Possessing significant ecological and landscape values, river shorelines are regarded as a region’s most important interface to resist natural disasters while they are also extremely dynamic and sensitive. Therefore, it is critical to follow the laws of nature in design and planning of river shorelines to achieve the harmonious coexistence of human and nature free of flood catastrophes.

This article takes the S River Park on the Living Shoreline of the Rule Lake New Town, Ganjiang New District, Jiangxi Province as an example of nature-based design approach: First, by examining remote sensing maps and water level data in different historical periods of the site, the design team learnt the evolving hydrological characteristics of the river; Second, the relations between the river’s evolution and major human interventions in history are clarified and sorted; Last but not the least, guided by the nature laws of water erosion and sedimentation, a nature-based design solution was approached—By catalyzing natural processes with appropriate human interventions, it aims at rehabilitating the damaged sandbar habitats through spontaneous remediation of the river, and creating fascinating riverfront experience out of a rational function zoning of the park based on various natural conditions, thus to make the new town more vibrant and resilient by connecting it with the seasonal waterfront landscape driven by the ebb and flow of the river.

KEYWORDS
Nature-Based Solution; River Evolution; Shoreline; Ecological Restoration; Habitat Rehabilitation; Urban Resilience
2 现状问题与设计目标

水位变化、水沙运动、河道整治和开发行为共同塑造了赣江中下游河段的现状形态，而沿线城市的发展脉络则蕴含着城市与赣江、人与水岸未来的对话方式。因此，设计团队通过系统分析河流形态的演变历史以及人工治理和经济活动对河道的影响，厘清了场地的主要问题及其影响因素，以为后续设计提供理论基础和策略指引。

2.1 河流演变过程分析

通过场地踏勘和区域地理资料查阅，设计团队发现，赣江尾闾河段在1989年以前受人工干预影响较小，其形态主要受鄱阳湖区三角洲沉积作用影响，水流流速较缓，岸基地貌松散，凹岸流速快，易受冲刷形成深槽；凸岸流速慢，水流中的泥沙逐渐沉淀产生淤积，形成边滩[4][5]，河道整体呈蜿蜒的“S”形，这一形态在整个赣江中下游流域极为典型。然而，近几十年来人类对赣江的几次重要干预已使其趋于直线，特色河流地貌逐渐消失。对此，设计团队通过不同历史时期的河流卫星遥感影像资料分析了河床地形的演变过程，以及不同水位下水岸边界的变迁，以此对未来场地和水岸的关系提出设想。

根据Landsat-5 TM卫星影像，以赣江南昌外洲水文站水位（16.5m）为基准，可知场地水岸线在1991~2001年间变化并不明显，河流地貌在凸岸处为与河岸平行的弧形自然边滩；2001~2009年期间，水岸线向下游推移，凸岸的边缘演化出了一个江心洲[9]（图4）。

通过对比该河段1996~2019年间若干枯水期的Landsat-7 ETM+和Landsat-8的卫星影像可见，2010年以后，水岸线向下游退越发明显，边滩和江心洲逐渐萎缩[7]；由2019年低水位时期卫星图可见，江心洲迎水面几乎已被侵蚀殆尽（图5）。

根据文献资料，1965~2015年间，赣江年最高水位变化范围为18.45~25.60m，年最低水位变化范围为11.50~17.17m，平均水位变化范围为14.83~19.63m，年际水位变幅最大值为14.10m（图6）。历年年均水位呈现下降趋势，且在1998~2011年间下降最为明显[8]。结合河流形
态演变分析可知，随着场地附近的河流边滩逐步萎缩，赣江水位也在逐年下降。

2.2 人工干预河流事件梳理

随后，为了更深刻地理解上述演变的成因，找出场地内需要解决的关键问题，设计团队深入调研了过去20余年间主要的人工干预河流事件，并对其与河流水文特征演变的时间对应关系进行了梳理（图7）。

