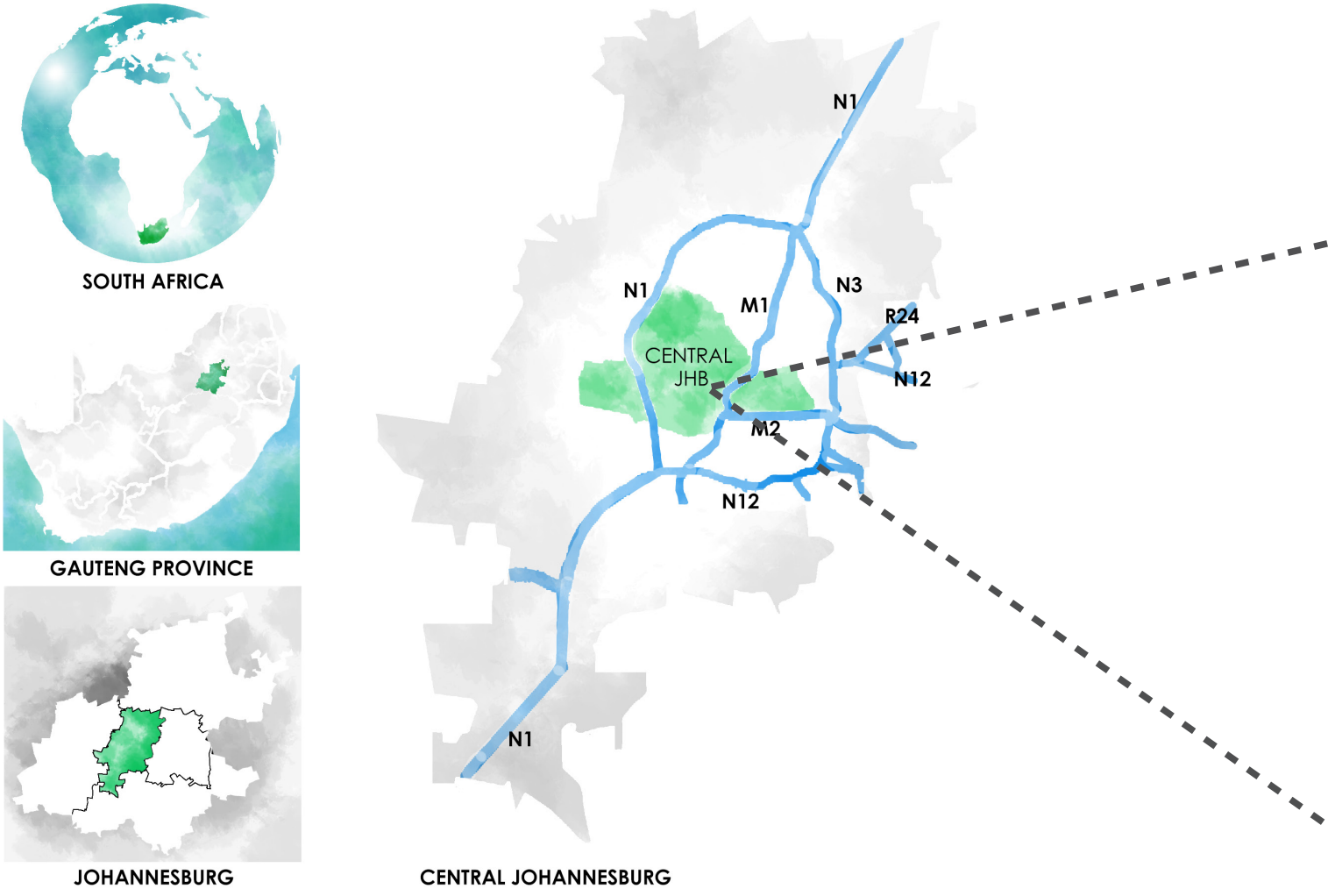
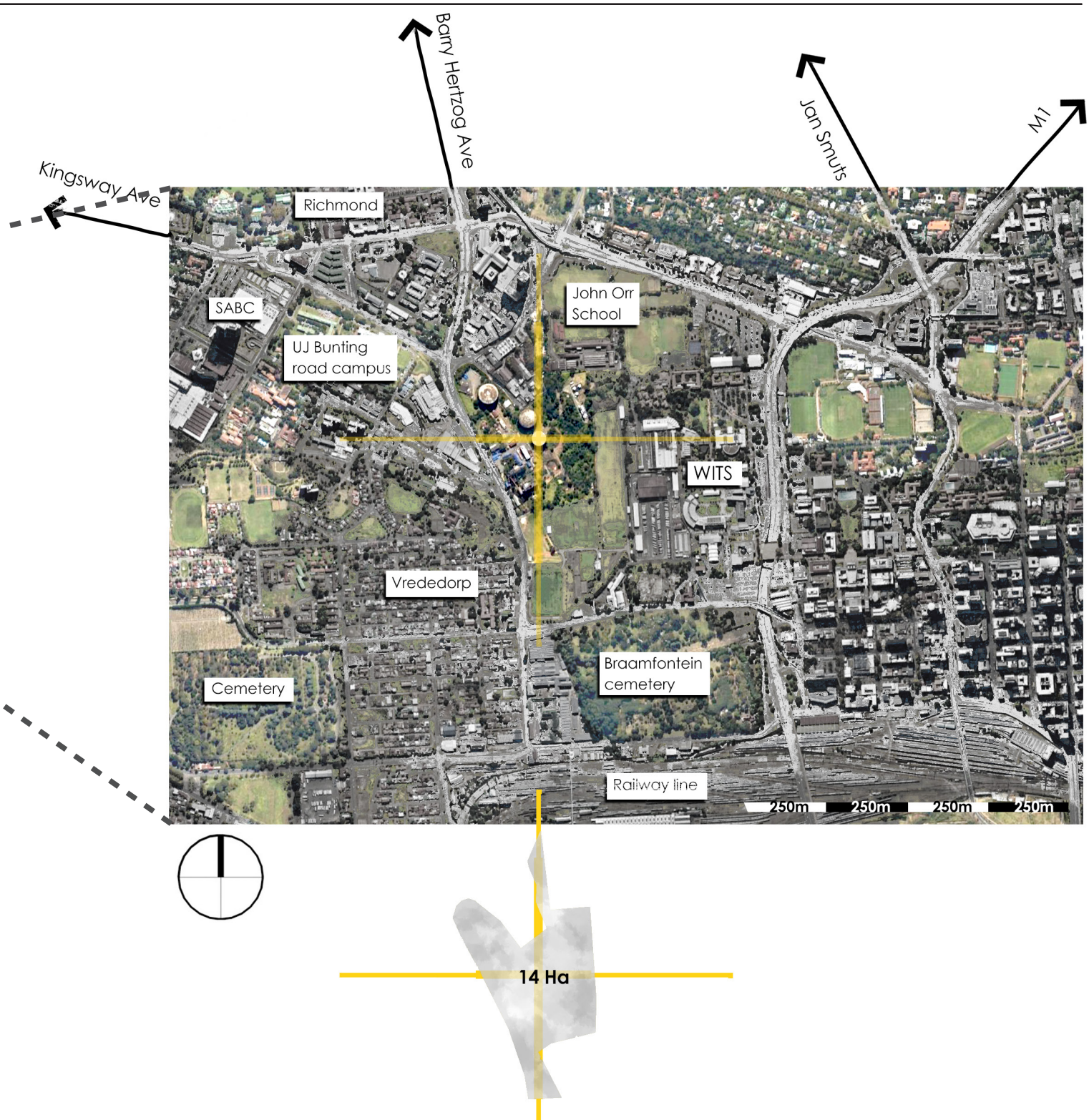
Chapter 2

The Site: The Johannesburg Gas Works

Figure 1 Site Location (Author, 2017)

2.1 Site Location





Bottom left: **Figure 2** Ecological condition (Author, 2017)
Bottom right: **Figure 3** Industrial condition (Author, 2017)
Far Right: **Figure 4** Post-industrial condition (Author 2017)

