

Water Resources Authority

Lake Victoria South Basin Area

MANAGEMENT GUIDELINES FOR GAZETTEMENT OF KAJULU HILLS SUB CATCHMENT

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Draft Version



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<u>Acknowledgement</u>

<u>Acronyms</u>

- WRA Water Resources Authority
- WRUA Water Resources Users Association

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1 Introduction and Background Information

1.1 Introduction

A catchment area is defined as the land from which water naturally flows into a water course. The status and conditions of a catchment determines the reliability, quantity and quality of its water yields. A catchment area acts like a water storage facility where during the rains, the vegetation cover allows the water ample time to percolate deep down and move as a sub-surface flow to recharge the rivers, springs and ground water storage in both shallow and deep aquifers. This sub-surface flow is slow resulting in rivers from a wellmaintained catchment having higher base flows even during the dry season as well as good water yield from boreholes in the vicinity. In poorly maintained and degraded catchment, the rainfall results in the rapid surface run-off which is channelled into the river courses, resulting in flash-floods and high volumes of suspended solids. Since there is little storage in such a catchment, the rivers originating from such catchment will not be able to sustain their base flows during the dry season.

Catchment areas are thus a vital component in water resource management and they should be formally delineated, gazetted, protected from encroachment and pollution and managed sustainably to maintain their ecological integrity.

1.1.1 Legal Framework for Catchment Protection:

Because of its nature, environmental management and protection in general and catchment protection and management in particular falls within the mandate of various institutions. Catchment protection is therefore, a cross-cutting issue which is spread over several legislations, which have a bearing on the environment and/or natural resources management. These legislations include:

i). Constitution of Kenya, 2010.

Article 62(3) of the Constitution vests these categories of public land on the National Government in trust for the people of Kenya- all rivers, lakes and other water bodies, the territorial sea, the exclusive economic zone, the sea bed, the continental shelf and any land between the high and low water marks. Article 66(1) further provides that the State may regulate the use of any land, or any interest in or right over any land, in the public interest.

Additionally, Article 69 obligates the State to ensure sustainable exploitation, utilisation, management and conservation of the environment and natural resources and the equitable sharing of the accruing benefits. It is also the duty of every person to cooperate with State organs and other persons to protect and conserve the environment and ensure ecologically sustainable development and use of natural resources.

The Article 43(1) (d) of the Constitution guarantees every person the right to clean and safe water in adequate quantities. In order to ensure orderly delivery of this right, the Constitution has bestowed water resources functions to the National Government under the Fourth Schedule in trust for the people of Kenya. This is resultant from the provisions of Article 186 which classifies the functions assigned to each level of government as exclusive, concurrent or residual.

ii). Water Act 2016

Section 22 of the Act provides that where the Authority is satisfied that in order to conserve a vulnerable water resource, special measures are necessary to protect a catchment area or part thereof, it may by order published in the Gazette declare such an area to be a protected area.

The Authority is empowered to impose such requirements, and regulate or prohibit such conduct or activities, in or in relation to a protected area that the Authority may consider necessary to impose, regulate or prohibit for the protection of the area and its water resources.

Under Sections 23 of the Act, where the Authority considers it necessary that special measures are necessary for the conservation of ground water are necessary in the public interest, it may by public order published in the Gazette, declare the area to be a groundwater conservation area and impose requirements or prohibit certain activities in relation to a groundwater conservation. The Authority, in conjunction with relevant institutions and stakeholders, establish management rules or plans that shall apply to each Protected Area or Groundwater Conservation Area.

iii). Water Resources Management Rules 2007

Rule 124 and Part D of the Sixth Schedule to the Water Resources Management Rules 2007, sets out the contents of Management Plans related to a protected area to include:

- i.) Procedures to be applied for the management of the Protected Area or Groundwater Conservation Area;
- ii.) Prohibited activities;
- iii.) Any measures required to be undertaken for water resource conservation and protection;
- iv.) The timeframe for implementation of required measures;
- v.) Any other conditions that the Authority may consider relevant

Rules 116 to 120 of the Water Resources Management Rules 2007 provides for the determination of the riparian land, which as defined in Part I of these rules does not imply a change of ownership but imposes management controls on land use for water resource quality as defined in these rules.