1989年之前，人工干预对河流影响较小；1990年万安水利枢纽截流后，赣江下游泥沙量减少，河水冲刷力增强，导致河床严重下切；到2000年，这一影响已扩大至南昌市附近[6]；2001年后，赣江河道盗采砂现象严重，特别是场地附近的乐化镇瓜洲村沿岸沙洲遭到滥采，沙洲最宽处由1990年的约990m缩减至2019年的约310m。萎缩的自然边滩不仅导致河流生态系统被破坏，也使河岸更易坍塌，防洪堤坝的稳固性亦受到威胁[9]。2011年后，大规模的盗采砂现象才得到一定遏制[6]。

2012年，由于原本的瓜洲联圩防洪堤坝（下文简称“瓜洲堤”）不能满足防洪需求，当地水利部门将其进行了加高和加固，以缓解江水对圩堤的冲击[10]。重修后的瓜洲堤顶宽24m，设计标高为24.0m，防洪等级由5~8年一遇提高至50年一遇，其安全性虽然得以提高，但景观效果生硬，缺乏变化，更破坏了周边的生物栖息地；不透水的混凝土护岸切断了水陆生态之间的诸多互动，加快了水流下泄速度，使河道和流域的保水、滞水能力降低[11]。

总体而言，在近30年来的一系列人工干预的影响下，场地内河段边滩的表径流增加，与采砂坑连通为新的流槽，质地松散的河岸沉积物遭到侵蚀，原本稳定的S形凹岸逐渐破碎、瓦解，乃至消失。

值得一提的是，在瓜洲堤固坝工程同期，凸岸弯道处新建了一座长约300m的临时性丁坝，以保障水利工程顺利实施。丁坝主要被用于改变所在河段的流场分布和河床形态，以便进行航道管理，也可改变其周围水生生物分布格局。倘若布置得当，回流区可对主流区的生境损失进行一定程度的补偿[12]。卫星图显示，2012年丁坝筑成后，坝后回流区逐渐恢复河漫滩形态。这一发现也使设计师重新思考了丁坝的意义，并试图在沿江公园设计中使其发挥更大的生态和景观价值。

2.3 设计目标：恢复独特的“S”形河流地貌

综上，使河流恢复S形自然地貌成为此次设计的核心目标，其关键点在于：1）通过生态技术和符合河流地貌自然发育规律的整地策略对新增的坑塘流槽进行管理，以减缓、遏制侵蚀过程；2）利用河水自然
3. Management projects and development activities along the Ganjiang River

4. Historical evolution of the shoreline morphology, cross section, and thalweg of the Ganjiang River

(Source: Ref. [5][6])
冲淤作用，恢复边滩和江心洲等S形河流地貌单元；3）打破原有防洪堤的平行线式断面设计，并在满足防洪需要的前提下提升河岸生态效益和景观品质。

3 基于自然的解决方案：赣江“S湾”活水岸公园

设计将沿江公园命名为“‘S湾’活水岸公园”，以突出标志性的S形河流地貌，并将自然的力量作为公园规划的核心驱动力，运用自然法则提高水岸和城市对抗自然灾害的韧性，使之与动态变化中的河流同生共存（图8）。

3.1 顺应自然的整地策略

设计团队根据河流地形及其演变规律的分析结果，确定河岸和植被保护范围，进而结合场地自然条件和儒乐湖新城规划，分析公园不同区块的开发适宜度及强度，并得出公园的整地策略和实施步骤；

1）首先，根据历史河道地形图，模拟不同水位下的边滩边界，确定防洪堤外受损边滩的修复范围。并增设符合生态学原理的新型丁坝群，以利用河流自然发育规律整合现状破碎坑塘，建立弧形条状沙洲，稳固沙洲间不同高程的流路河槽，促进边滩自我修复，从而恢复河流自然蜿蜒的形态及生态群落，创造具有景观美学价值的水岸空间；

2）其次，在防洪堤内保留瓜洲村现状湿地水塘系统和周边植被，建立雨水花园等绿色生态基础设施，并塑造微地形，引导地表径流进入，实施雨水净化，并补给地下水；

3）最后，消化堤坝与滨江交界道路规划标高之间的高差，增加水岸岸线形式的多样性，并对河岸景观及其空间功能随赣江水位变化而变化的情况进行模拟（图9）。

3.2 从人工堤坝到“有生命的堤岸”

