

# **Rejuvenation of Horikawa Canal-River in Nagoya**

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## 1. Backgrounds

Nagoya City is located at the central part of Japan facing to the Pacific Ocean, and forms an important midway of Tokaido Megalopolis that is running from Tokyo to Kyoto-Osaka area. Nagoya city has the population of 2.2 million within the city limit, but it has about ten million population within Nagoya Metropolitan Area basically defined by approximately 50 km radius from the center of Nagoya. Nagoya is the most prosperous industrial center in Japan, and it also can be said as one of leading industrial and manufacturing centers in the world, represented mainly by the automobile and air/spacecraft manufacturing, a variety of machinery/electronic production and almost all other types of industrial outputs.

Nagoya is planned city in 1610 as a clear grid-iron street network for a provincial capital of 50,000 people, relocating the former provincial capital called Kiyosu located 7 km away from Nagoya, avoiding flood disasters often suffered due to the location of former town in lower swampy area. The relocation of the provincial capital of 50,000 population was a great works at that times mainly depending on the manual work. New capital was designed with a huge castle pavilion surrounded by moats and rock fenced forts, therefore, it needed many rocks and timbers for the castle construction and town development.

The Horikawa Canal-River was excavated in same time to carry the materials for the construction of the new provincial capital of Nagoya. The Horikawa has approximately 10 km length only with 30-100 meter width between the Ise bay and Nagoya Castle site. Main original purpose of the excavation was Canal function to bring the big rocks and timbers needed mainly for the construction of the castle. These huge materials were brought from hundreds km away by ships.



Map of Japan

Through the feudal age to pre-industrial age, the Horikawa was clean and naturally blessed Canal river that was flowing down the mid of downtown Nagoya. The Horikawa was the most attractive and livable place in old days of Nagoya with water-front shops, boat riding, cherry blossom, so on.

When we started the rapid urbanization in late 19<sup>th</sup> century, the city launched the overall sewer system in the built up area of Nagoya. In Japanese traditional societies, excrements from the households were installed in the pots, and recycled to the rural area as agricultural fertilizers. Therefore, in old days, many streams and rivers in Japanese urban settlements were kept as very clean condition supported by a plenty of rainfall and steep water flow by mountainous topography. But, the Horikawa Canal-River is exception as an artificial Canal that has not enough rainfall water basin and also it was excavated in the flat plain field. There is no water resource from upper stream flowing down to the Horikawa, and the water remained in the Canal, therefore, the water quality is getting worsen. There were some tries to bring the fresh water into the Horikawa Canal-River, but the inducing of water from other upper rivers were constrained not only by topographical barriers, but by the interests of water utility right owned by each local community and concerned entity along the river.

Even though, the Horikawa Canal-River was closed water stream, the water quality then was considered as very clean, and many people enjoyed the swimming as well as fishing in the Canal-river until the end of world war 2 in 1945. In this war, almost all central Nagoya was destroyed by consecutive air raids, and the whole city was completely devastated. The Horikawa Canal-River was physically remained itself, but the Canal was heavily damaged and polluted by dumping of trash and other dirty things. But this was not main reason of the Canal pollution of today, the dumping of dirty things was easily cleared away in short period, but the extensive installation sewer system became a major cause of water pollution of the Horikawa Canal-River.

## **2. Sewer System**

The sewer system in Nagoya was developed gradually from 1890's. The first stage of sewer system had very slow development so that effects of the sewer installation were not extensive until world war 2 started in the Pacific Ocean in 1941. Also, majority of excrements from households were very often separately collected and recycled as fertilizers as mentioned earlier.

The old sewer system installed before the war was completely destroyed and rebuilt drastically after the world war 2, to meet the reshaped road network in the whole central built-up area. It was seemed to stop the pollution of the Horikawa

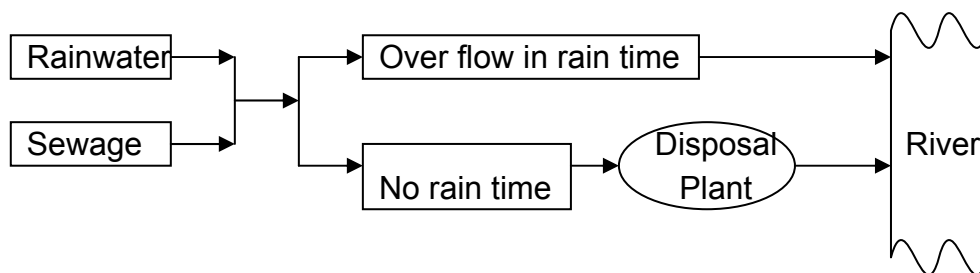
by introducing the modern sewer system. Ironically, this was quite opposite, and the pollution of Horikawa was worsen due to the development of sewer system.