This part deals extensively with the management of the riparian land including its management, activities that are allowed or proscribed within the riparian land.

The Authority shall undertake Public Consultation with respect to the establishment of areas to be Protected or designated as Groundwater Conservation Areas and the management rules or plans that shall apply with respect to these Areas.

1.1.2 Background information on *Kajulu Hills catchment*:

Kajulu Hills is a significant water tower within the Northern Shoreline of Lake Victoria Basin Area. Two major rivers, namely Awach Kajulu (Nyangori) and Awach Kibos emanate from the hills. The two rivers confluence to form Nyamasaria river which flows into Lake Victoria through Kisumu City. Awach Kibos river supply approximately 1,700 m3 per day of water to Kisumu City, supplementing the main Kisumu Water Works at Dunga.

Kajulu hills falls within the jurisdiction of Awach Nyang'ori Water Resources Users Association (WRUA) which was formed in the year 2015 and registered at the Attorney General Chambers the same year.

1.1.3 Rationale for Catchment Protection through Gazettement;

Kajulu Hills is a significant water tower within the Northern Shoreline of Lake Victoria Basin Area. Two major rivers, namely Awach Kajulu (Nyang'ori) and Awach Kibos emanate from the hills. The two rivers confluence to form Nyamasaria river which flows into Lake Victoria through Kisumu City. Awach Kibos river supply approximately 1,700 m3 per day of water to Kisumu City, supplementing the main Kisumu Water Works at Dunga. WRA is however concerned by the changes in land use which threatens the long-term sustainability of Awach Kajulu, Awach Kibos and Nyamasaria rivers which are a critical source of water for Kisumu town and its environs.

A management plan is therefore critical for the conservation and protection of Kajulu Hills catchment area. This will tackle poor land use practices and restoration of the destroyed catchment area. The management plan will include a catchment investment plan for the sustainable management of the water resources.

LVSBA's CMS (2014 - 2022) recognised the need to protect the water catchment and increase its environmental functions. This is anticipated to be achieved through the implementation of the following strategies:

- Sensitization of the local community and stakeholders on the need to protect the catchment (water tower) to ensure environmental sustainability;
- Development of an action plan to protect the catchment and their rehabilitation;
- Participatory mapping of the protection zones around the water tower with the community;
- Apply the law to protect wetland (enforcement for catchment and riparian protection);

In addition, Part XI of WRM Rules 2007, Rules 123 - 125 sets out the process and procedure for, the identification of an area as a protected or groundwater conservation area. This is the procedure used in coming up with this Gazettement document for the Kajulu Hills Sub Catchment.

1.2 Location and size of area to be gazetted

The area identified for Gazettement is spread within Wathorego and Kadero sub locations of West Kajulu and East Kajulu locations of Kisumu County. The area is located 9 km to the east of Kisumu City. The sub catchment covers an area of 5.5 km² and is within the 1HA-sub basin of Lake Victoria South Basin Area.

1.2.1 Watershed area;

Kajulu Hills is partly fed by rainfall, sub-surface flow and occasionally receives water from Lake Victoria South River during flood flows. The area of the hills that contributes surface run-off into the rivers has been delineated through the use of a GIS software. The area measures 5.5 square kilometres out of the 858 km2 catchment area of the whole 1HA sub basin as shown in Fig 1 below



Fig.2. Location of Kajulu Hills sub catchment within 1HA sub basin

1.2.2 Physiography, climate and rainfall;

a) Physiography

Kajulu hills constitutes the raised area to the east of Kisumu City, rising approximately 1431 m.a.s.l from the elevation of 1156 m.a.s.l around Kisumu City, a distance of 9 kilometres from the City. the slope ranges from a low of 0.2% near the City but increasing to 5.7% near the hills, and giving an average slope of 1.7% between the City and the top of the hill.

b) Climate

The climate around Kajulu hills area is tropical with significant amount of rainfall during the year. This climate is classified as Af according to the Köppen-Geiger climate classification. The average temperature around Kajulu hills is 22.2 °C with February having the highest mean temperature of 23.9oC and June having the lowest mean temperature of 21.2°C.