河流堤坝是重要的水陆过渡地带，其生态性对于河道生态系统非常重要。打破防洪堤单一的平行线式断面设计，软化人工堤基，重建有生命的堤岸是项目的设计目标之一，也是延缓流槽侵蚀、修复受损滩地的重要保障。

在岸线材料的选择上，设计团队运用多孔隙的自然材料创造可渗透的多样化水陆交界面，并根据不同区段河水冲刷力的强弱选择不同的堤岸抗侵蚀材料，例如净水石笼砌块、椰棕纤维生态垫、柳条和沉水木桩、挺水植物种植笼等，使形成流速不同的水环境，保护滩体免遭侵蚀，并将不透水的硬质人工堤坝转变为可供生物栖息和繁衍的自然堤岸，以提高河流景观质量，满足亲水需求（图10）。

在岸线横剖面的设计上，根据堤坝与河流之间的不同高差，通过地形缓坡、植栽退台、石笼阶梯等形式打破防洪堤单一、生硬的边界，实现从城市建成区到水岸的自然过渡，同时保证满足50年一遇的防洪需求（图11）。

在防洪大堤的断面设计中，设计充分利用堤顶的高程优势，打造视野开阔的城市滨江慢行绿道；通过增层布设快行和慢行廊道，提供自行车骑行、慢跑和闲步等多种功能，廊道之间产生的高差可就地解决种植覆土不足的问题；两侧在通道之间种植植物绿带，既可以起到分隔空间的作用，亦能提供树荫，形成形式丰富的立体通行空间和舒适的微气候（图12）。
### 3.3 基于河流自然形态的公园功能分区

在自然状态下，场地北段凹岸不断被河流侵蚀，岸线距离堤坝近；河流沉积物在南段凸岸淤积，形成平坦宽阔的扇形边滩。在这一规律的基础上，设计团队结合儒乐湖新城规划对沿江开发强度和用地性质的规定，将“S湾”活水岸公园从北到南划分为三个主要功能区：腹地狭长的北段为湖江一线亲水区，毗邻金水大道地下段与新城中央商务区的中段为中心河港区，腹地宽阔的南段为沙洲湿地区。

#### 3.3.1 湖江一线亲水区

S湾北段毗邻儒乐湖水坝，现状岸线受其干扰较大，自然环境退化严重；且由于凹岸河水对河岸和堤底的冲刷作用较强，堤坝与水面高差悬殊，河岸极易塌方。因此，设计团队提出尽可能保留现状河流浅滩沙洲及岸上植被，并利用新型生态丁坝促进河砂在丁坝之间沉积，形成新的边滩栖息地，以减小近岸的水流剪应力并降低流速，既可缓解河岸侵蚀，稳固河岸，又可消化堤坝与水面的高差；城市街道则可通过丁坝延伸至水岸，提高滨水可达性。

#### 3.3.2 中心河港区

S湾中段紧邻规划中央商务区和一幢超过200m的超高层地标建筑，是新城沿江开发强度最高的区段，将主要承担公园的城市形象展
示、科普教育和市民活动等功能。由于金水大道在该区段的部分已被改为地下隧道，地上部分将设置观光巴士车道、城市公园绿道和森林缓冲带，便于市民直接前往滨江公园。防洪堤内的排涝区为海绵城市示范区，也是该区段的核心绿色开放空间，内部设置了一系列寓教于乐的主题空间以推广“海绵城市”理念，展示“吸水、净水、蓄水、渗水”的雨洪管理主题；防洪堤外，赣江抽水泵站和排涝闸口恰好位于两条街道延伸线与河岸的交点，为弱化其影响，设计团队将其打造为两条与街道相融合的生态栈道，一条通向公园的主游船码头，另一条作为通往沙洲浅滩的渔人栈道。两条生态栈道将滨水区围合成中心河港空间，形成新城核心建筑群天际线的景观基底，未来也将成为重要的市民活动和庆典场所；栈道水下落柱结合生物栅净化装置，可直接向市民展示生态净水过程，将公园的生态性和展示性融为一体（图13）。