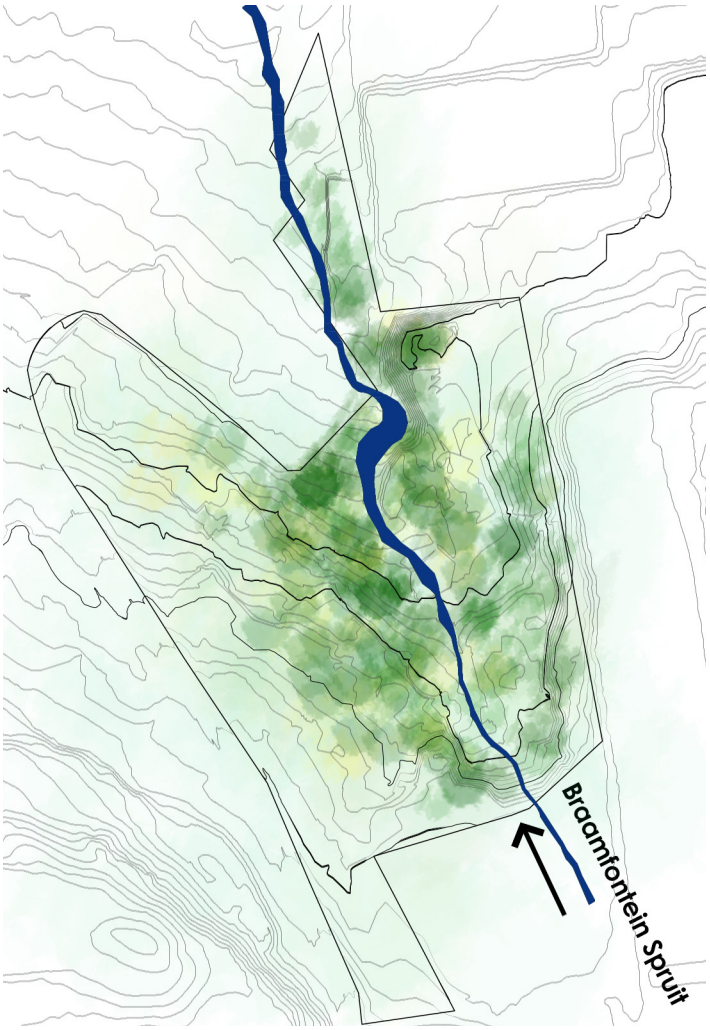
2.2 Site Morphology

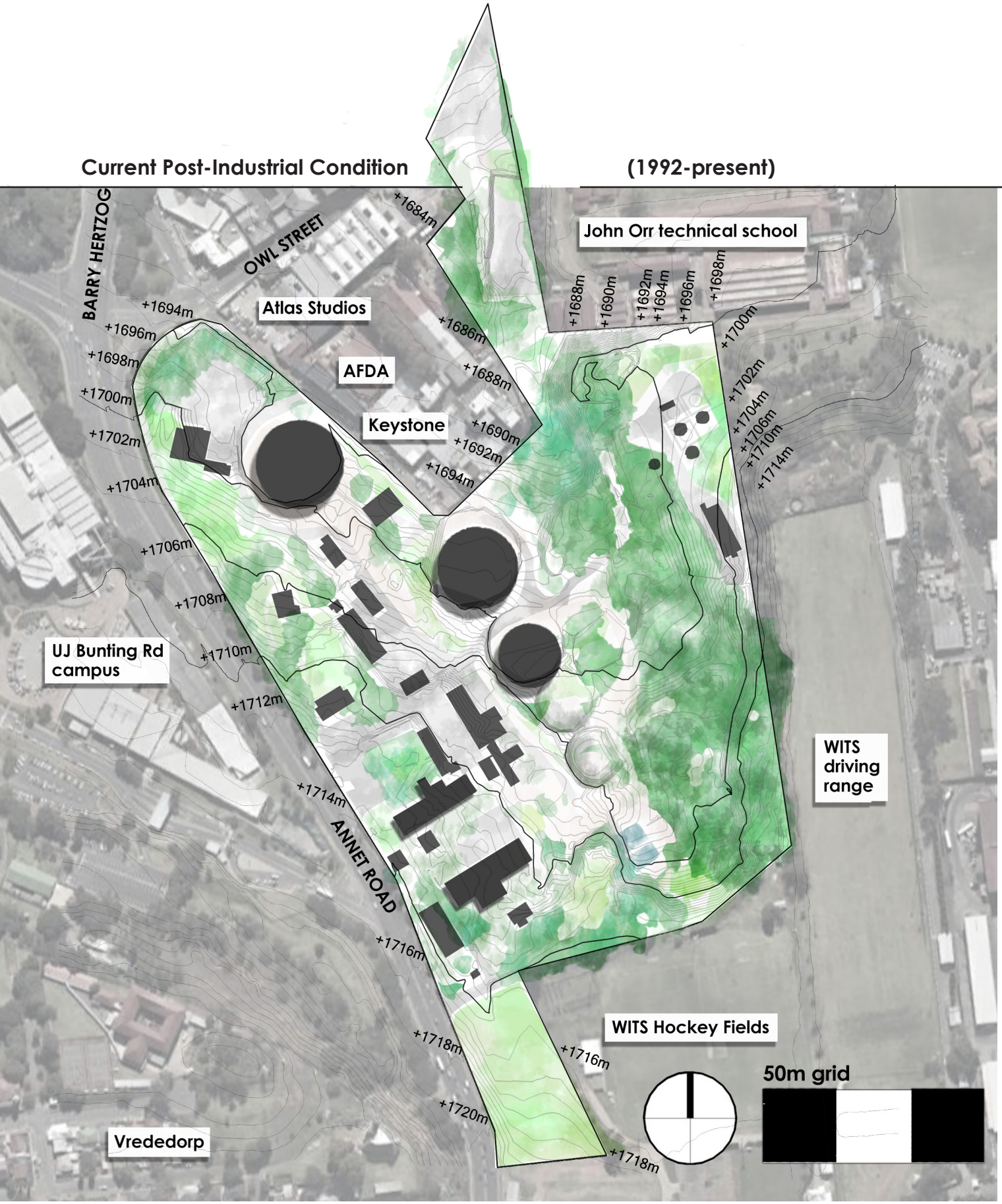
Ecological Condition (Prior to 1926)

Site features: The site's topography forms a basin-like valley within which the Braamfontein Spruit flows northward, from its source near the Braamfontein cemetery and joining other tributaries further North.

Industrial Condition (1928-1988)

Site features: The site's topography was found to be favourable for the coal to gas plant since the slope could facilitate the flow of runoff fluids and gas towards the gas storage tanks at the site's lowest point. The Braamfontein Spruit is channeled in an underground stormwater pipe to protect it's water from pollution.





2.3 The History of the Gas Works

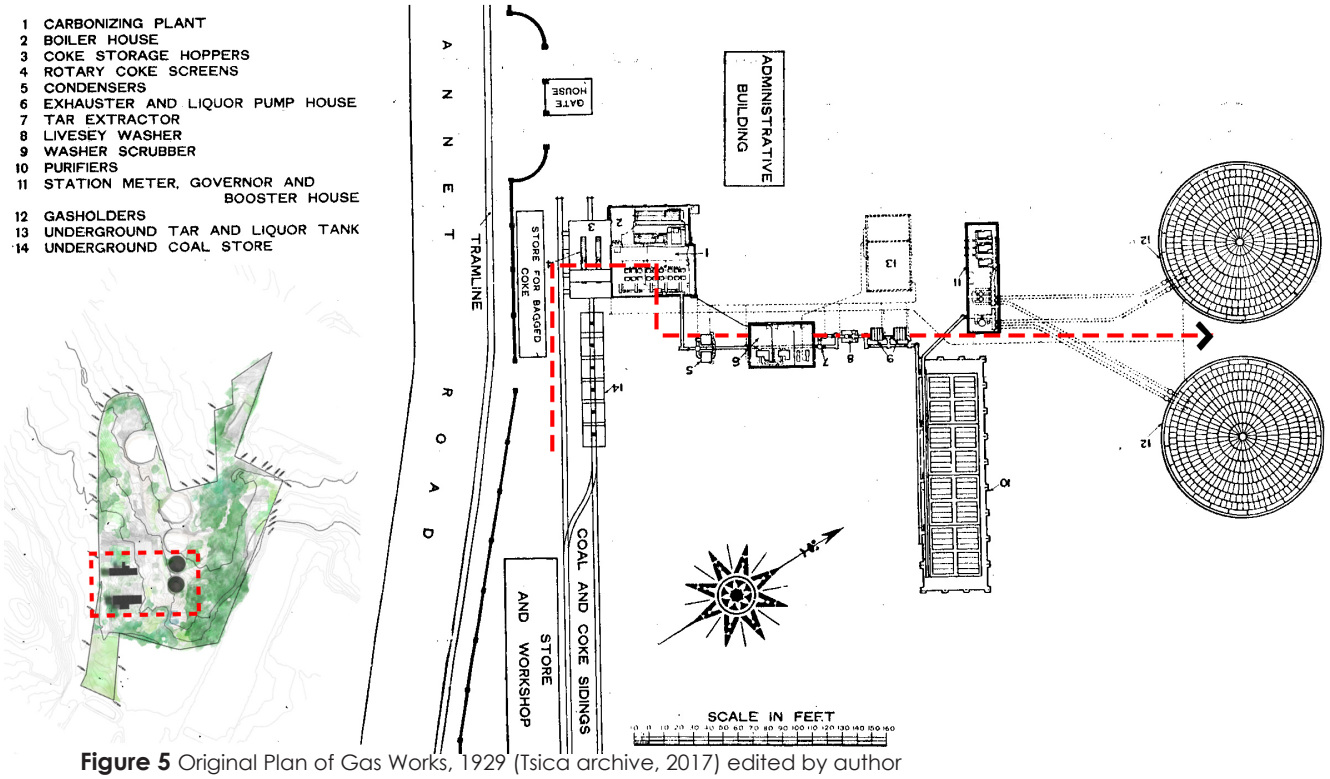


Figure 5 Original Plan of Gas Works, 1929 (Tsica archive, 2017) edited by author

Figure 6 View of Gas Works from Annett road looking East, 1929 (Tsica archive, 2017)

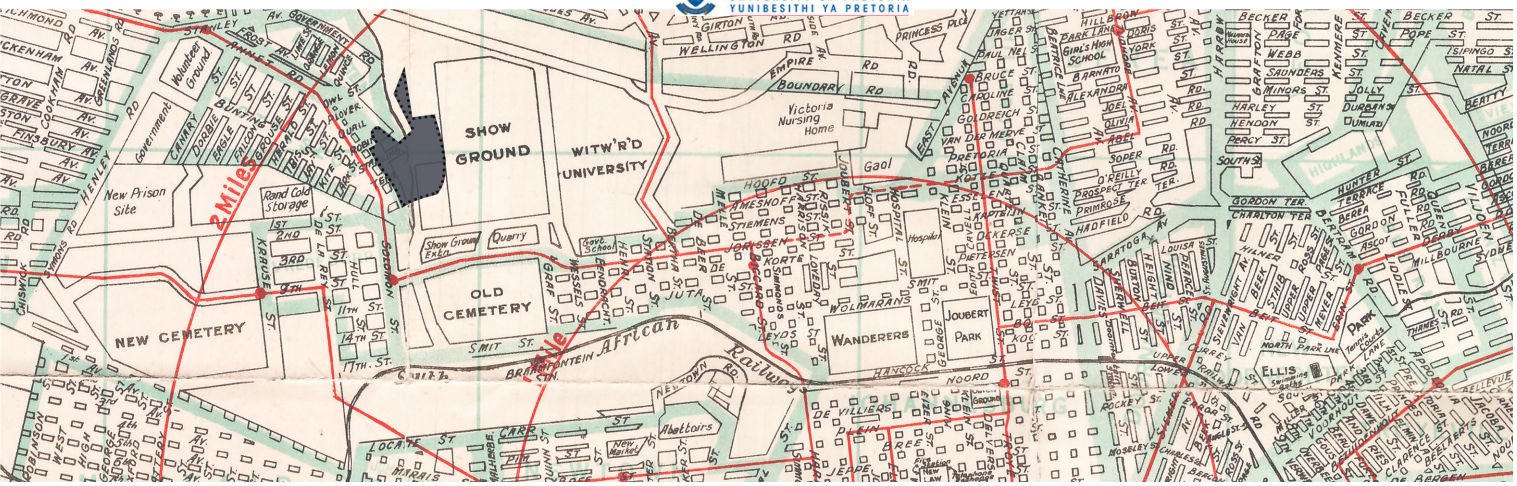


Figure 7 Holmden's street map of Johannesburg and suburbs (Map office, 1929) edited by author

