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**River Development Project
Report**





1 INTRODUCTION

This report conveys the outlook of the primary river/riverfront development projects in the world and India which is confined but not of the same kind, serving different objectives which we would be observing in this report with major concerns on each project's Performance and Factors posing different purposes with necessary information of their Scale, Budget, Cost-benefit Analysis, Length and stakeholders Involved in the projects.

2 INDIA OUTLOOK:

2.1 Sabarmati River Project

- **Scale:** large
- **Budget:** High, as of Nov 2019 ₹1,400 crore (US\$170 million) were spent and for Phase 2, ₹850 crore (US\$100 million) were provisioned in the state budget.
- **Length:** This projects total length including Phase 1 and Phase 2 is 23 kms to 34 kms.
- **Cost-Benefit Analysis:** Despite its substantial costs, the project has yielded significant economic, social, and environmental benefits. It has transformed Ahmedabad into a more liveable and vibrant city, attracting tourists and investors.
- **Stakeholders Involved:** Sabarmati Riverfront Development Corporation Ltd. (SRFDCL), Ahmedabad Municipal Corporation (AMC), Residents of Ahmedabad, Environmental NGOs, Private developers.

About: The Sabarmati Riverfront Development Project (SRDP) is a waterfront being developed along the banks of Sabarmati River in Ahmedabad, India. The project aims to transform the riverfront along the Sabarmati River into a vibrant public space with various amenities, enhancing the quality of life for residents and promoting tourism. Under environmental restoration, the project focuses on restoring the ecological health of the river, improving water quality and managing flood risks. Phase 1 of the project was largely completed by 2012 and Phase 2 commenced following the completion of Phase 1, with ongoing development based on project goals and funding availability.

Performance and factors:

- **Scalability:** The Sabarmati Riverfront Project represents a comprehensive and large-scale urban redevelopment effort that has transformed a previously underutilized and polluted riverbank into a thriving public space, setting a precedent for similar projects worldwide.
- **Length:** The entire Sabarmati Riverfront Development will be covered from Ambedkar Bridge to Indira Bridge and would take the total length of the Sabarmati Riverfront Development Project from 23 kms to 34 kms. The project creates a public edge along the



river on the eastern and western banks. By channelling the river to a constant width of 263m, riverbed land of 204.91 hectares has been reclaimed.

- **Budget:** Initially the proposal was to construct the riverfront to cover a stretch of 10.4 kilometres (6.5 mi) stretch from Subhash bridge to Vasna barrage, in 2003, the project extended to cover 11.25 kilometres (6.99 mi) stretch and reclamation of 202.79 hectares (501.1 acres) and was put on fast track. The project estimated to cost ₹1,200 crore (US\$140 million) which was to be recovered by selling of a part of reclaimed land for commercial and residential purpose. The construction began in 2005. By November 2019, the ₹1,400 crore (US\$170 million) were spent. In 2019 state budget, total ₹850 crore (US\$100 million) was provisioned for Phase 2. The Phase 2 was approved by SRFDCL in October 2020.[2] While in its draft budget for 2021-22, AMC has set aside Rs 1,050 crore for the Phase 2.
- **Stakeholders:** The Project involves several key stakeholders. The Sabarmati Riverfront Development Corporation Ltd. (SRFDCL) manages the project, focusing on urban renewal and sustainability. The Ahmedabad Municipal Corporation (AMC) oversees the project, aiming to enhance infrastructure and residents' quality of life. Residents benefit from improved public spaces and economic opportunities, while environmental NGOs ensure ecological standards are met. Private developers invest in commercial and residential developments, boosting the area's economic vibrancy.

2.2 Tapi-Par-Narmada Link Project

- **Scale:** Very large
- **Budget:** According to the National Water Development Agency (NWDA), the estimated budget based on the project cost is around ₹10,211 crore (US\$1.2 billion) as of 2017.
- **Length:** The project involves constructing seven reservoirs in north Maharashtra and south Gujarat with a total canal length of 395 km (including 33 km of feeder canals).
- **Cost-Benefit Analysis:** NWDA estimates the Tapi-Par-Narmada Link Project to be marginally profitable. With a Benefit-Cost Ratio (BCR) of 1.035, the project's annual benefits are expected to slightly exceed its annual costs.
- **Stakeholders Involved:** Govt of India, State Govts of Maharashtra and Gujarat and local communities, including tribal populations who have raised concerns and protests regarding the project are the key stakeholders.