3.3.3 沙洲湿地区
S湾南段曾是采砂活动集中区，自然边滩沙洲破损，生物栖息地退化严重。因此，修复边滩自然形态是该区段的核心目标，具体的场地干预策略包括建立生态丁坝群及弧形状沙洲、修复土体生态，以及建立植物群落。设计团队根据问题分析阶段得到的河流历史地形，模拟了在自然条件下不同水位对应的水岸边界，确定了边滩修复范围，并利用丁坝群和生态护岸技术建立高程分别为16m、15m、14m的人造河槽，利用洪水漫滩和回落，引导包括现状江心洲在内的三组弧形沙洲的修复或形成；周期性的水位涨落可将营养物质输送到沙洲表面，帮助建立水生植物栖息地，以稳固沙洲边滩。该区域的游憩活动开发强度从沙洲接近城市一侧到河岸一侧应逐渐降低，可随赣江水位变化呈现不同的景观风貌。

该区段堤坝内腹地较为宽阔，现存森林植被茂密，水塘、湿地状况良好，但与周边规划道路标高存在较大高差。对此，设计团队运用景观退台等手法予以解决，使植被与水塘均可被保留。此外，设计团队还规划了一条生态干溪谷地以衔接诸如庄塘湖、瓜洲水塘等区域内原有的分散水体（图14），以实现雨洪调节功能，将该区段打造为新城南部门户的绿色核心（图15）。
4 总结与反思

基于自然的解决方案的核心价值在于运用科技手段重新了解自然系统的力量，引导自然力量做功。在本项目中，面对航道运输、防洪安全、公众教育、休闲游憩等诸多挑战和诉求，设计师不仅需要理解场地的自然属性，也需要掌握河流对人工干预的动态响应机制，才能最终提出以河流自然演变规律为核心的规划方案。

项目运用创新的设计方法回应了以下挑战：1）将人造堤坝转化为“有生命”的生态堤岸，为形式单调、生硬的人造基础设施赋予更多富有活力的景观元素；2）通过人工干预复育受损的沙洲边滩，提升滨江地带的可达性；3）顺应自然，根据场地自然条件划分公园功能区，在不被洪水侵扰的堤内满足休闲游憩需求，并结合自然地形实现雨水管理功能，同时对受季节和水位波动影响较大的堤外区域进行适度干预，借助河滩形态发育规律，推动河流的自我修复。该设计使儒乐湖新城在面对自然灾害时更具韧性，而场地极具特色的自然属性也将成为新城独一无二的名片（图16）。

由于设计周期较短，生态丁坝对研究河段对岸及场地周边行政区赣江河段的水文影响还有待进一步论证。此外，方案未来的落地实施还有赖于河流生态监测和评估系统的建立。设计团队希望未来有更多利益相关方能够参与到项目中，并与他们建立更长期的跨专业合作关系，以进一步检验设计方法、优化设计策略与实施步骤，从而使基于自然的解决方案这一规划理念真正落地。

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项目信息

| 项目地址 | 江西省南昌市儒乐湖新城 |
| 项目面积 | 13.9hm² |
| 项目委托 | 南昌国家经济技术开发区管理委员会 |
| 景观设计 | SWA集团 |
| 首席设计师 | 李慧 |
| 设计团队 | 张楚晗, 邵宇洲, 马小萌, 詹修贤 |
| 设计时间 | 2018年8~12月 |
| 所获奖项 | 2019ASLA北加州分会分析和规划类荣誉奖 |

10. 多样化的岸线类型

Diversified shoreline typologies

Education + habitat

+24.0 m

Water purification + education

Destination + event

Sinking log piles

Ecological stone steps for intensive usage

Ecological coir fiber mat / willow branch revetment + sinking log piles

Such as structural framework, vegetation, or water level control structures.
1 Background