2.3.1 Inception and early days

In the late 19th century for the then mining camp of Johannesburg, gas was initially supplied to meet the insatiable demand for power (Lauferts le Roux & Mavunganidze, 2016). In 1888 President Paul Kruger signed a concession leading to the construction of the first Gas Works site in President Street in 1892, four years after the first plant in South Africa at the Cape Town Gas Works. The need for expansion led to the search for a more suitable site and by 1928 the Gas Works moved to a site in Cottesloe. The site was a favourable choice due its topography since it could firstly assist in the gravity flow of gas and run-off fluids and secondly, render the largest structures on site relatively invisible from the richer neighbourhoods to the North. As can be seen in Figure 7, the site is situated about 3km from the then city centre which was a location far enough that the Gas Works could be relatively inconspicuous, but close enough to supply gas to its immediate surroundings. The original role of the Gas Works was to supply gas for street lamps, although it's distribution network has since grown to supply thousands of households with gas for cooking as well as industries who require gas as energy source. The Gas Works took advantage of the site's slope and as can be seen in Figure 5, the production of gas from coal followed a linear sequence from the coal drop-off point to the South-West downslope towards the No.1 & 2 gas storage tanks to the North-East. The Gasworks grew tremendously in its supply, from producing 3,9 million m³ in 1928 to a peak of 48 million m³ in 1948. After the early days of the Gas Works, this supply reached a peak until gas production started to decline in the period following the 1960s.

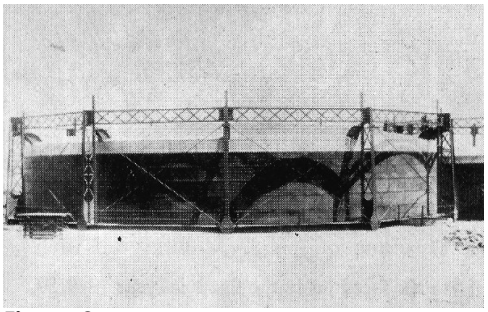


Figure 8 Gas storage tank at President street Gas Works (Tsica archive, 2017)

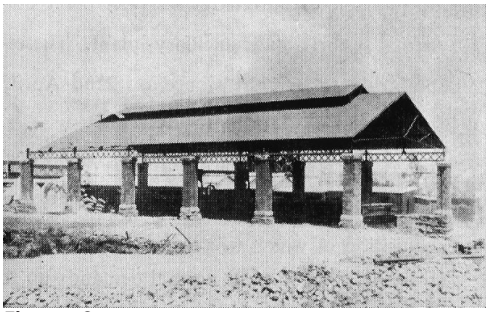


Figure 9 Purifiers at President street Gas Works (Tsica archive, 2017)

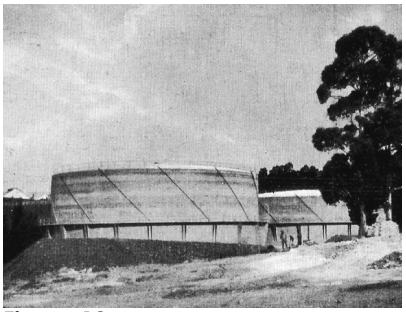
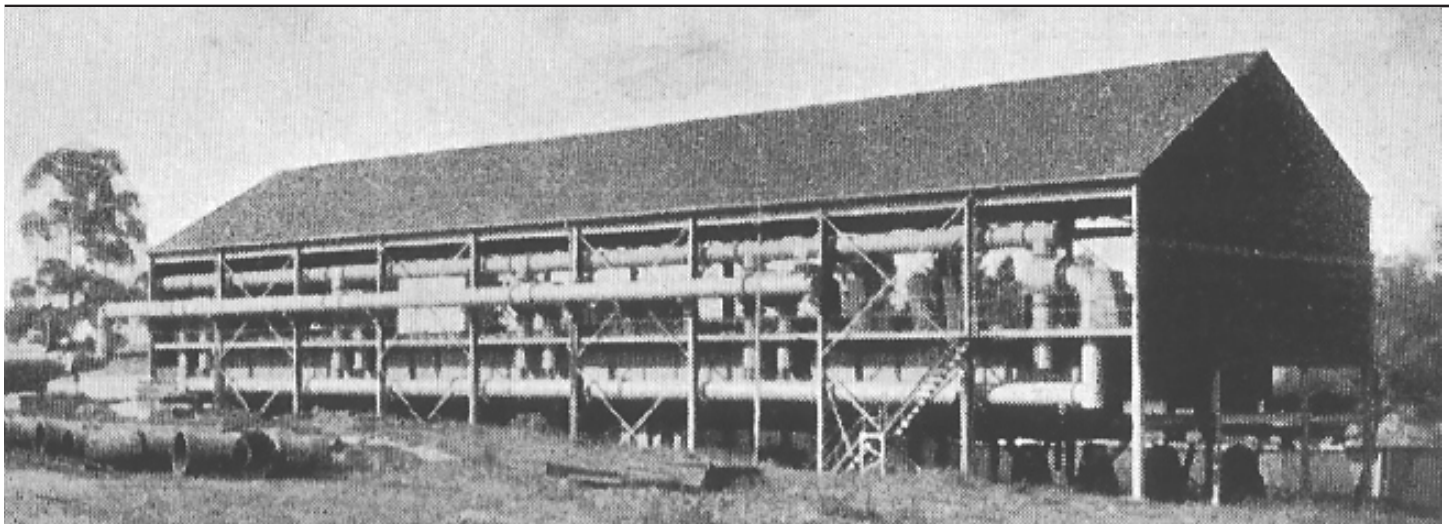
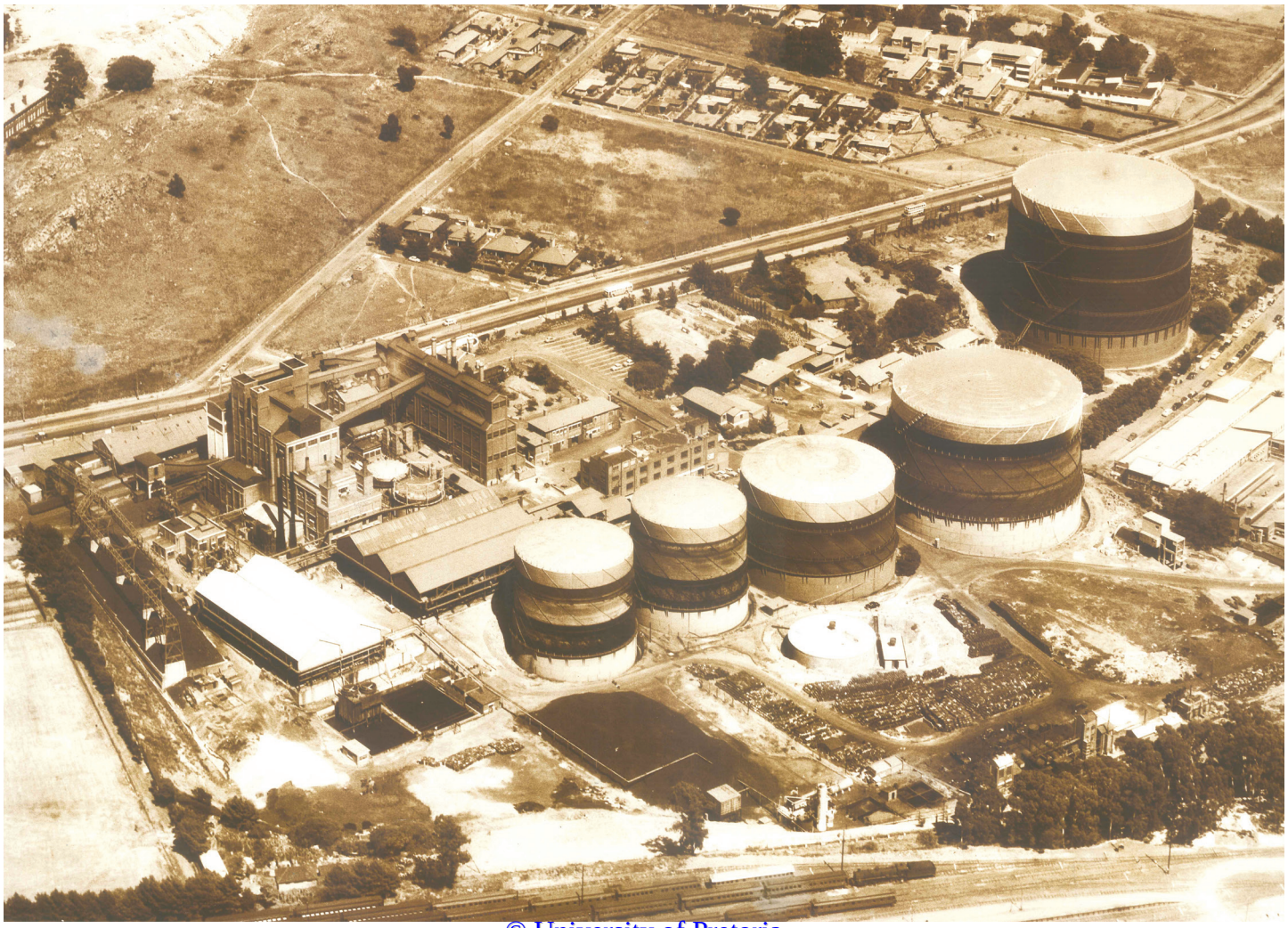


Figure 10 No.1 & 2 gas tanks at new Cottesloe site (Tsica archive, 2017)

Below: **Figure 11** Photograph of Purification plant, 1929 (Lauferts le Roux & Mavunganidze, 2016)
Bottom: **Figure 12** Aerial photograph of Gas Works site, 1960 (Lauferts le Roux & Mavunganidze, 2016)
Right: **Figure 13** Mr Therm, the mascot for Egoli Gas (Lauferts le Roux & Mavunganidze, 2016)
Far Right: **Figure 14** The liquid Ammonia collection area (Lauferts le Roux & Mavunganidze, 2016)





2.3.2 Years of growth & eventual shutdown

The Johannesburg Gas Works was designed with expansion in mind and in the 1940s and 1950s the company built three more gas storage tanks to make its twelve-fold growth in supply since 1928 possible. Many more structures were built, including retort no 2 (which together with retort no. 1 form the two most iconic buildings on the site) as well as four more purification plants similar to the one shown in Figure 11.

