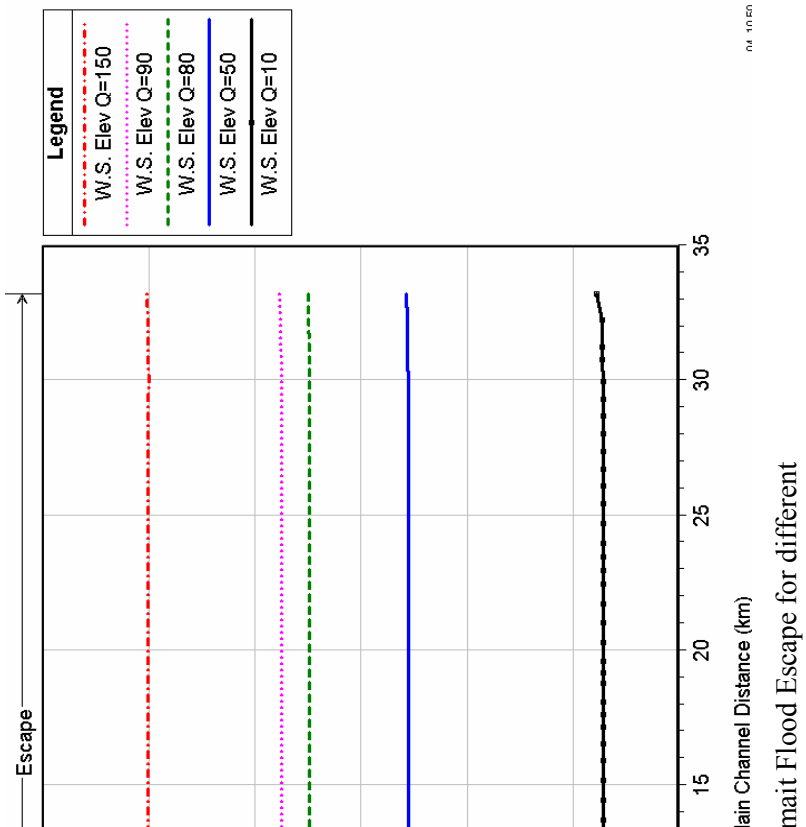
Under the present capacities of Kmait escape and AsSanna'f Marsh outlet, the maximum allowable flow at each month of a wet year of Kmait flood escape that reaches Al Huwayza Marsh through AsSanna'f Marsh were calculated and were listed in Table 3. The maximum capacity of this escape is limited by the obtained maximum capacity of $80m^3$/sec. The maximum additional allowable inflow at each month is equal to the difference between the maximum capacity of AsSanna'f Marsh outlet and the available outflow from the marsh. The Maximum flow of the escape is set equal $80m^3$/sec during the year except for January and February months. During these two months, AsSanna'f Marsh outlet capacity, of $402m^3$/sec, restrict the controllable flow from Kmait flood escape to be $14m^3$/sec and $35m^3$/sec, respectively.

To make use of Kmait flood escape maximum capacity during January and February months, which could be absorbed by Al Huwayza Marsh, the maximum capacity of AsSanna'f Marsh outlet should be developed to be $468m^3$/sec. The control structure must be operated according to the maximum allowable monthly inflows from Kmait escape, Table 3.

Table 2. Maximum Allowable and total required monthly inflow (m^3/sec) into Al Huwayza Marsh. (After CRIM 2006 [4])

Month	**Maximum Allowable inflow into Al Huwayza Marsh**	**The total required inflow into Al Huwayza Marsh**
Oct.	459	144

Nov.	528	218
Dec.	519	209
Jan.	799	494
Feb.	755	447
Mar.	751	449
Apr.	850	550
May	608	372
Jun.	311	206
Jul.	249	144
Aug.	357	132
Sep.	445	130



Kmait Flood Escape for different

hrottling at the end of Kmait River, 80 m^3/sec (Landsat Satellite Image).