As one of the main tributaries of the Yangtze River and the largest river in Jiangxi Province, China, the Ganjiang River plays a significant role in promoting transportation and economic development along the regions it passes through. Located in Rule Lake New Town that sits in the core launching area of Ganjiang New District, Jiangxi Province, this project envisions an about 6-kilometer-long riverfront park, covering nearly 14 hm², as one of the most important waterfront spaces of the new town, which had been reserved thanks to the master planning of Rule Lake New Town completed in 2016: According to SWA Group's proposal, the planning proposal changed part of the originally planned Jinshui Expressway into an underground tunnel to conserve a piece of land connecting nearly 20 planned streets for potential linkage between the new town and the waterfront. In 2018, SWA Group was commissioned again by the local government to formulate a comprehensive masterplan for ecological restoration and landscape improvement of the riverfront park (Fig. 1).

Significant water level variation is one of the most important driving forces for the channel evolution of the Ganjiang River watershed (Fig. 2). Notably, this evolution is especially complex in the middle-lower reaches of the main tributary in the downstream of the Ganjiang River, north to Nanchang City, due to water-sediment movement, deltaic deposition of Poyang Lake, and human activities[1]. Historically, various measures have been taken on the river for urban development and flood control, including levee and wing dike building, tributary blocking, sand excavation, and waterway management (Fig. 3), directly or indirectly disturbing the natural evolution of river geomorphology and destroying local ecological environment and biodiversity[2][3].

2 Current Problems and Design Goals

The current status of middle-lower reaches of the Ganjiang River is shaped by the water level variation, water-sediment movements, river management and development activities together, while its future relationship with the cities along and people living there could be found in the urban development vein. Therefore, the design team conducted a systematic analysis of the river morphology evolution, as well as the impacts of human governance and economic activities on the river, so as to reveal site's major problems and influence factors, and provide theoretical basis and strategic guidance for subsequent design.

2.1 Analysis of River Evolution Process

Through site surveys and regional geographic data review, the design team found that the middle-lower reaches of the Ganjiang River was more influenced by the natural deposition process within the Poyang Lake delta instead of human intervention before 1989, when the water flow was gentle and the river bank was mainly composed of sandy soil. Generally, the water velocity is faster along the concave bank, resulting in severe erosion on the shoreline, while point bars gradually formed at the convex bank out of heavy sedimentation brought by much slower flows[4][5], creating an S-shaped channel along the site, which is a very typical geomorphology in the middle-lower reaches of the Ganjiang River; however, such a meandering channel has been gradually straightened, even almost erased by human interventions in recent decades. In response, the design team analyzed the evolution of the riverbed based on remote sensing images throughout different historical periods, as well as the changes of the shoreline at different water levels, in order to rebuild the future relationship between the site and the river.

Taking 16.5 m (the average water level of the Nanchang Waizhou Hydrometric Station on the Ganjiang River) as the benchmark, it can be seen from the Landsat-5 TM satellite images that the shoreline did not evolve much between 1991 and 2001, and there was an arc-shaped natural point bar parallel to the convex bank; from 2001 to 2009, the shoreline moved downstream and a central shoal evolved out of the point bar[6] (Fig. 4).

Comparing Landsat-7 ETM+ and Landsat-8 satellite images of the dry seasons from 1996 to 2019, it can be seen that the shoreline has moved downstream greatly, while the point bars and the central shoal have gradually shrunk[7] since 2010. As shown in the satellite image of the dry season in 2019, the convex bank had been encroached by sand-mining pits and ponds and the upstream end of the central shoal had almost disappeared (Fig. 5).

According to data in literature, during 1965 to 2015, the annual maximum water level of the Ganjiang River ranged from 18.45 m to 25.60 m, while the annual minimum water level ranged between 11.50 m and 17.17 m; the average water level varied from 18.45 m to 25.60 m, and the maximum of interannual water level variation is 14.10 m (Fig. 6). The annual average water level shows a downward trend over the years, and the most significant decline happened in 1998 – 2011[8]. Combined with the evolution of the river morphology, it is concluded that the water level decline goes along with the shrinking of point bars along the site.