In this period of growth, the Gas Works maintained a good public image through clever marketing by using a mascot (Figure 13) in all of its advertising material. The public could access the site to collect free liquid ammonia since ammonia was one of the by-products of the gas-making process and could be used as fertilizer. It seems that in spite of this interactive relationship with the public, concerns grew surrounding the pollution caused by the Gas Works. Yellow gas plumes could be seen billowing from the retort building chimneys occasionally and concerns also revolved around the condition of the Braamfontein Spruit, running underneath the tar distillation area within a stormwater drain. Although the concerns regarding the water pollution were unfounded (Tsica Heritage consultants, 2011:12) the end of gas production drew near for the Gas Works as natural gas began to be supplied from Mozambique via Sasol Secunda. The reasons for this transition was that the demand for gas had grown and secondly, the gas being supplied by Sasol was said to be of a higher quality.

Thirdly, the technology that was used on site was outdated by this time and it made more economic sense to buy gas from Sasol than to produce on site. In so doing, the existing distribution network could still be used to distribute gas to the city rather than produce on site. In the late 1980s the Gas Works was only producing 5% of the gas needed by consumers and in 1988, the decision was made to decommission the Gas Works as a gas producer.

The city leased it's asset to a private company to run its operations but by 1992 the lease was terminated and the Gas Woks officially shut down in July 1992. In 1993 the demolition of various structures on site commenced as the city sought to open space for other purposes. Perhaps the intention was that these new open areas could be leased out, similar to the two other existing leases on site. In 2003 the Gas Works site was sold to a company of which Egoli Gas owns 5% and it has since become profitable as gas pipes in Johannesburg are being relaid to provide more households with natural gas. The current brand identity of Egoli Gas has actually placed the heritage buildings in a more stark contrast to the company's operations. Only the distribution plant and three remaining gas tanks are used currently but since the company can shift it's location to another smaller location, the fate of the site and these structures in their post-industrial state remains to be seen.

2.3.3 The Gas Works and cooking

A little known aspect of the Gas Works heritage is it's connection with cooking. The marketing mentioned above was aimed at popularizing gas as a preferred energy source for cooking and to market this to the public, the Gas Works had its own showroom containing various American and British gas stoves on sale. The showroom with stoves are still on display to this day and was used for decades for cooking demonstrations (Figure 15)

The Gas Works even compiled and sold a cook book containing recipes for meals that were ideally prepared on gas appliances. This was one the few ways that the Gas Works maintained an interactive relationship with the public.

Left: **Figure 15** A cookery demonstration at the showroom at the Gas Works (Lauferts le Roux & Mavunganidze, 2016)

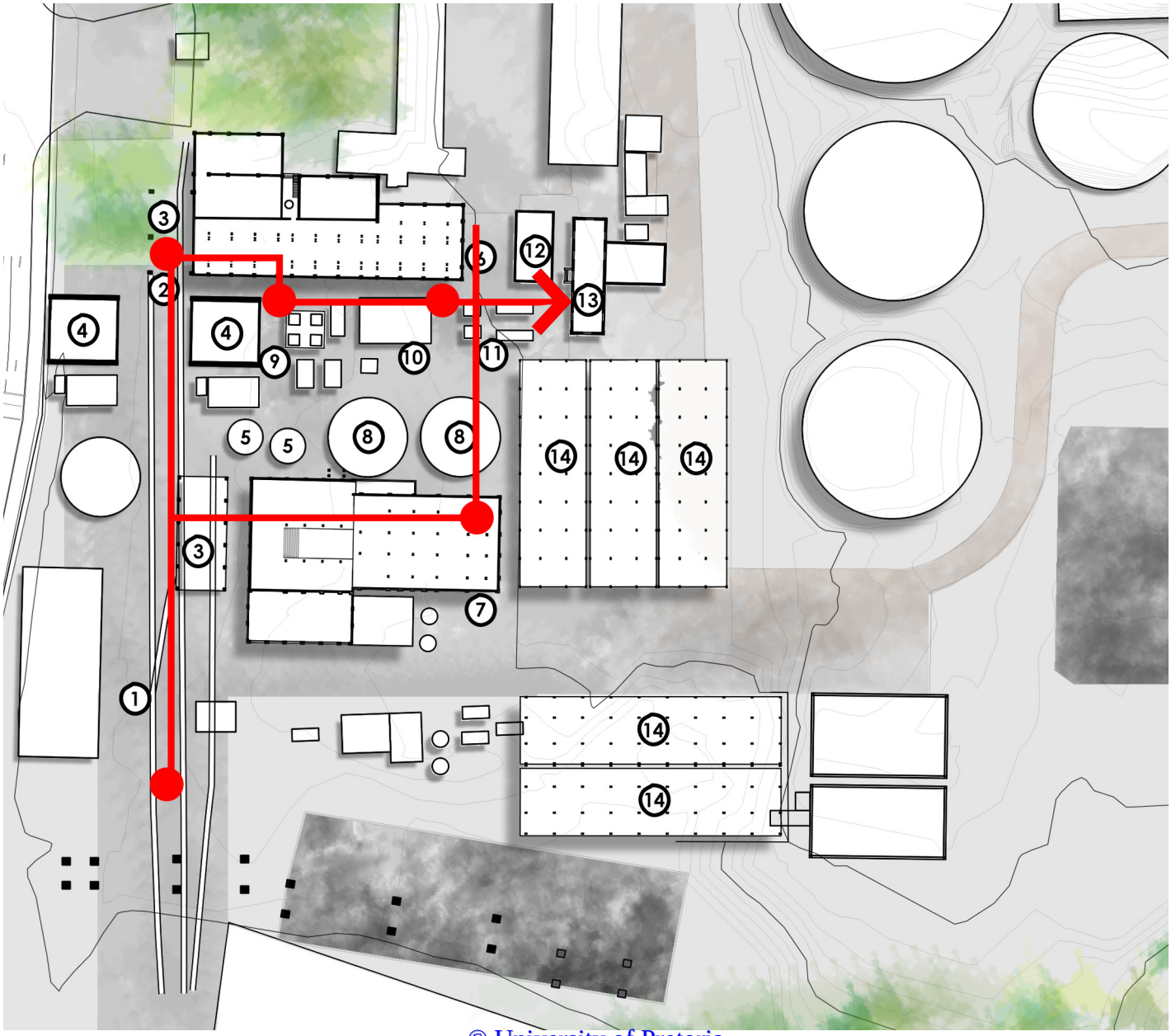
Bottom: **Figure 16** Gas stove cooking (iStock, 2017)