About: Tapi Par Narmada Link proposes to transfer water from the water surplus regions of Western Ghats to the water deficit regions of Saurashtra and Kutch. This would save Sardar Sarovar water which will be used to extend irrigation in Saurashtra and Kutch region. The link mainly envisages construction of seven dams, three diversion weirs, two tunnels (5.0 km & 0.5 km of length), 395 km long canal (205 km in Par-Tapi portion including the length of feeder canals and 190 km in Tapi-Narmada portion), 6 power houses and a number of cross-drainage works.

Performance and factors:



- **Scalability:** The Tapi-Par-Narmada Link Project is a large-scale water management endeavour aimed at enhancing irrigation, flood control, and water supply in Gujarat and Maharashtra. By linking three major rivers, the project seeks to boost agricultural productivity and provide reliable water resources to drought-prone areas while incorporating measures to address environmental impacts.
- **Length:** The length of this projects includes constructing seven reservoirs in Maharashtra and Gujarat, along with a 395 km long canal network. This canal will have dedicated sections for Par-Tapi (205 km) and Tapi-Narmada (190 km) connections, along with feeder canals. Three diversion weirs and two tunnels (totalling 5.5 km) will help manage water flow, while six powerhouses will generate hydroelectric power. The project also includes extensive drainage works for effective water management.
- **Budget:** Based on the data of the National Water Development Agency, the budget of this link project is estimated to be around ₹10,211 crore (US\$1.2 billion) as of 2017.
- **Cost and Benefits:** The total cost of the link project works out to be Rs. 10211 crores at 2014-15 price level (6,016 crore at 2004-05 price level), which includes Environmental Management Plan and Socio-economic Survey and Rehabilitation and Resettlement Plan. The Benefits of this project include irrigation to enroute command areas and save water in the Sardar Sarovar project, which will then be used to extend irrigation to the Saurashtra and Kutch regions. Construction of six powerhouses that will generate approximately 93 million kWh of hydropower annually. And the project will also help in managing floods in the region. According to NWDA, the net annual benefits from various components of the project work out to Rs. 126586.70 lakh and the annual costs works out to Rs. 122364.64 lakh. Thus, the Benefit-Cost Ratio of the project works out to 1.035
- **Stakeholders:** The project includes the Govt of India where The National Water Development Agency (NWDA) from the central government leads on funding and approvals, State Govt of Gujarat and Maharashtra, and Local communities, including tribal populations who have raised concerns as their key stakeholders.

2.3 Mahanadi Godavri link Project

- **Scale:** Very large
- **Budget:** The total Cost and Budget of the link canal project is estimated to be Rs. 1,754,054 lakhs at 2003-04 price level.
- **Length:** The link canal for the Mahanadi-Godavari project spans approximately 828 km.
- **Cost-Benefit Analysis:** The project's annual direct benefits are ₹116,662 lakh, with a total cost of ₹1,754,054 lakh (2003-04 prices). The Benefit-Cost Ratio is 1.60, and the Internal Rate of Return is 12.77%.



- **Stakeholders Involved:** National Water Development Agency (NWDA), State Governments of Odisha and Andhra Pradesh and Local Communities are the key stakeholders associated with this project.

About: Mahanadi Godavari Link Project envisages construction of a storage reservoir on Mahanadi River at Manibhadra and a link canal from this reservoir to the Godavari River. This project is a significant component of India's National Perspective Plan for interlinking rivers.

Performance and factors:

- **Scale and Length:** The link canal for the Mahanadi-Godavari project spans approximately 828 km. For the purpose of the proposed link canal, The FRL and MDDL of Manibhadra reservoir will be raised to 91.0 m and 74.15 m respectively and then the gross storage will be 8520 Mm³ and the live storage will be 6608 Mm³. The existing Dowlaiswaram barrage across the river Godavari near Dowlaiswaram village in East Godavari district of Andhra Pradesh with a pond level of 13.64 m, to act as the final outfall point of the proposed link canal.
- **Budget:** The budget for this project vary with the sources, older reports suggest a cost of around ₹17,541 crore at 2003-04 price levels and the most recent one is from the National Water Development Agency (NWDA) that estimates the project cost at ₹54,019 crore at 2018-19 price levels.
- **Cost and Benefits:** The Project plans to divert 12,165 Mm³ of water from the Manibhadra reservoir, using 3,790 Mm³ for en route irrigation in Odisha (3,184 Mm³ for 256,770 hectares) and Andhra Pradesh (606 Mm³ for 107,189 hectares). A 70 MW power plant will generate 197 million units annually. Additionally, 802 Mm³ will be allocated for future domestic and industrial needs. Transmission losses are estimated at 1,073 Mm³, leaving 6,500 Mm³ to be transferred to the Godavari River. The project's annual direct benefits are ₹116,662 lakh, with a total cost of ₹1,754,054 lakh (2003-04 prices). The Benefit-Cost Ratio is 1.60, and the Internal Rate of Return is 12.77%.
- **Stakeholders:** This Project involves key stakeholders including the National Water Development Agency (NWDA) responsible for planning and execution. The Government of India provides crucial funding and policy support. Both the state governments of Odisha and Andhra Pradesh are active participants and beneficiaries, focusing on integrating the Mahanadi and Godavari River basins. Local communities along the canal route, especially those in water-deficit areas, are also central stakeholders expected to benefit directly from improved water resources and socio-economic conditions.



The various other River development projects with the specifications:

Project	Length	Estimated Cost in the year 2003 or earlier [#]	New irrigation capacity added (hectares)	Potential Electricity generation capacity	Drinking & Industrial water added (MCM)	Reference	Status
Mahanadi Godavari	827.7	₹17,540.54 crore (US\$2.1 billion)	363,959	70 MW	802	[37]	
Krishna–Pennar	587.2	₹6,599.80 crore (US\$790 million)	258,334	42.5 MW	56	[25]	Under Construction
Par Tapi Narmada	395	₹6,016 crore (US\$720 million)	169,000	93 MW	91	[38]	
Nagarjunasagar Somasila	393	₹6,320.54 crore (US\$760 million)	168,017	90 MW	124	[29]	Under Construction
Godavari–Krishna	299.3	₹26,289 crore (US\$3.1 billion)	287,305	70 MW	237	[26]	Completed ^[27]
Kaveri-Vaigai-Gundar	255.6	₹2,673 crore (US\$320 million)	337,717	-	185	[33]	Under Construction ^[34]
Parbati Kalisindh Chambal	243.7	₹6,114.5 crore (US\$730 million)	225,992	17 MW	89	[28]	
Ken Betwa	231.5	₹1,988.74 crore (US\$240 million)	47,000	72 MW	2,225	[30]	Under Construction
Srisailem Pennar	203.6	₹1,580 crore (US\$190 million)	187,372	17 MW	49	[31]	
Ilavaram-Vijayawada	174	₹1,483.91 crore (US\$180 million)	314,718	72 MW	664	[35]	Under Construction ^[36]
Pamba Achankovil Vaippar	50.7	₹1,397.91 crore (US\$170 million)	91,400	500 MW	150	[39]	
Damanganga Pinjal	42.5	₹1,278 crore (US\$150 million)	-	-	44	[32]	



3 WORLD OUTLOOK:

3.1 Tennessee Valley Authority (TVA) Project - United States:

- **Scale:** Large
- **Budget:** High initial investment, but highly efficient due to extensive benefits.
- **Length:** Covers the entire Tennessee River Basin.
- **Cost-Benefit Analysis:** The TVA project is considered highly efficient due to its multipurpose benefits, including flood control, electricity generation, and regional development.
- **Stakeholders Involved:** U.S. federal government, local communities, businesses, and agricultural sectors.

About: TVA project is a vast project covering 49 dams and reservoirs of 80,000 square miles across parts of seven states in the southeast concentrating on the Three Es: Energy, Environment and Economic Development.

- i. **Energy:** Providing affordable, Reliable, resilient and clean energy for decades to come with methods of renewability, advanced nuclear solutions, hydroelectric, gas and more.
- ii. **Environmental Stewardship:** Compressing of 11,000 miles of shoreline, the Environmental benefits that offers water supply and multiple other public benefits with the help of partners drawing biodiversity projects, stewardship and conservation.
- iii. **Economic Development:** Attracting capital investments and job to its seven-state service area targeting Six key markets: Aerospace and Defence, Automotive and Mobility technologies, clean technologies, Food and Industrial technologies, Information systems and Security and Life sciences.