The table and figure below show the monthly average temperatures around Kajulu hills: Mean Temperatures and Sunshine Hours around Kajulu Hills

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	22.9	23.9	23.2	21.8	21.3	21.2	21.4	21.7	22.3	22.2	21.8	22.1
Min.	16.6	17.3	17.2	16.8	16.3	16.1	16.2	16.3	16.5	16.8	16.5	16.4
Max.	29.6	31.1	29.8	27.4	26.6	26.4	26.5	27.2	28.2	28.1	27.7	28.2
Av Sun hours	10.3	10.4	9.9	9.4	9.5	9.7	9.7	9.9	10.1	9.9	9.7	10



Mean Temperatures and Sunshine Hours around Kajulu Hills

c) Rainfall

The presence of the elevated land mass and the Lake Victoria water body results in high rainfall. The rainfall pattern in the area is bi-modal with 2 major peaks in April and November with continental rains in between the peaks and with no absolute dry period in between. MAM rainfall accounts for 37% of the annual precipitation with OND rainfall accounting for 33% of the annual precipitation of 1724 mm. The balance is accounted for by the continental rains in between the 2 major rainy seasons.

The driest month is February with a mean precipitation of 75 mm while the wettest if April with a precipitation of 272 mm.

The month with the highest relative humidity is May (73%). The month with the lowest relative humidity is February (48%). This is consistent with moisture availability with February, being the driest, having the lowest moisture availability while due to the rains in April/May, the moisture availability is highest in May. The table and figure below shows the mean monthly rainfall and humidity around Kajulu hills:

Mean monthly rainfall and humidity around Kajulu hills

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Rainfall	96	75	165	272	198	91	80	86	96	176	228	161	1724
Humidity	55%	48%	58%	72%	73%	68%	63%	62%	60%	64%	66%	61%	63%



Mean monthly rainfall and humidity around Kajulu hills

2 Current Situation Analysis

2.1 The vulnerability of the water resource

Kajulu Hills Sub-Catchment falls under sub basin 1HA which is drained by Awach Kibos and Awash rivers in the upper reaches and which confluences further downstream to form the Nyamasaria River. Nyamasaria river drains into Lake Victoria at the Winam Gulf and is also a source of water for Kisumu Town.

The encroachment and human activities within the Kajulu hills catchment land through cultivation, clearing of indigenous vegetation and the planting of exotic tree species has resulted into reduced recharge into the ground, lowering of the water table and a decrease in the discharge of the rivers.

In order to have a clear understanding of the surface water resources availability in the Kajulu hills catchment, the available data has been used and collated with the existing daily discharge data. Nyamasaria river is gauged at RGS 1HA15 located at the confluence of Awach Kajulu (Nyangori) and Awach Kibos rivers (coordinates N00.047, E034.804) while Awach Kajulu (Nyangori) is gauged at RGS 1HA14 located at coordinates (N00.067, E034.814) 2.6 kilometres upstream of RGS 1HA15. The catchment area upstream of the 1HA14 station is 104 km2 and the station has been used to develop surface water availability scenario for the Nyamasaria river.

The table below shows the flow duration analysis for Awach Kajulu (Nyang'ori) river at RGS 1HA14

		Allocation	Allocated	Balance
Q95	Reserve	13,738	0	13,738
Q80	Normal Flow	21,946		21,946
Q50	Flood Flow	38,794		38,794

 Table.1.
 Surface water availability for Nyamasaria river

Mean	6.265
Standard deviation	14.215

Probability of non-exceedance	Probability of exceedance	Flow	Flow	Available for allocation	Days	Total volume	Volume per year
%	%	m ³ /s	m ³ /day	m ³ /s	nos	Million m ³	Million m ³
99%	1%	8.187	707,322		3.65	2.58	218.1
95%	5%	4.243	366,595		18.25	6.69	215.5
90%	10%	2.958	255,571		36.50	9.33	208.8
85%	15%	2.241	193,622		54.75	10.60	199.5
80%	20%	1.841	159,062		73.00	11.61	188.9
75%	25%	1.610	139,104		91.25	12.69	177.3