2.2 Review on Human Interventions

Afterwards, in order to find out the reasons of the evolution mentioned above and the key problems need to be addressed in this project, the design team reviewed the major human interventions on the river in the past two decades, and attempted
to reveal their relations with the evolution timeline of the river’s hydrological characteristics (Fig. 7).

Before 1989, human interventions had minor influence on the river. However, due to the river closure of the Wan’an Hydro Project in 1990, the sediment discharge in the lower reaches of the Ganjiang River decreased, resulting in severer erosion and downcutting of the riverbed and even impacting river channel along Nanchang City till 2000[6]. Since 2001, illegal sand excavation had spread along the Ganjiang River, causing extensive decline of natural sandbars across the watershed, especially around the Guazhou Village, Lehua Town near the site, where the widest sandbar had shrunk from about 990 meters to 310 meters from 1990 to 2019. As a result, river ecosystems were damaged, and shorelines and levees became more vulnerable during floods[9][10]. Such illegal exploitation has not been curbed until 2011[11].

In 2012, the original Guazhou Levee was heightened and reinforced to meet a higher standard for flood prevention[10]. Although it could resist a 50-year flood with a designed elevation of 24.0 meters, the new levee, 24-meter-wide on the top, failed to provide good landscape and caused habitat degeneration due to the application of concrete revetment, which not only cut off the interactions between the land and the river, but also lowered the water retention capacity with faster water discharge rate within the river watershed[11].

To conclude, the river segment along the site has suffered from human interventions during the past 30 years. Influenced by human activities, surface runoff in point bars increased, washing away sediments from the bank through new channels between point bars and pits and ponds caused by sand excavation. As a result, the original convex bank of the S-shaped shoreline gradually became fragmented then disappeared.

Besides, it is worth to note that there is a wing dike at the turning of the convex bank. It was built as a temporary assistant facility during the reinforcement of the Guazhou Levee. The wing...
dike is usually used for optimizing the flow field distribution and riverbed forms for shipping; if being located suitably, it can also create a recirculation zone in the downstream, where the flow conditions are favorable for rehabilitating aquatic habitats to compensate the ecological damages in the upstream. According to the satellite map, this 300-meter-long wing dike has helped re-establish the floodplain since its completion in 2012, showing great potential for ecological restoration and landscape improvement in this project.

2.3 Design Objective: To Rehabilitate the S-Shaped River Morphology

As above, this project aims to restore the natural S-shaped morphology of the river along the site. The critical approaches include 1) mitigate or curb the erosion caused by pits and ponds and new channels left by sand excavation through proper ecological technologies and land preparation strategies; 2) rehabilitate the typical features (like point bars and central shoals) of the original S-shaped river by taking advantage of the natural scour-and-fill process; and 3) improve the ecological performance and landscape quality of the levee with diverse landscape design strategies while meeting flood control needs.

3 A Nature-Based Solution: The S River Park on the Living Shoreline of the Gangjiang River

Featured with the typical S-shaped river channel, the project is named as S River Park in the expectation for a resilient coexistence of the new town and the river through a nature-based planning approach (Fig. 8).

3.1 Nature-Based Land Preparation Strategies

Based on the analyses on the evolvement of river landform above, the scope of riverbank and vegetation protection was determined. Then, combined with the site’s natural conditions and the new town’s master planning, the design team proposed the park’s program zones according to development suitability and intensity, and further developed following land preparation strategies and implementation steps:

1) First, simulate boundaries of the point bars under different water levels according to historical images, and identify the restoration extent of point bars at the convex bank. Then, establish new wing dikes at the suitable locations to repair the shoreline from existing pits and ponds, restoring scroll bars and reinforcing channels between them at different elevations, thus allowing for spontaneous revival of the points bars. As a result, the meandering river with diverse shoreline habitats would be restored, providing...
attractive riverfront for the new town;

2) Second, for areas inside the levee, preserve the existing wetlands, ponds and vegetation around in the Guazhou Village, transforming them into rain gardens as part of a new green infrastructure for stormwater management, and create gentle landforms through which the surface runoff could flow into the green infrastructure, then get filtered and recharge groundwater;

3) Finally, mitigate the gap created by the elevation difference between the levee top and the roads nearby and increase the diversity of shoreline topologies, providing different and resilient shoreline landscapes adaptive to varying water level scenarios of the Ganjiang River (Fig. 9).