Performance and Factors:

- **Scalability:** \$3.7 billion planned investment for power Transmission system improvements to build additional generation and upgrade the existing power system and a total of \$16.4 billion planned investments in 2024 through 2028 with 12,276 new jobs to be created on FY 2023.
- **Budget:** The projected capital investments for the past 5 years of \$45.9 with the projected capital investment of \$9.2 billion in FY 2023 and \$12 billion for Ecotourism and Recreation supported by TVA dams and reservoirs.
- **Length:** The management of 49 dams out of which 29 TVA dams are used for hydroelectric power generation and provided navigation system with 13 locks along



652-mile length Tennessee River which finds 25,000-30,000 barges annually with 40-50 million tonnes of goods, saving consumers \$400-\$500 million transportation costs.

- **Cost-Benefit Analysis:** The flood damage costs prevented each year, on average, through food control operations and Tennessee River which finds 25,000-30,000 barges annually with 40-50 million tonnes of goods, saving consumers \$400-\$500 million transportation costs.
- **Stakeholders:**
 - City of Knoxville
 - Oak Ridge National Laboratory
 - 4County Electric
 - Southeast Energy Efficiency Alliance
 - WestRock
 - Tennessee Department of Environment and Conservation
 - BrightRidge
 - Tennessee State University
 - UT Chattanooga
 - The Nature Conservancy
 - Redstone US Army Garrison DPW—Redstone Arsenal
 - Tennessee Farm Bureau Federation
 - Tennessee Valley Industrial Committee
 - Tennessee Interfaith Power and Light
 - University of Tennessee
 - Commonwealth of Kentucky Energy and Environment Cabinet, Office of Energy Policy
 - Tennessee Advanced Energy Business Council
 - Tennessee Department of Economic Development
 - Nashville Electric Service
 - City of Chattanooga
 - Tennessee Valley Public Power Association
 - Oak Ridge National Laboratory
 - Middle Tennessee Natural Gas Utility District
 - City of Florence Electricity
 - Memphis and Shelby County Division of Planning and Development



Figure 1: Fields related to the stakeholders of the TVA project

3.2 South-to-North Water Transfer Project – China

- **Scale:** Very large
- **Budget:** Extremely high, but justified by the benefits to over 100 cities and provinces.
- **Length:** Thousands of kilometers.
- **Cost-Benefit Analysis:** Despite the high costs, the project is deemed efficient due to the critical need for water in northern China, significantly benefiting agriculture, industry, and urban areas.
- **Stakeholders Involved:** Chinese central government, provincial governments, urban and rural communities.

About: The South-to-North Water Diversion Project in China is the largest of its kind ever undertaken. The project involves drawing water from southern rivers and supplying it to the dry north which is planned for completion in 2050 which the potential transfer of 44.8 billion cubic meters of water to the population destination of the drought affected dry north consisting of: the Yangtze, Yellow River, Huaihe and Haihe which requires construction stretching south-to-north across the eastern, central and western parts of the country.

Performance and Factors:

- **Scalability:** The potential Diversion volume of 44.8 billion cubic meters per year which passes through the routes: Eastern route of 14.8 billion cubic meters covering 1,156 kms, Central route of 13 billion cubic meters covering 1,267 kms and Western route of 17 billion cubic meters covering 1,300 kms (estimated), proving the scalability takes 50 years construction.
- **Budget:** The projected investment of \$62 billion where the construction costs of the eastern and central routes is estimated to be \$37.44 billion. China out of the \$7.9



billion reserved for the south-to-north water diversion project, the central government has budgeted \$2.12 billion special funds in treasury bonds from central government accounts for \$1.47 billion, and local governments are funding \$2.73 billion and the loans contributing \$2.73 billion for the project.