70%	30%	1.395	120,528		109.50	13.20	164.6
65%	35%	1.230	106,229		127.75	13.57	151.4
60%	40%	1.086	93,830		146.00	13.70	137.8
55%	45%	0.971	83,894		164.25	13.78	124.1
50%	50%	0.862	74,477	38,794	182.50	13.59	110.3
45%	55%	0.759	65,578		200.75	13.16	96.8
40%	60%	0.710	61,344		219.00	13.43	83.6
35%	65%	0.617	53,309		237.25	12.65	70.2
30%	70%	0.571	49,334		255.50	12.60	57.5
25%	75%	0.490	42,336		273.75	11.59	44.9
20%	80%	0.413	35,683	21,946	292.00	10.42	33.3
15%	85%	0.332	28,685		310.25	8.90	22.9
10%	90%	0.247	21,341		328.50	7.01	14.0
5%	95%	0.159	13,738	0.000	346.75	4.76	7.0
1%	99%	0.071	6,134		361.35	2.22	2.2



3 Current Situation Analysis

3.1 The vulnerability of the water resource

Kajulu Hills is an important water tower that is a source of several rivers that drain into Lake Victoria through river Nyamasaria. The hill is not protected and due to its rich soils with readily available water resources, it has attracted human activities that include cultivation, harvesting of trees for charcoal/woodfuel as well as human settlement. This unsustainable approach to the water resources abstraction and catchment management is threatening the survival of the rivers emanating from the hills.

3.2 The water resource quality objectives and the current status of the water resource

Section 20 of the Water Act, 2016 requires the Authority to prescribe the criteria for classifying water resources for the purposes of determining water resources quality objectives for each class of water resource.

The Resource Quality Objectives represent the desired status of the resource, covering all aspects of quantity, quality, timing and aquatic biota. The RQOs are different for different classes of water resource. The objectives generally relate to the extent to which the water body is allowed to be adversely impacted by water use with respect to its natural state. Conceptually the RQOs provide a "target" condition of the resources. Management decisions should be made such that the condition of the resource is progressively trending towards the RQO. The status of the resource is a measure of how far the condition of the resource is from the RQO. Initially, RQOs shall be determined at the nodes where the Reserve flows are being determined.

The minimum number of parameters that are monitored are 7. The Regional office has initiated the water quality monitoring where the following parameters are being monitored at specific nodes (points) along the rivers:

- Electrical conductivity;
- Turbidity;
- Total suspended solids;
- Dissolved Oxygen;
- Total Nitrogen;
- Total Phosphorus

3.3 The class of the water resource

The Kajulu Hills sub-catchment can be classified as "Alarm" as the available water is at not of adequate quality to meet the demand. The Kajulu Hills aquifer is at the risk of pollution due encroachment of the catchment area and threat of salt water intrusion.

3.4 Land uses and their potential impact on the water resources

The area around Kajulu hills is predominantly rural settlement with the main land use being cultivation and rearing of livestock.

The potential impacts on the water resources as a result of human acts includes:

- a. **Encroachment:** People have encroached water catchment areas in the upper parts of the catchment;
- b. **Overexploitation of available resources:** The population in the area has been rapidly growing over the years. This leads to excessive pressure on available natural resources that includes water resources leading to potential water use conflicts;
- c. **Soil Erosion:** Following uncontrolled farming and other human activities, soil erosion leads to siltation and loss of top soil cover;
- d. **Deforestation:** The forest cover around the Lake, the immediate catchment areas as well as the wider catchment has been depleted due human activities. Forests have been cleared to give way for farmlands, settlements as well as charcoal burning and timber.
- e. **Water Pollution:** Due to excessive economic activities around the Lake, the water has been polluted. Fishermen do not have sanitation facilities within the Lake leading to open defecation. The farms in the surrounding area use agro-chemicals which eventually find their way into the Lake and leading to pollution. Other pollutants include solid waste that is washed into the rivers by runoff water during rains.

4 Measures for Protection, Conservation and Rehabilitation of the area

Land within and around the Kajulu Hills sub catchment River is legally owned by Government, local communities and individuals and this in some instances limits the scope of conservation regimes that can be applied to the whole basin.