There are two sewer systems in Nagoya. One is “separate sewer system” that is applied to a thirds of eastern area of the city, and other is “combined sewer system” that is largely applied for the rest of two thirds of the city area including downtown area. The Horikawa Canal-River is located in mid of this area, and the Canal was heavily polluted by the weakness of “combined sewer system” that is used only one pipe both for rainwater and sewage. When heavy rainfall comes, sewages are over flown directly to Horikawa, and the Canal River was tremendously polluted, and the citizens said “Horikawa was dead”.

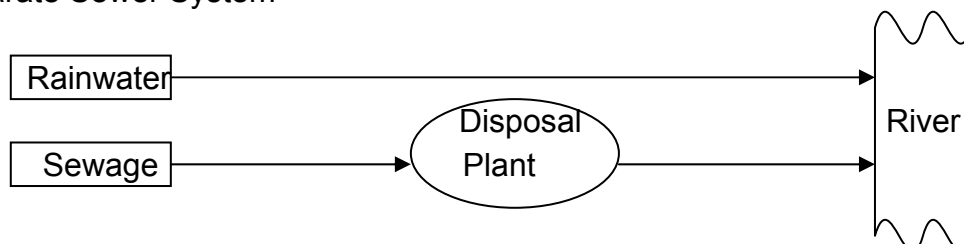
The separate sewer system is the sewer system that the rainwater pipe and sewage pipe are separately installed, and sewages are sent to sewage disposal plant to dispose the sewage, and disposed water and the rainwater are directly flown to the river. On the other hand, combined sewer system is one pipe sewer system that combines sewage and rainwater together by single pipe connecting to the disposal plant. In no-rain falling time, all sewages are sent to disposal plant as same as the sewage pipe of separate pipe system, but when it becomes heavy rain falling, the disposal plant cannot accept the big volume of mixed sewage and rainwater. Therefore, in rain-falling time, mixed sewage and rainwater are over flown to the Canal due to the limited capacity of main pipe and disposal plant. The principle of two systems is illustrated as below.

### Sewer System Diagrams

Combined Sewer System



Separate Sewer System



### **3. Change of Sewer System**

If present combined sewer system is kept as a measure sewer system in Nagoya, the Horikawa is never cleaned as a symbolic Canal that flows in mid of down town Nagoya. According to the overall sewer system in Nagoya, the Horikawa Canal-River is placed as a main sewer trunk. In rain falling times, very often the sewage including the excrements is directly released to the Canal without the disposal treatment, bypassing the disposal plant.

Many citizens are not well informed the technical weakness of this sewer system, and wishing to clean the Canal by sweeping the riversides, picking up the abandoned things in the Canal by social campaign in cooperation with the city administration. Citizens are often informed that the dirty water is the result of closed water area, so that a plenty of fresh water is needed to flow down the dirty water in the Canal.

The City of Nagoya searched a plan to inducing the water from other river to clean up the Canal. The plan made about 40 years ago to take clean water from Kiso River at 35 km north of Nagoya. The construction of the water channel was so difficult to across the urban area and too expensive for the cleaning of the Canal only. This water inducing plan was abolished about 10 years ago due to the heavy financial burdens.

In some areas, some over-flow control reservoirs were built to reduce direct flashing of sewage to the Canal. But total amount of available capacity of the reservoirs is so limited that the fundamental defaults of combined sewer system remain almost same as previous conditions.

In order to protect the continuous pollution of the canal, the combined sewer system must be changed to separate sewer system. Now, 98% of Nagoya City is served by public sewer system, and two thirds of the City area are applying for the combined sewer system. The Horikawa Canal-River is totally affected by this sewer system, and the water quality of the canal never be cleaned unless the present combined sewer system is completely modified. The radical change of sewer system needs a gigantic cost for installing another sewer pipe in the area of combined sewer system area.