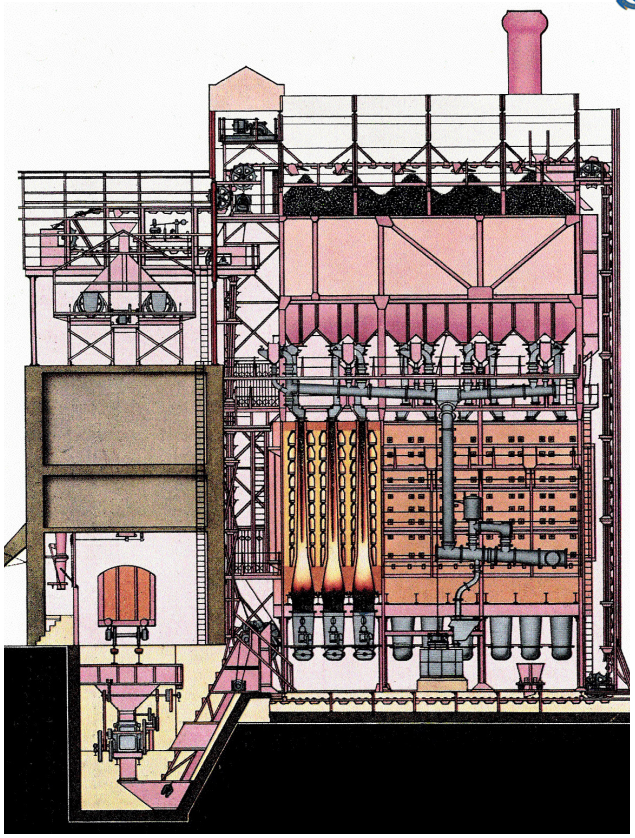
2.4 Gas production from coal

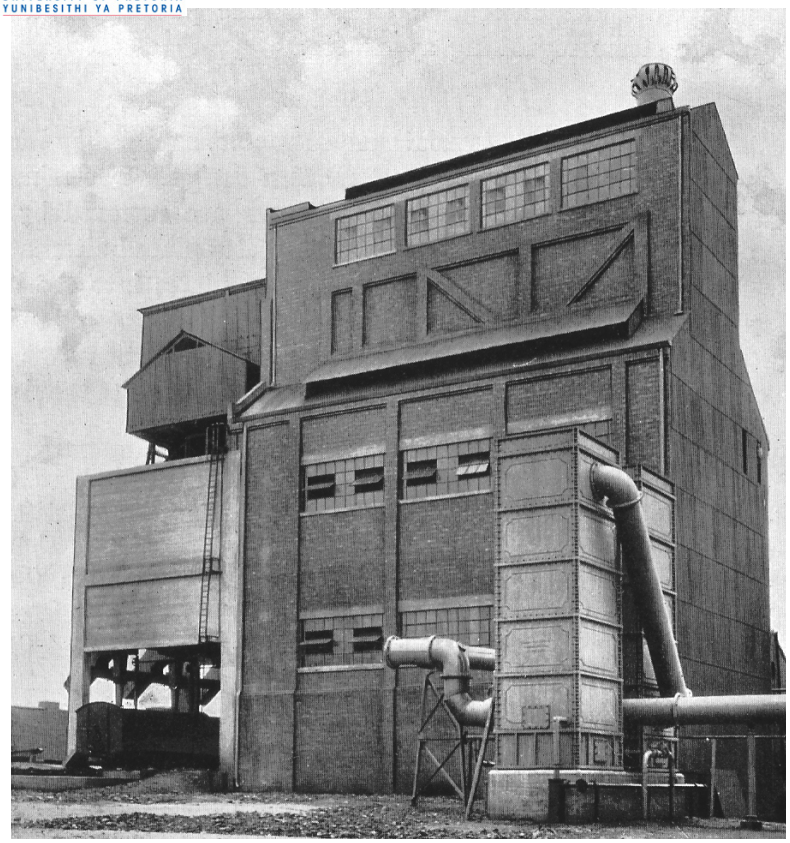
The process begins with coal being delivered by rail after which it is elevated by means of a conveyor system to the coal bunkers at the top of the Retort. As it gravitates down inside the Retort, it is heated until it breaks down chemically into a foul gas, tar and coke. The foul gas is partially cooled with water sprays, which causes the tar vapours to condense. The condensed water and tar then flow together towards the tar and liquor well. Upon leaving the Retort the gas passes through condensers, which cools it down to room temperature. During this cooling, condensate known as gas liquor separates and also flows towards the tar and liquor well.

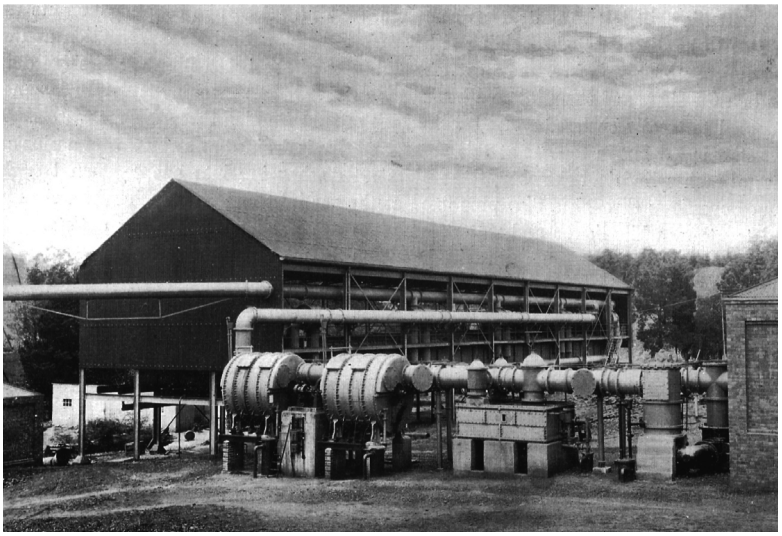
The gas then passes through the exhausters which provides the necessary pressure differential to drive the gas towards the Gas Holders. On the delivery side of the exhausters the gas passes through a electrostatic detarrer that draws the remaining tar out of the gas by means of an electric charge of 30 000 volt.

The gas then passes through a series of washers, firstly the Livesey washers, then the rotary multi film washers. Here, a counter-current of water is brought into contact with the gas. Being soluble in water, the ammonia, present in the gas as an impurity, is removed.









Top Left: **Figure 17** Longitudinal section through Retort House 1 (Tsica archive, 2017)

Top Right: **Figure 18** Retort House 1 with condensers in foreground (Tsica archive, 2017)

Far Left: **Figure 19** Plan of structures involved in process and direction of energy flow (Author, 2017)

Left: **Figure 20** Condensers (item 9) in their current state (Photograph by author,2017)

Right: **Figure 21** Livesey and rotary multifilm Washers (item 11) with purifier (item 14 on plan) shown in back ground (Tsica archive, 2017).

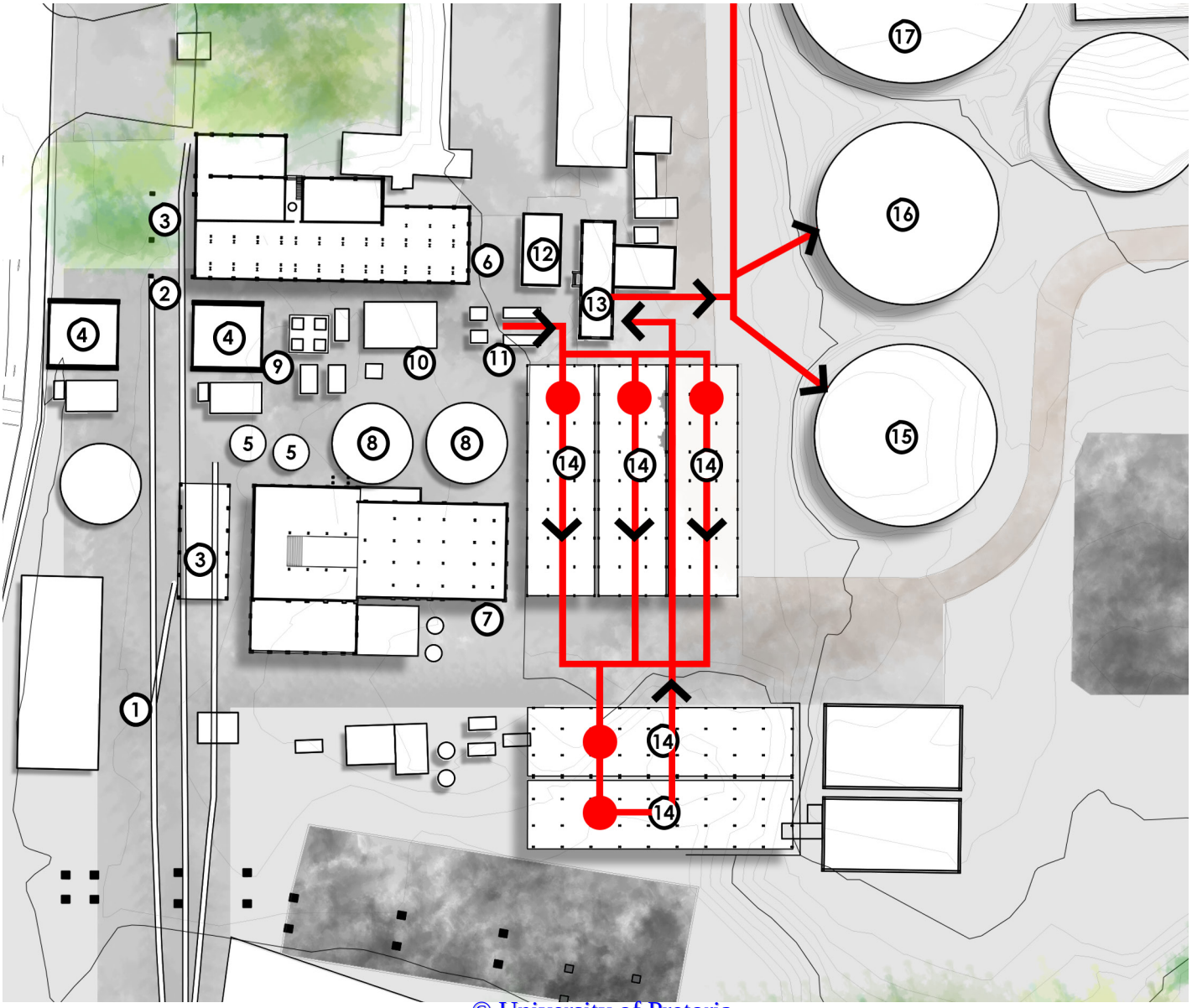
Plan legend of relevant structures

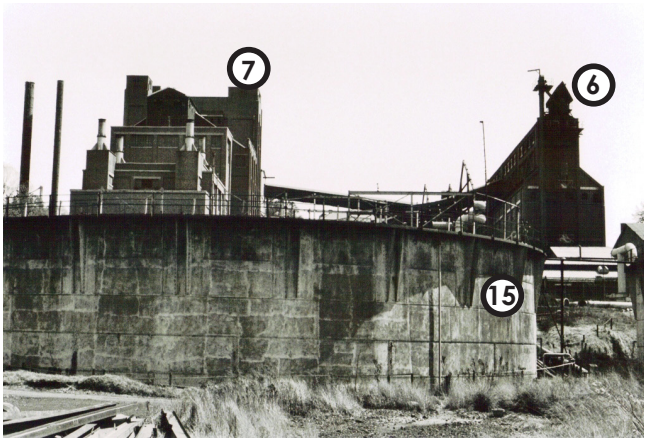
1) Railway line
2) Coal drop-off point
3)Coke bunker and coal bunker above
6) Retort House 1
9) Condensers
10) Exhausters and detarrer
11) Livesey and Multifilm Washers
14) Purification plants

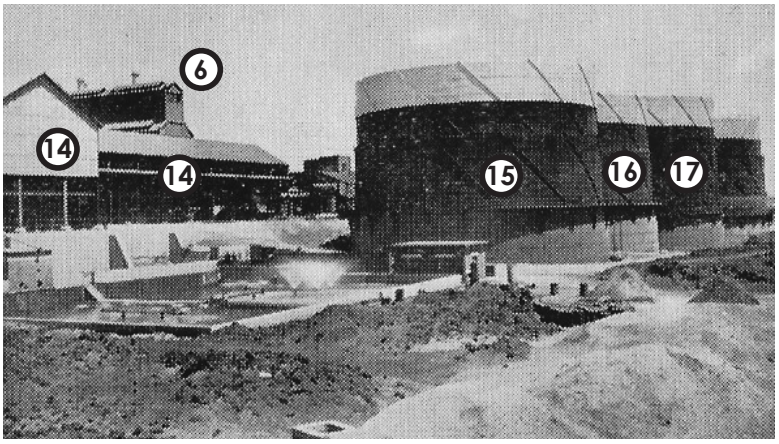
After ammonia has been removed by the washers and has flowed as ammonia-laden water to the tar and liquor well, the only remaining major impurity in the gas is hydrogen sulphide. This was removed in the form of solid sulphur by mixing the gas with a small amount of air and passing it over an iron oxide catalyst supported on a suitable porous medium, such as wood shavings.