In order to ensure the protection and conservation of Kajulu hills is achieved and sustained, several measures and strategies will be applied. These includes the following:

4.1 Proscribed Activities;

According to the applicable legal framework as discussed in Sub-Section 1.1.1 above, protected areas can be used in a sustainable manner. The activities to be undertaken within the protected area are those with zero impact on its ecological status and integrity. The following activities are specifically proscribed in a protected area:

- *i*). Tillage or cultivation
- ii). Clearing of indigenous trees or vegetation
- iii). Building of permanent structures (especially boreholes and houses)
- iv). Disposal of any form of waste
- v). Excavation of soil or development of quarries
- vi). Planting of exotic species that may have adverse effect to the water resource

4.2 Catchment Protection Plan

The objective of the protection plan is to protect Kajulu Hills catchment by encouraging activities that enhance both water quality and quantity while discouraging activities that cause the catchment degradation and promoting beneficial land and water management practices.

Actions

- Sensitization on catchment management
- Revegetation of the catchment area
 - o Indigenous and water friendly Plant Propagation
 - Exotic species control
- Water storage enhancement to ease pressure on use of rivers water
 - Rain water harvesting tanks
 - Water pans
- Regulating activities that may lead to pollution and destruction of the eco-system (Charcoal burning, grazing, cultivation)
- Controlling abstraction limits and observing of safe yields
- Controlling encroachment and cancellation of illegal titles

Activity	Sub-activity	Timeframe	Cost (Ksh)	Responsibility
Gazettement of Kajulu Hills Catchment as	Delineate & survey the lake's catchment area.	2022	800,000	WRA, WRUA, Kisumu County Lands & Survey Team
a protected area	Develop the Part Development Plan for the lake catchment	2022	500,000	WRA, Physical Planning Dept., CGK
	Create awareness on the status of the hill's catchment area.	Continuous	500,000	WRA, , WRUA, NEMA, CGK,
	Develop guidelines and conservation/protection plan through stakeholders' engagement	2021	5,000,000	WRA with all stakeholders
	Submit gazettement instrument to the AG	2021	100,000	WRA

Enforcement of Kajulu Hills catchment management guidelines and other legislations	Enforce Kajulu Hills catchment guidelines, management plan and relevant legislations	continuous	5,000,000	WRA, County, Govt, NEMA, KWS.
Re-vegetation of the	Establish indigenous vegetation Propagation	Continuous	3,000,000	WRUA, WRA, KFS
catchment area	Grow live fence on the boundary of the catchment.	Continuous	3,000,000	WRA, KFS, WRUA
	Planting and growing of propagated seedlings (Watering and tending)	Continuous	5,000,000	WRUA
	Exotic species control	Continuous	500,000	WRUA
Restricting activities that	Public awareness creation	Annually	1,000,000	WRA, CGK, KFS, WRUA.
may lead to pollution and destruction of the catchment.	Controls/restrictions on charcoal burning, grazing, bathing and farming near sensitive areas.	Continuous	300,000	WRA, CGK, KFS, WRUA.
	Enforcement	Quarterly	500,000	NGAO, WRA, KFS, NEMA, WRUA.
Alternative livelihood activities	Promote bee keeping, poultry farming and butterfly keeping, eco- tourism.	Continuous	10,000,000	WRA, WRUA, Agriculture and Livestock
TOTAL			35,200,000	

4.3 Conservation Plan

The objective of the conservation plan is to protect the long-term environmental sustainability of the catchment for enhanced water resources yield and maintain its ecological functions in terms of flora and fauna.

In the development of the management programmes, care has been taken to ensure that there are explicit and logical links between the vision statement, management objectives, and the management strategies to achieve the objectives. Each management programme is discussed in further detail in the following sections:

Goals

The overall goals of the management are to:

- a) Ensure sustainable management and use of water resources within the sub catchment while promoting equitable sharing of water resources
- b) Ensure the conservation of the catchment areas to improve on the water quantity and quality

Objectives

- i). To enhance implementation of existing regulations to protect the rights of all users
- ii). To promote water, use efficiency that is hydrologically and economically beneficial to domestic, agricultural, and industrial water users and the environment.
- iii). To identify funding sources to implement water conservation programs that help to enhance water resources