3.2 From the Artificial Levee to the Living Shoreline

The levee is an important transitional zone between territorial and aquatic environments, critically influencing the ecological performance of a river ecosystem. Therefore, this project attempts to convert the monotonous concrete levee into a vibrant and permeable shoreline, which can restore riparian ecological habitats by helping mitigate the erosion and remediate the disappearing sandbars.

Porous natural materials are used to establish diverse shoreline typologies, and different materials are applied at different river segments according to water velocity and force, e.g., gabions, ecological coir fiber mats, willow branches and sinking log piles, and planters of emerging aquatic plants—These help make the shorelines more adaptive to various erosion intensities by creating dynamic environment in the river, and convert the impervious riverbank into a natural shoreline, providing habitats for living creatures and quality recreational space for local residents (Fig. 10).

Then, different forms of shoreline are proposed based on the elevation difference between the levee and the river, such as gentle landforms, planting terraces, and gabion steps. A vibrant interface is created, not only connecting urban built area to the river but also providing protection against 50-year floods (Fig. 11).

The design team proposed to build a double-layer greenway system on the 24-meter-high levee to make full use of the spectacular view to the river on its top: the greenway system, consisting of different corridors for cyclists, joggers, and pedestrians, would create various experience from quick passing through to promenade; the elevation differences between them can provide space for greenbelt with tree groves, not only solving the
problem of soil depth shortage on the levee top but also creating more shadows and enriching visitors’ spatial experience in a pleasant micro-climate (Fig. 12).

3.3 Program Zoning of the Park based on the River’s Natural Morphology

In the natural circumstance without much human intervention, intensive river erosion in the north of the site creates a steep concave bank, shortening the distance between the shoreline and the levee, while large amounts of sediments accumulate at the convex bank in the south, forming flat and broad fan-shaped point bars. Combining this natural law with the regulations on the development intensity and land use in the master planning of Rule Lake New Town, the S River Park is divided into 3 program zones from north to south: the River-Lake Waterfront Zone, the Central River Harbor Zone, and the Living Oasis Wetland Zone.

3.3.1 The River-Lake Waterfront Zone

Influenced by the dam of Rule Lake nearby, the existing shoreline at northern stretch of the park has gone through gradual ecological deterioration; besides, severe erosion on the concave bank has resulted in dramatic drop between top of the levee and water level, making the bank extremely prone to collapse. In response, the design team proposed to preserve the existing vegetation and riverbank, and establish ecological wing dikes to promote sand deposits in between. In this way, new point bars will emerge as soft shoreline, and bank erosion will be mitigated while the elevation drop can be reduced. Aligned with urban street grid, the wing dikes will also increase access to waterfront for citizens.

To better serve the adjacent planned Culture and Health Zone, a new floating bridge with boating pier is proposed at the north end of the zone. The wing dikes and the bridge help divide the emerging point bars into 3 relatively independent subzones from north to south, serving boating, waterfront recreation, and ecological habitat restoration, and the revetments are made of different materials to fit various program functions.

3.3.2 The Central River Harbor Zone

Sitting beside the planned central business district and an over 200-meter-high landmark building, the middle segment of the S River Park is positioned as a major icon and an important venue for education, civic activities and events to serve the intensive development along the riverfront of the new town. Thanks to the proposal of transforming the Jinshui Expressway into an underground tunnel, convenient pedestrian access to the riverfront has been reserved, and recreational and ecological amenities such as tour bus lanes, greenway corridors, and grove
buffers will be provided as well: inside the levee, a demonstration area for sponge city vision would be established to convey the “sponge” concept through a series of educational units, showing the collection, purification, retention, and infiltration process of stormwater management; outside the levee, to mitigate the impacts of the existing water conservancy facilities (a pump station and a sluice for flood discharge) on the end of two planned streets, the design team proposed to combine them into two ecological trestles—one leads to the largest cruise pier of the park, and the other one serves as a fishing corridor to the restored central shoal in the river. In the future, citizens would enjoy the harbor as a landscape base for the skyline of the central business district, as well as a place for various festival events. Processes of how water get purified through the underwater biofilm grilles beneath the trestles can be showcased at the same time (Fig. 13).