- **Length:** The development project from the south to the dry north which transfers water by this construction accounting for covering 1,156 kms of eastern route, Central route covering 1,267 kms and Western route with the estimated coverage of 1,300 kms, proving the scalability takes 50 years construction.
- **Cost-benefit Analysis coming with the trade-offs:** Like China's other mega-project –the Three Gorges Dam – the diversion scheme has provoked many environmental concerns, principally regarding the loss of antiquities, the displacement of people and the destruction of pasture land. However, to help counter this threat, the Chinese Government has earmarked just over \$80m for Jiangdu, Huai'an, Suqian and Xuzhou, in the east of Jiangsu Province to build treatment facilities although estimates suggest that the actual cost is more than double this figure. Overall, around 260 projects have been instigated to reduce pollution and help ensure that water in the areas of the diversion project will meet minimum drinking standards. Despite this high costs, the project is deemed efficient due to the critical need for water in northern China, significantly benefiting agriculture, industry, and urban areas and building the pioneer for eradicating drought through River development projects.
- **Stakeholders:** The responsibility beholds to Chinese central government, provincial governments, such as:
 - State Development and Planning Commission
 - Ministry of Water Resources
 - Ministry of Construction
 - State Environment Protection Administration
 - China International Engineering Consultant Corporation

3.3 Itaipu Dam Project - Brazil and Paraguay:

- **Scale:** Large
- **Budget:** High, but cost-effective considering the power generation capacity.
- **Length:** Dam spans approximately 7.76 km.
- **Cost-Benefit Analysis:** Highly efficient in terms of energy production per dollar spent. Provides a significant portion of electricity for both countries, leading to economic and industrial benefits.
- **Stakeholders Involved:** Governments of Brazil and Paraguay, energy consumers, local communities.



About: The dam being located on the Parana River at the border of Brazil and Paraguay which was developed in response to both countries recognizing the energy potential of the river, facilitating coordinated effort between Brazil and Paraguay despite corruption issues during construction. However, the dam provided economic and diplomatic relations between Brazil and Paraguay thus making it a significant project in the history of both nations.

Performance and factors:

- **Scalability:** The treaty of Itaipu signed between Paraguay and Brazil on the basis of each sharing 50% of entity's equity defining the conditions for the exploitation of the Parana River for Hydroelectric power by utilizing maximum number of generating units, gaining the tag of second-largest operational hydroelectric power plant with generation capacity of 14 GW and although the development of the dam was progressive, with the generation capacity incrementally increased, the dam was able to reach and plateau at the current level of energy production capacity within about 10 years of commencing electricity production operations with Brazil approximately 90% of the total energy generated.(GWh – Gigawatt hours):