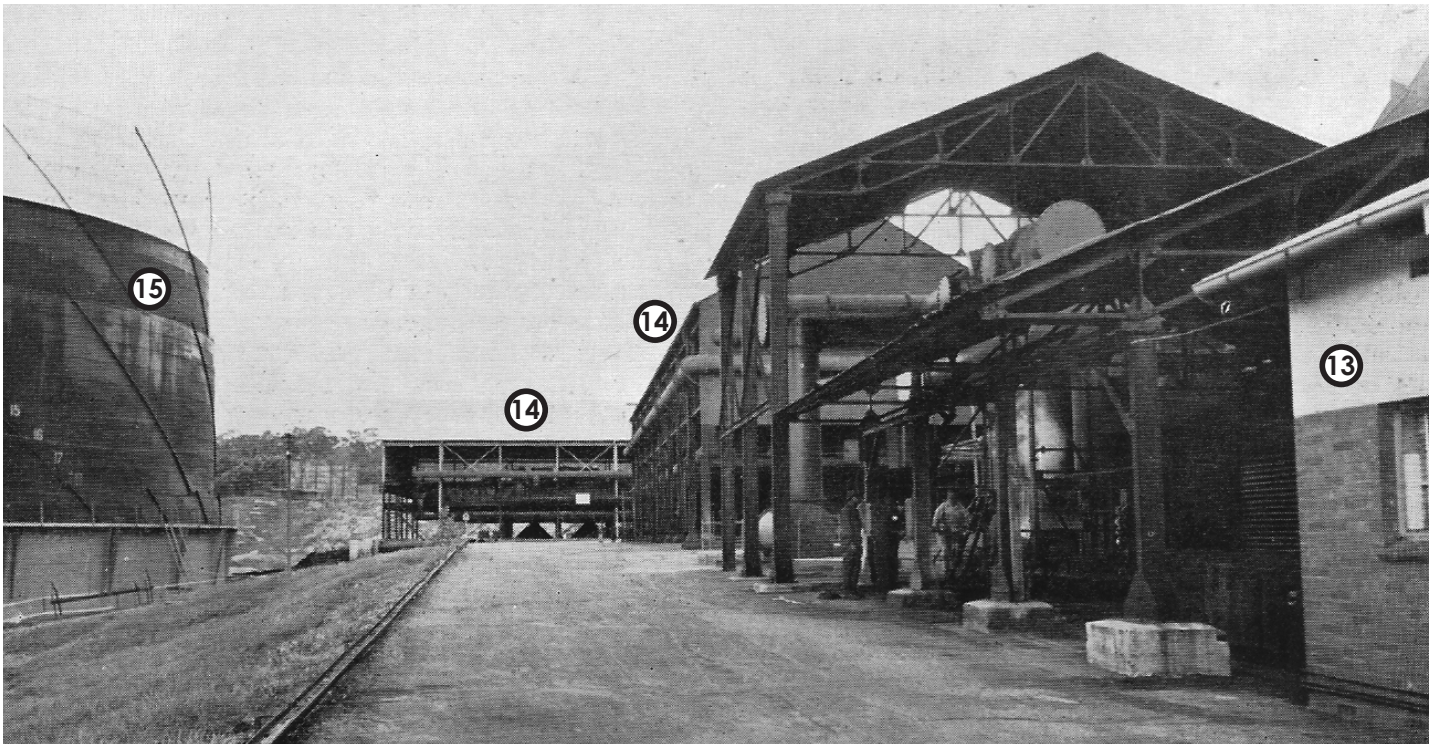
This process was facilitated within the Purification plants. After this the gas passes to the distribution plant or also known as the governor and meter house.

In here, gas flow is then measured by means of a station meter for accounting and record purposes and stored in the gas tanks. From the gas tanks the gas can follow two different paths. The first is via a governor to reduce the pressure to a value suitable for direct supply through a customer's meter into the customer's premises. The second is via the boosters into the high-pressure system, which carries the gas to strategic points throughout the city, where district governors allow the gas to flow at a lower pressure into the low-pressure distribution system.









Plan legend of relevant structures

11) Livesey and multifilm washers
13) Distribution plant
(meter and governor house)
14) Purification plants
15) Gas storage tank 1
16) Gas storage tank 2
17) Gas storage tank 3

Far Left: **Figure 22** Plan of structures involved in process and direction of energy flow (Author, 2017)

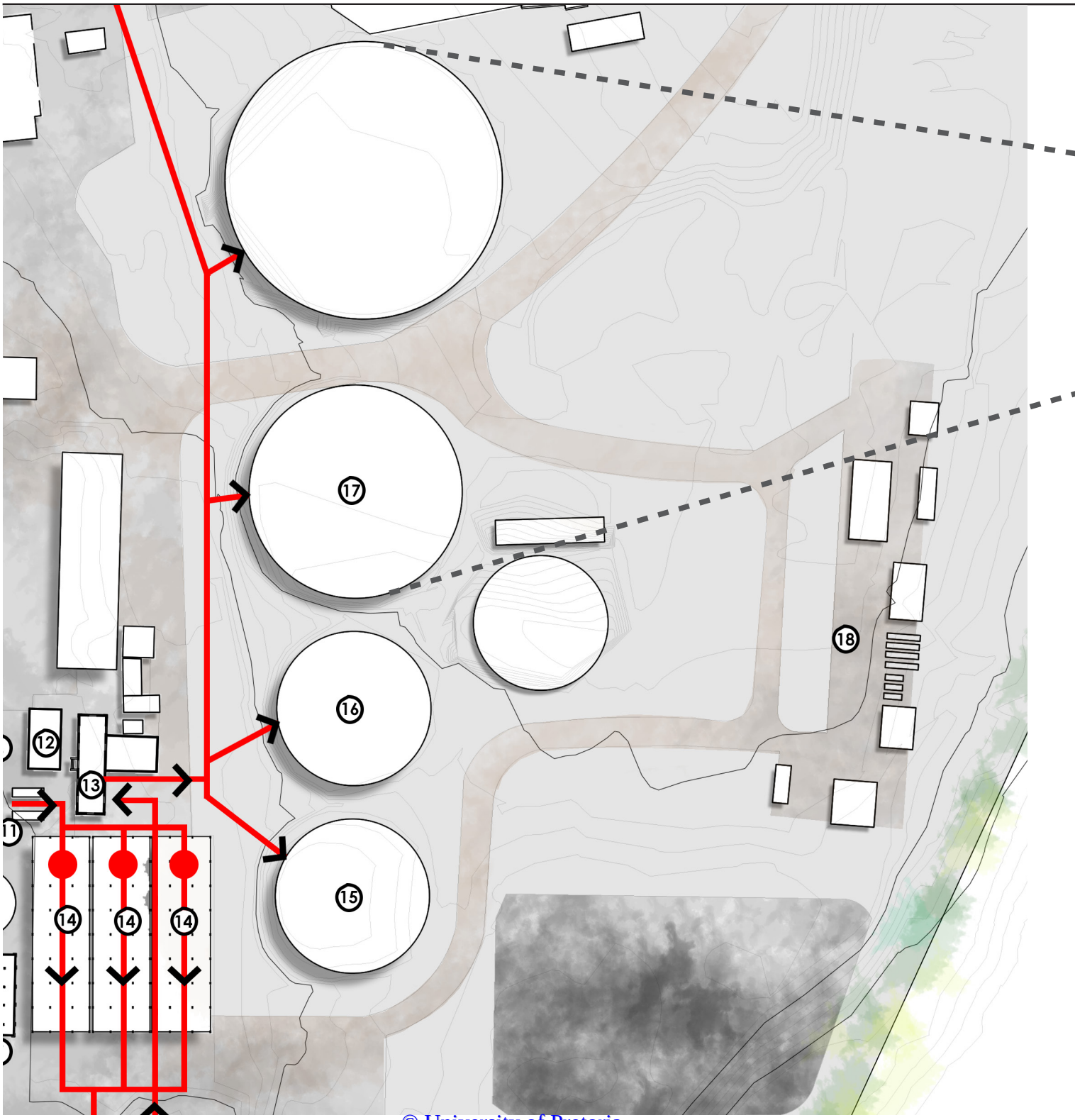
Top Left: **Figure 23** View towards Retort No 1 & 2 (Tsica archive, 2017)

Top Right: **Figure 24** View of the No 1,2 and 3 gas storage tanks (Tsica archive, 2017)

Above: **Figure 25** View towards easternmost purification plants (Tsica archive, 2017)

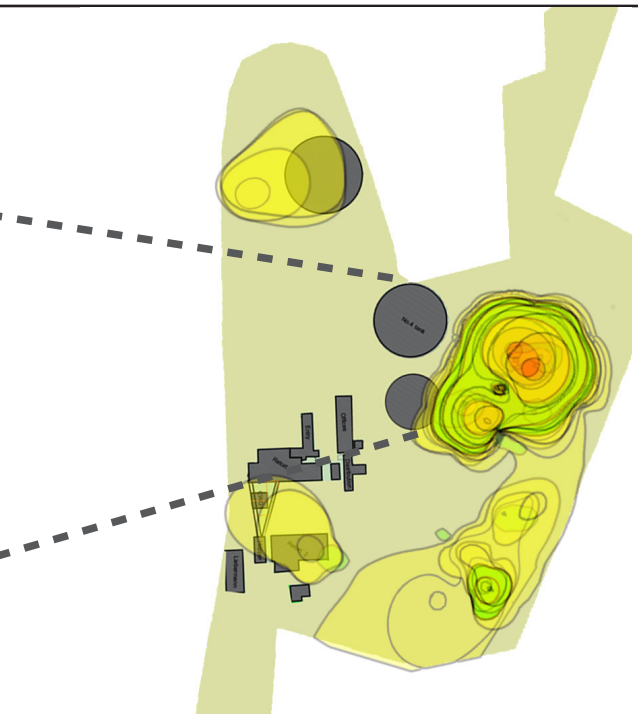
Legend of relevant structures

11) Livesey and multifilm washers
13) Distribution plant (meter and governor house)
14) Purification plants
15) Gas storage tank 1
16) Gas storage tank 2
17) Gas storage tank 3
18) Tar distillation plant