Activity	Sub-activity	Timeframe	Cost	Responsibility
Establish the water balance	Assess demand and availability	2021	1,000,000	WRA, County Government, WRUA, KWS
Develop water allocation plan for	Develop Water allocation Plan	2021	2,000,000	WRUA, WRA, KWS, County Government,
the Kajulu Hills	Implement water allocation plan	continuous	5,000,000	WRA, WRUA, NEMA, County Government
	Enforce permit conditions	continuous	5,000,000	WRA, WRUA,
Enhance Water use efficiency (introduction of technologies)	Sensitization and model water use units – irrigation, domestic Demonstration on efficient water use technology	Continuous	8,000,000	WRA, WRUA, County Government
	Total		21,000,000	

4.4 Catchment Monitoring Plan

The objective of the monitoring plan is to collect water resources data and maintain a comprehensive database on the Kajulu hills that provides information on water levels and quality of the spring's water.

Actions

- Establish a water quality and pollution control plan.
- Water sampling and analysis
- Establish a water resources database

Action	Sub Activities	Time frame	Costs	Responsible
Water sampling and analysis	Collect water resources samples and conduct analysis for biological and physico-chemical parameters	Quarterly	500,000	WRA
Capacity Building	Capacity building on data collection and monitoring	Continuous	500,000	Stakeholders and WRA
Water resources monitoring	Install water level gauges	1 year	2,500,000	WRA, WRUA
Total			3,500,000	

4.5 Establishment and operationalization of management structure

The objective of the management structure is to ensure that the Kajulu Hills catchment protected area is managed in a sustainable manner with the involvement of all stakeholders under the leadership and coordination of WRA - LVSBA. This will be achieved through:

- Setting up the management structure with defined ToRs and mandates;
- Development of resources mobilization strategies to raise funds for operations, maintenance and conservation of the protected areas;

Activity	Sub-activity	Timeframe	Cost	Responsibilit
				y
Setting up the management structure	 Appoint 1No. Member from each of the following stakeholders: 1. Kenya Forest Service 2. National Environment Mgt Authority 	3 months	0	WRA

	 National Government Administration in Kisumu County; Kenya Wildlife Service; Ministry of Agriculture; Kajulu Hills WRUA; 			
	 Terms of References (ToR) will include but not limited to: To manage the catchment prudently on behalf of other stakeholders To submit quarterly reports to WRA - LVSBA on all planned and implemented activities; 	Continuous	0	WRA, WRUA
	 To develop by - laws and submit a copy to WRA – LVSBA for approval before implementation 			
Develop and implement resources mobilization strategies	 Mandate and responsibilities: Promote the conservation and protection of the catchment Promote equitable distribution of the resources within the catchment Promote socio-economic and environmental sustainability of the catchment 	Continuous	0	Management Committee
	The sources of funds for the committee may include: • Bee keeping • Tree Nursery; • Eco-tourism; • Well-wishers/Donors • WRA/WRUA - (WDC)	Continuous	5,000,000	WRA
Sub Total		1	5,250,000	

WRA as the agent of the National Government in the regulation of use and management of water resources, will be the Coordinator of the committee. The members appointed to the Management Committee will serve on honorary basis as this will be a non-profit, non-

commercial venture. The Committee will be required to solicit for funding from wellwishers and other sources to supplement the income that may be derived from activities permitted in a protected area.

The following are the proposed linkages between various stakeholders. The arrows indicate the direction of flow of information. The dotted lines indicate WRUA can also communicate directly to communities and vice versa.

4.6 Catchment and Water Resources Monitoring

The objective of the monitoring plan is to collect and analyse Kajulu Hills catchment and water resources data to provide information on water discharge, water quality and catchment health as a response to human activities within the neighbourhood. This will be achieved through:

The following are the proposed linkages between various stakeholders. The arrows indicate the direction of flow of information. The dotted lines indicate WRUA can also communicate directly to communities and vice versa.



Fig.3. Reporting Linkages for the Management Committee

5 Monitoring and Evaluation Matrix

The following matrix will be used for Monitoring and Evaluation to capture detail of the progress of implementation of the planned activities.

Table.2.Monitoring and Evaluation template	
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Activities	Implementation Schedule		Status (% completio	Planne d Cost	Total expendi	Source of	Outp	Comments
	Start date	End date	n)	Ksh.	ture to date	funds	ut	