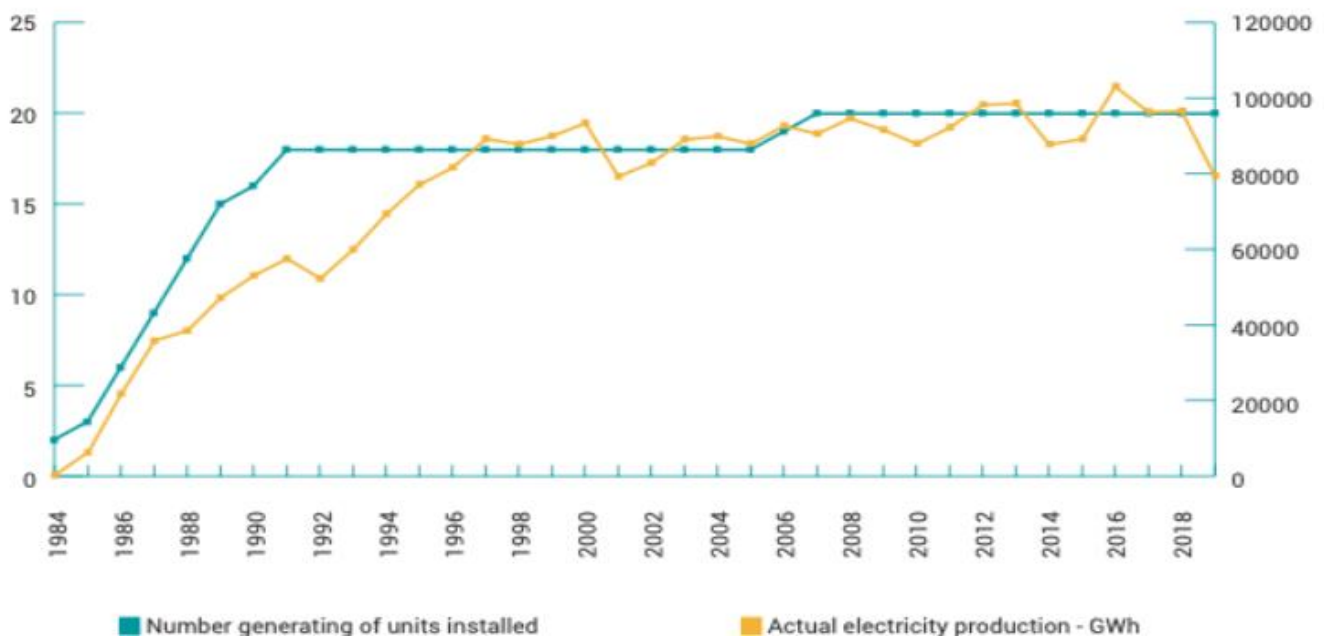


Figure 1: Yearly electricity production in relation to the number of generating units installed

As Itaipu Binacional reports, “In 2018, the net energy generated was 95,883 GWh. Of the total, 80,839 GWh were provided for Eletrobras, which corresponds to 15% of the demand of the Brazilian market. For Ande, 15,044 GWh were supplied, serving almost 91% of the demand of the Paraguayan market.” The Itaipu project also included the construction of a 7,919m-long and 196m-high dam more like a lake.



- **Length:** Itaipu has 20 generating units each with a capacity of 700MW with a separated distance of 34m between the power plants and the dam's reservoir which covers an area of 1,350 km² being the seventh-largest reservoir in Brazil.
- **Budget:** The construction began in February 1971 and was completed in 1984 with a total cost of \$17.6 billion adjusted to 2018 prices. Itaipu Binacional states "the Fixed Assets in the 2018 Balance Sheet, in the amount of \$17.6 billion, may represent the price of the dam's construction." That amount includes the financial charges incurred during the construction until each generator unit went online and the direct investment without financial charges averaged \$12 billion (2018 prices). The funds raised for the construction, including financial rollovers, totalled \$27 billion, in addition to the USD100 million in paid-in capital.
- **Cost-benefit:** The direct investment – without financial charges – averaged USD12 billion (2018 prices). The funds raised for the construction, including financial rollovers, totalled USD27 billion, in addition to the USD100 million in paid-in capital which means that the debt for the construction of the dam and its maintenance costs are also evenly distributed. In accordance with the Treaty, Paraguay has thus been selling the rest of its share to Brazil. The Treaty, when originally signed, required Paraguay to sell its unused electricity to Brazil for USD120 million a year until 2023. After Paraguay expressed concerns about this amount, the two countries signed a deal in July 2009 after several months of negotiation, under which Brazil agreed to triple its payments to Paraguay. In parallel, and as per the Treaty, the Brazilian and Paraguayan Governments have been receiving 'royalties' (compensation payments) from Itaipu Binacional since the start of electricity production from the dam in 1985. They are paid on a monthly basis as financial compensation for the use of the natural resources of the reservoir where Brazil has received \$5.7 billion in royalties since 1987, while Paraguay has received \$5.4 billion.
- **Stakeholders:** A consortium of US-based IECO and Italy-based ELC Electroconsult carried out the viability studies of the project and its construction and a consortium led by GE Renewable Energy's hydropower business will be responsible for the technological upgrade of the 14GW Itaipu hydropower plant on the Paraná River between Brazil and Paraguay. Further, the consortium, comprising GE Power and CIE Sociedad Anonima, was awarded a contract to supply electrical equipment for the replacement of obsolete equipment.



4 References:

1. **Tennessee Valley Authority (TVA) Project - United States:**

[TVA project](#)
[TVA project1](#)

2. **South-to-North Water Transfer Project – China:**

[South to North](#)

3. **Itaipu Dam Project - Brazil and Paraguay:**

[Itaipu1](#) , [itaipu2](#)

4. **Budget-SRDP:**

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5. **Cost and Benefits of Par Tapi Narmada Link Project:**

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6. **Budget of the Mahanadi Godavri link Project:**

https://nwda.gov.in/upload/uploadfiles/files/ES_of_MG_Link.pdf

7. **Some useful links that can add further World River development projects information:**

[Riverfront: The Latest Architecture and News](#)

[River development cost lookup](#)



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