Bottom: **Figure 26** View on tar distillation plant_1950 (Lauferts le Roux & Mavunganidze, 2016)

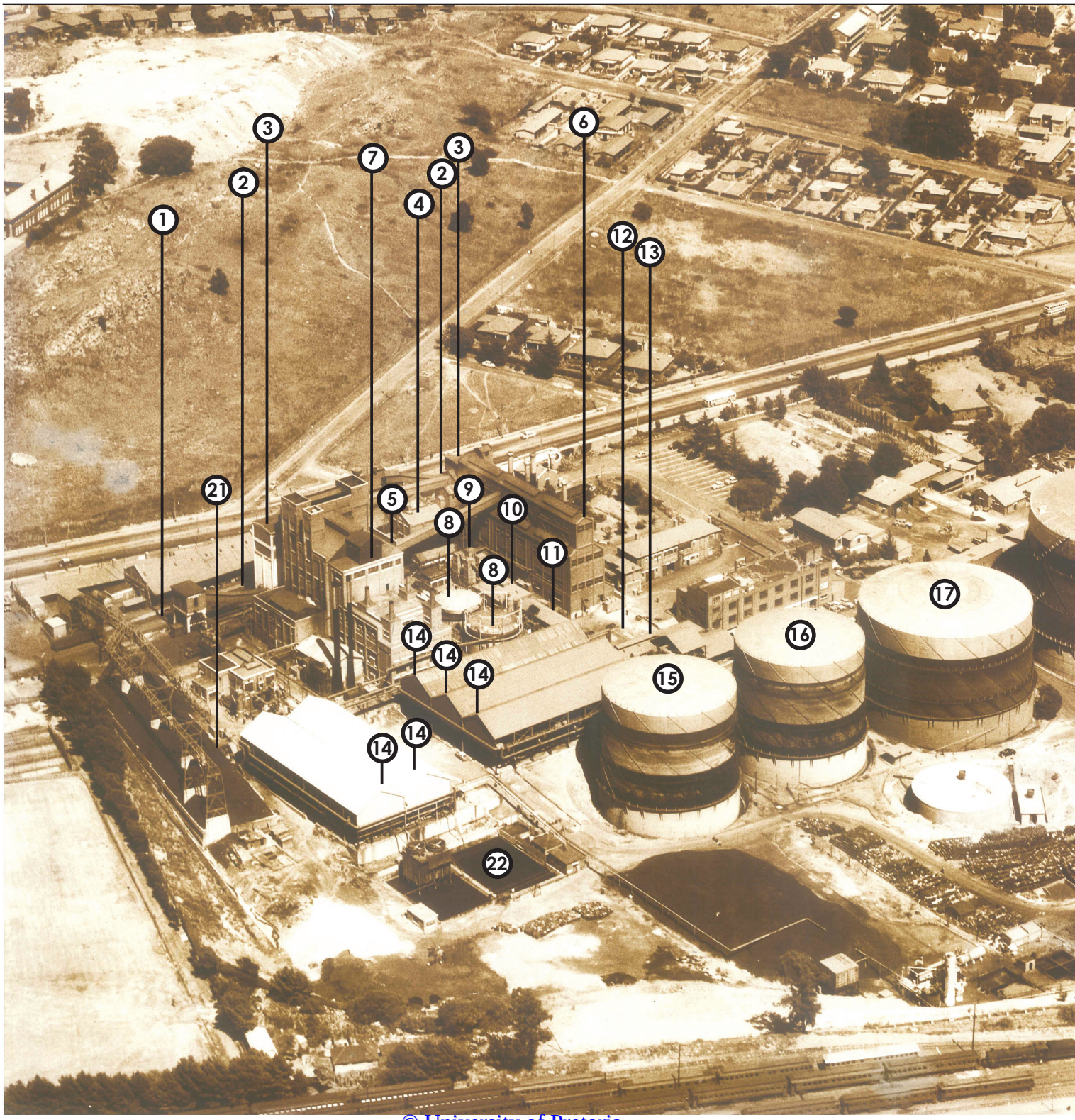
Below: **Figure 27** Pollution distribution diagram (Author, 2017)

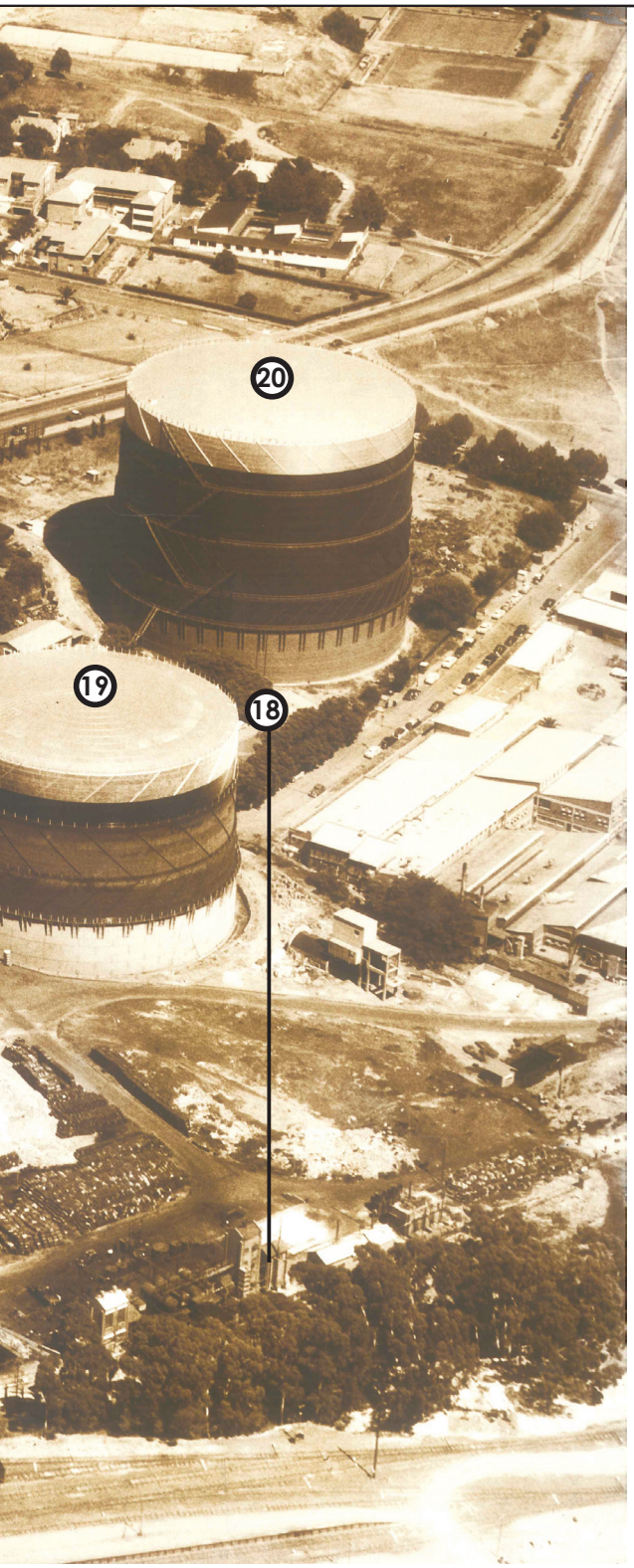


The Distillation plant

Since tar was one of the main by-products of this method of producing gas, it was required to build two tar distillation plants on the Eastern boundary of the site capable of handling 30 tons per day. The area of the site where tar was distilled has become severely polluted as a result of the soil's exposure to tar. The tar distillation plant has since been demolished but the layers of coke, tar, creosote and other hazardous materials are left as legacy and this area requires the most drastic remedial intervention of all the site.

Figure 28 Aerial of the gasworks site from the 1950's (Isica archives, 2017) edited by author