Now, Nagoya city has almost full service of sewer system, so that the priority of the sewer service should focus on the upgrading of environmental quality. New pipes must be installed throughout the area of combined sewer system in overall network. The separation of sewer is so difficult, because not only at the public space on roads, parks, etc., but the numerous sewer pipes are already

combined in individual house. The separation of the pipes must be carefully done, and it takes a lot of time and requires a huge cost. But it must be accomplished in a long-term view to rejuvenate the Canal's environmental quality. The Horikawa Canal-River is not the mere canal running the urban area in Nagoya, it was a symbolic canal river with the historical origin and nostalgic canal with urban life, e.g. cherry blossom seeing, boating, out-eating so on.

#### **4. Rejuvenation and Regeneration of The Canal**

The tasks of the rejuvenation of Horikawa Canal-River are not only the improvement of the water quality, but it is aiming at the redevelopment of riversides providing open public access to the Canal. Many parts of the riversides today are blocked by buildings, and unable to access to the Canal. The rejuvenation of the Canal must consider to restore the open space along the Canal as it had in olden times. In this sense, the rejuvenation of the Canal is comprehensive redevelopment approach for urban regeneration of the Canal and its environs.

In down town area, the land price is so expensive to acquire to create the public pathway clearing the existing buildings. Currently, the City of Nagoya is providing the pathway at the edge of the Canal by narrowing the width of water area. This is damaging the original feature of the Canal. This is very easy approach for creating the pedestrian pathway design by engineer's way of thinking. Townscape along the Canal must be considered by more wider view of urban design concept clearing some buildings those are blocking the public access to the Canal and to enhance the visual amenity of urban canal.

The rejuvenation or regeneration of the Horikawa Canal-River must be handled in manner of comprehensive approach. It will have two major tasks to realize the aim of the canal rejuvenation and regeneration of the adjacent environments. For sustaining these programs, a range of different term spans and a variety of efforts must be continued as following actions lasting 100 years as maximum target year.

#### **5. Strategies for the Action**

Currently, Nagoya City has 2.2 million population, and the citizens are eagerly campaigning to rejuvenate the polluted Horikawa Canal as a symbolic and historic feature in Nagoya. This final chapter presents the strategies for the rejuvenation of the Horikawa Canal River itself and action programs of urban regeneration along the Canal in different ranges of terms.

#### A: Short term strategies (1-10 years)

- Dredging of the Canal should be continued mainly for sludge piled on the river bed those were released by over flow from combined sewer pipes.
- The polluted water and sludge in the Canal should be returned to the sewage disposal plant in non-rainy days. Particularly, winter is dry season, and has affordable treatment capacity in the plant.
- Continuous citizen's participation to clean the Canal to collect trash and other things.
- To build more numbers of sewage reservoir in case of heavy rainfall, and detent sewage should be treated later in non-rainy days.
- To start the installation of exclusive rain pipe to flow down to the Canal.
- Construction of water purification plant at every 1 km, or operated by purification ships.

#### B: Medium Term Strategy (10-30 years)

- Construction of intake and aqueducts to bring the clean water to the Horikawa Canal-River from other river. This requires a lot of cost and coordination with so many interests groups concerned, and also some criticisms come from harbor area because pouring the clean water in the Canal will push forward the polluted water and sludge to down stream and harbor area.
- Land and building acquirement of canal sides to create the pathways and canal vista.
- Promotion of urban redevelopment projects along the Canal.
- Application of Transferable Development Right (TDR) system should be encouraged to acquire the open space along the Canal.
- Continuous dredging and change of sewer system to separate sewage and rainwater.

#### C: Long Range Strategies

- To complete the sewer system as separate one avoiding the inflow of sewage in rain-falling time.
- To clean all sludge and sediments in the Canal, and bring back the natural environment with fish, weed, and other animals/Insects.
- To create urban water amenity as pedestrian pathways, boating enjoyment and seasonal events, so on.
- To create attractive urban vista with the Canal, open space and buildings standing the environs.
- To conserve historical settings and features, and accumulate cultural taste.