3.3.3 The Living Oasis Wetland Zone

The south part of the park used to see intensive sand excavation and suffered from serious loss of natural point bar habitats, the recovery of which then becomes the core design goal for this zone and requires wing dikes building, scroll sandbars restoration, soil ecological remediation, and plant community re-establishment. Based on the analyses of the historical river landform and simulations of the shoreline boundary at different water levels in natural state, the design team determined the extent of point bar restoration, then proposed to create artificial channels with elevations of 16 m, 15 m, and 14 m through wing dikes and ecological revetments, thus re-introducing the natural process of flooding and deposition to help restore 3 groups of sandbars including the existing central shoal. The periodical nutrients convey onto the sandbars can prepare a fertile base for aquatic plant communities that can reinforce the sandbars in turn. Besides, a varying recreation program intensity from active to passive is proposed from city to river, in response to water level change of the Ganjiang River and the dynamic waterfront accessibility.

There are abundant woodlands, ponds, and wetlands in the broad hinterland within this zone, the elevation of which, however, is much lower than those of the adjacent planned streets. In response, the design team proposed to reshape the landform into a series of landscape terraces to connect this well-preserved native green with the area beyond the levee, and planned an ecological stream valley to connect the existing fragmented water bodies such as the Zhuangtang Ponds and the Guazhou Ponds (Fig. 14) as a stormwater retention system, thus to make this zone a green hub in the south gateway of the new town (Fig. 15).

4 Reviews and Reflections

The core value of the nature-based solutions lies in that they take advantage of science and technologies to re-discover the power of natural systems and direct it to fully function. In this project, it is the designer’s deep understanding of the site’s natural conditions and the river’s dynamic corresponsive mechanism to human interventions that leads to the final planning proposal based on natural river evolution, which meets needs of water transportation, flood control, public education, and leisure and recreation at the same time.

With innovative design approaches, this project mainly attempts to 1) transform an artificial concrete levee into an ecological shoreline with vibrant landscape; 2) restore the deteriorated sandbars and enhance the accessibility of the riverfront park by reasonable human interventions; and 3) apply rational zoning to the park according to various natural conditions on the site, realizing recreation and stormwater management in the city side the levee while catalyzing the self-healing process of the shoreline based on natural laws in the river side. By retrieving the typical river morphology, the Rule Lake New Town is expected to be more resilient to natural disasters, and the S River Park will be able to exemplify itself through the nature-based design solutions (Fig. 16).

However, more assessments are needed to demonstrate how the wing dikes would impact the hydrological conditions of the opposite riverbank of the site and other surrounding regions along...
the Ganjiang River. The implementation of the proposal also requires a complete monitoring and evaluating system for the river ecology. The design team hopes to engage more stakeholders in the future stages of this project for transdisciplinary collaboration in a long term, so as to further examine the design methods, optimize the design strategies and implementation agenda, and truly realize this nature-based solution. LAF

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PROJECT INFORMATION

LOCATION: Rule Lake New Town, Nanchang City, Jiangxi Province, China
AREA (SIZE): 13.9 hm²
CLIENT: Administrative Committee of the Nanchang National Economic and Technological Development District
LANDSCAPE DESIGN: SWA Group
CHIEF DESIGNER: Hui-Li Lee
PROJECT TEAM: Zhang Chuhan, Shao Yuzhou, Ma Xiaomeng, Zhan Xiuxian
DESIGN PERIOD: August – December, 2018
AWARD: 2019 ASLA North California Chapter Honor Award of Planning and Analysis Category

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