Case Number	Maximum Capacity (m^3/sec)		
	Kmait Flood Escape Structure	**AsSanna'f Marsh Outlet Structure**	**Al Huwayza Marsh Outlet Structures**
Case 1	80	402	325
Case 2	80	468	325

Case 3	250	402	325
Case 4	250	569	325
Case 5	400	402	500
Case 6	400	744	500

Figure 4 .Water volumes that can be diverted to Al Huwayza Marsh

Max allowable inflow from AsSanna'f Marsh 8=5+6+7
315
310
310
[569]402 *
[569]402 *
335
333
244
105
105
225
315

Table 4. The maximum allowable inflows into Al Huwayza Marsh from Kmait Flood escape, max. Capacity 250m^3/sec, across AsSanna'f Marsh for flooded year with Al Huwayza Marsh outlet capacity is 325m^3/sec.

Month	Max. allowable inflow into Al Huwayza Marsh 1	Total required inflow Into Al Huwayza Marsh 2	Max. Allow. surplus inflow into Al Huwayza Marsh 3=1-2	Available inflow from AsSanna'f Marsh 4	Required inflow from AsSanna'f Marsh 5	Surplus inflow from AsSanna'f Marsh 6=4-5	Max. allowable inflow From Kmait escape 7=3-6 and 7+4≤402
Oct.	459	144	315	0	0	0	315 = 250
Nov.	528	218	310	0	0	0	310= 250
Dec.	519	209	310	0	0	0	310= 250
Jan.	799	494	305	388	264	124	[181]14**
Feb.	755	447	308	367	170	197	[111]35**
Mar.	751	449	302	240	33	207	95
Apr.	850	550	300	103	33	70	230
May	608	372	236	67	8	59	177
Jun.	311	206	105	0	6	-6	111
Jul.	249	144	105	0	0	0	105
Aug.	357	132	225	0	0	0	225
Sep.	445	130	315	0	0	0	315= 250

There is no flood risk, proposed maximum capacity of Kmait escape control structure is 250 m^3/sec.

* Maximum capacity of AsSanna'f Marsh outfall. ** (7+4)>402→(7)=402-(4) , for ex.181+388>402→ 402-388=14

Table 5. The maximum allowable inflows into Al Huwayza Marsh from Kmait Flood escape, max. capacity is 400m^3/sec, across AsSanna'f Marsh with Al Huwayza Marsh outlet capacity is 500m^3/sec.

Month	Max. allowable inflow into Al Huwayza Marsh 1	Total required inflow Into Al Huwayza Marsh 2	Max. Allow. surplus inflow into Al Huwayza Marsh 3=1-2	Available inflow from AsSanna'f Marsh 4	Required inflow from AsSanna'f Marsh 5	Surplus inflow from AsSanna'f Marsh 6=4-5	Max. allowable inflow From Kmait escape 7=3-6 and 7+4≤402	Max allowable inflow from AsSanna'f Marsh 8=5+6+7
Oct.	634	144	490	0	0	0	490=400	402*
Nov.	691	218	485	0	0	0	485=400	402*
Dec.	693	209	485	0	0	0	485=400	402*
Jan.	974	494	480	388	264	124	[356]14**	[744]402*
Feb.	930	447	480	367	170	197	283=35**	[744]402*
Mar.	923	449	480	240	33	207	273=126**	[744]402*
Apr.	1028	550	475	103	33	70	405=299**	[744]402*
May	784	372	411	67	8	59	352=335**	[744]402*
Jun.	486	206	286	0	6	-6	292	286
Jul.	423	144	280	0	0	0	280	280
Aug.	532	132	400	0	0	0	400	400
Sep.	620	130	490	0	0	0	400	402*

Maximum capacity of Kmait escape control structure is 400 m^3/sec

* Maximum capacity of AsSanna'f Marsh outfall. ** (7+4)>402→(7)=402-(4) , for ex.365+388>402→ 402-388=14

7- References

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