Industrial structures

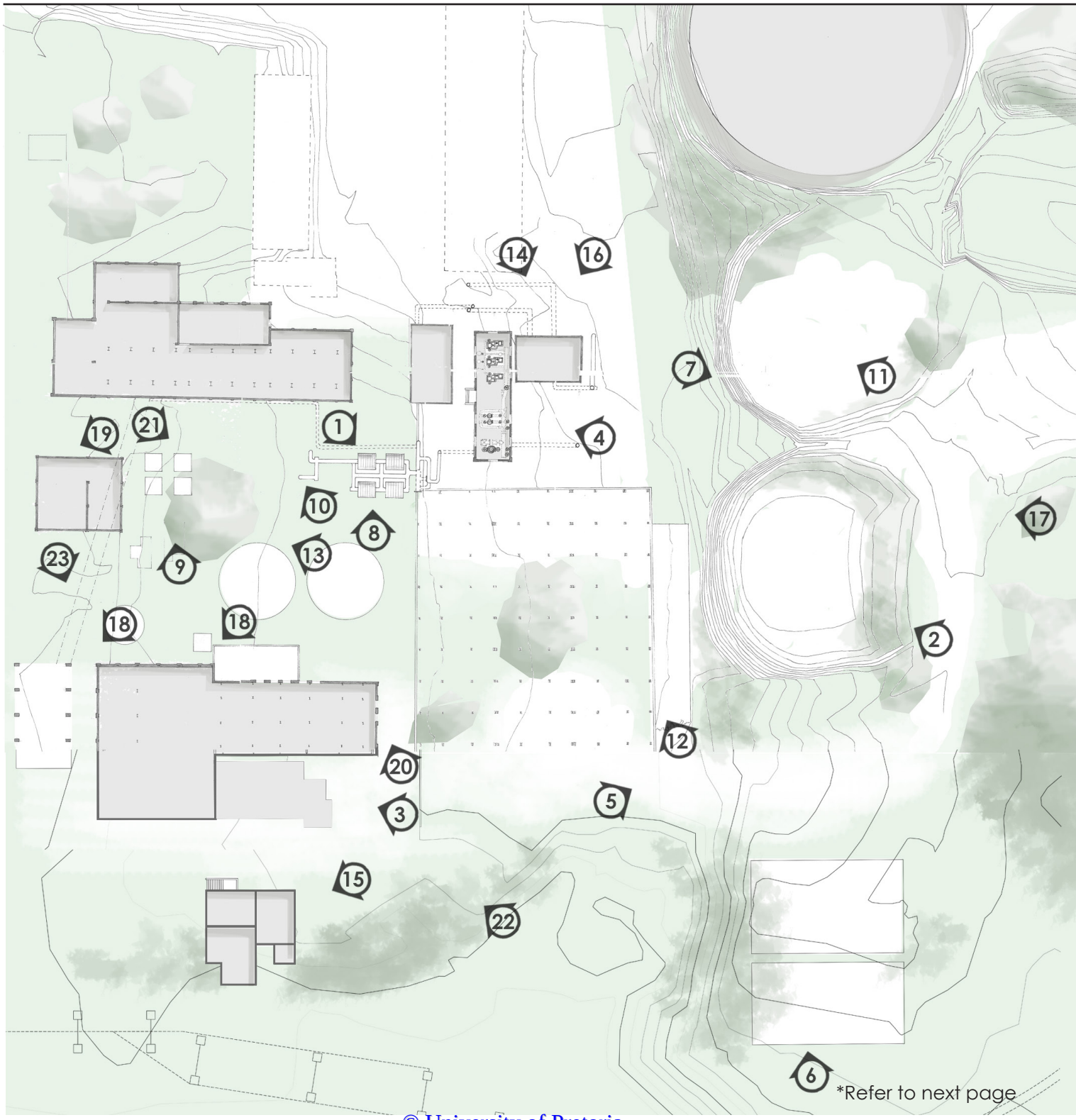
1) Railway line (demolished)
2) Coal drop-off point
3) Coke bunker and coal bunker above
4) Carburetted Water Gas plants
5) Small circular tanks (purpose unknown) (demolished)
6) Retort No. 1
7) Retort No. 2
8) Medium gas tanks (purpose unknown) (demolished)
9) Condensers
10) Exhausters and detarrer
11) Livesey and Multifilm Washers
12) Distribution plant additional building
13) Distribution plant (governor and meter house)
14) Purification plant (All five demolished)
15) Gas tank No.1 (demolished)
16) Gas tank No. 2 (demolished)
17) Gas tank No. 3 (operational)
18) Tar distillation plant (buildings demolished)
19) Gas tank No. 4 (operational)
20) Gas tank No. 5 (operational)
21) Weigh bridge
22) Cooling ponds (overgrown)

Figure 29 Aerial of the gasworks site (Tsica archives, 2017) edited by author

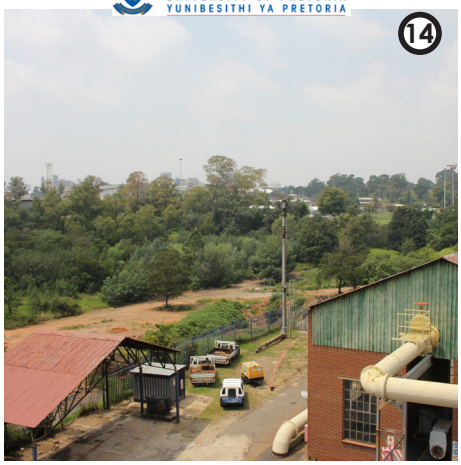
2.5 Present day zoning

At present there are three distinguishable landscapes observable on site of which the industrial core will be the particular site of investigation. From an early stage in the site research, it was decided that all four architectural interventions proposed for the Gas Works site will be located within the industrial core. The industrial core contains the most valuable heritage buildings on the site since it contained the essential industrial components for the production of gas. The auxiliary functions to the north were among others, the site managers house the labourers canteen. Although the reasons for focusing the schemes within the core are elaborated on in the urban vision description, this decision focused the site research to this particular zone

2.6 Present day condition of industrial core



*Refer to next page



2.7 Unpacking the immediate site (the identification of order and place)

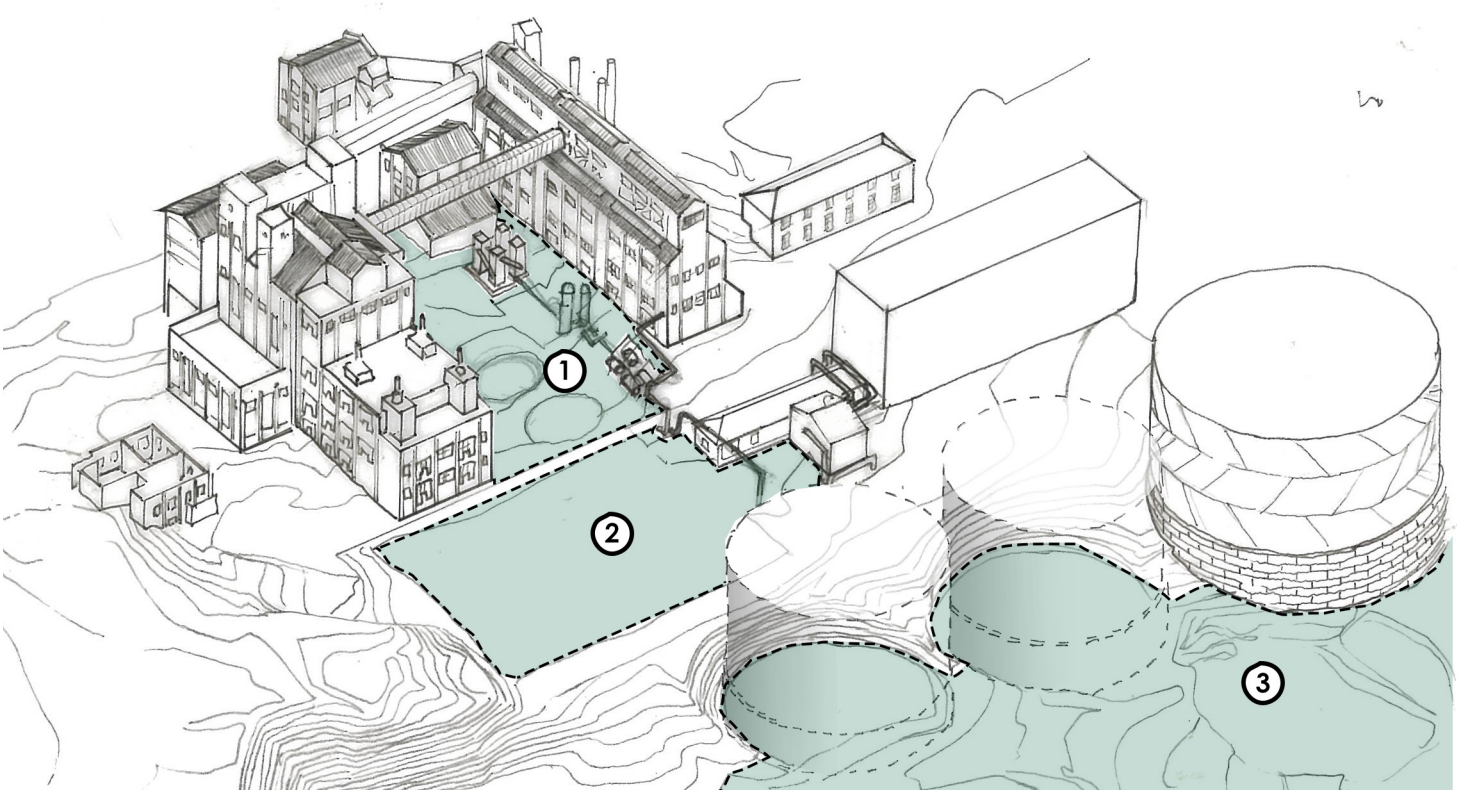


Figure 30 Identifying zones and place (Author, 2017)

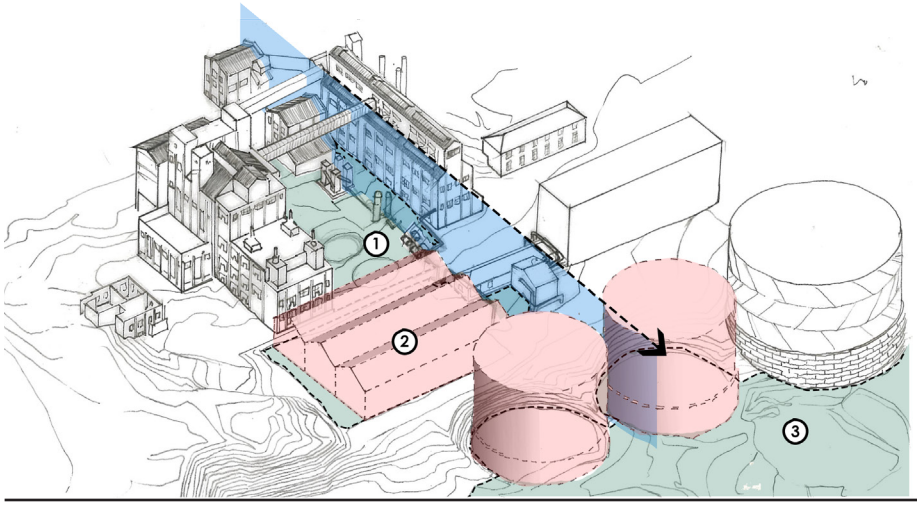
2.7.1 Identifying zones and place

Within the central zone of the site or the "nucleus" of industrial activity, the topography has been altered to create three zones. These zones can be identified by their roles in the production of gas from coal and are:

1) Production from raw materials,
2) Purification from impurities and distribution and
3) Reception and storage.

It is important to note that understanding each zone or place within the Gas Works site depends upon understanding it in relation to other zones. This is especially the case in zone three, where the large circular holes and severe soil pollution can only be understood as the result of the activities occurring up-slope in zones one and two. Maintaining an understanding of the nature of these zones should guide any new architectural or landscape interventions if the uniqueness of place is to be maintained.

Figure 31 Zones of industry, sequence of industry and demolished structures. (Author,2017)



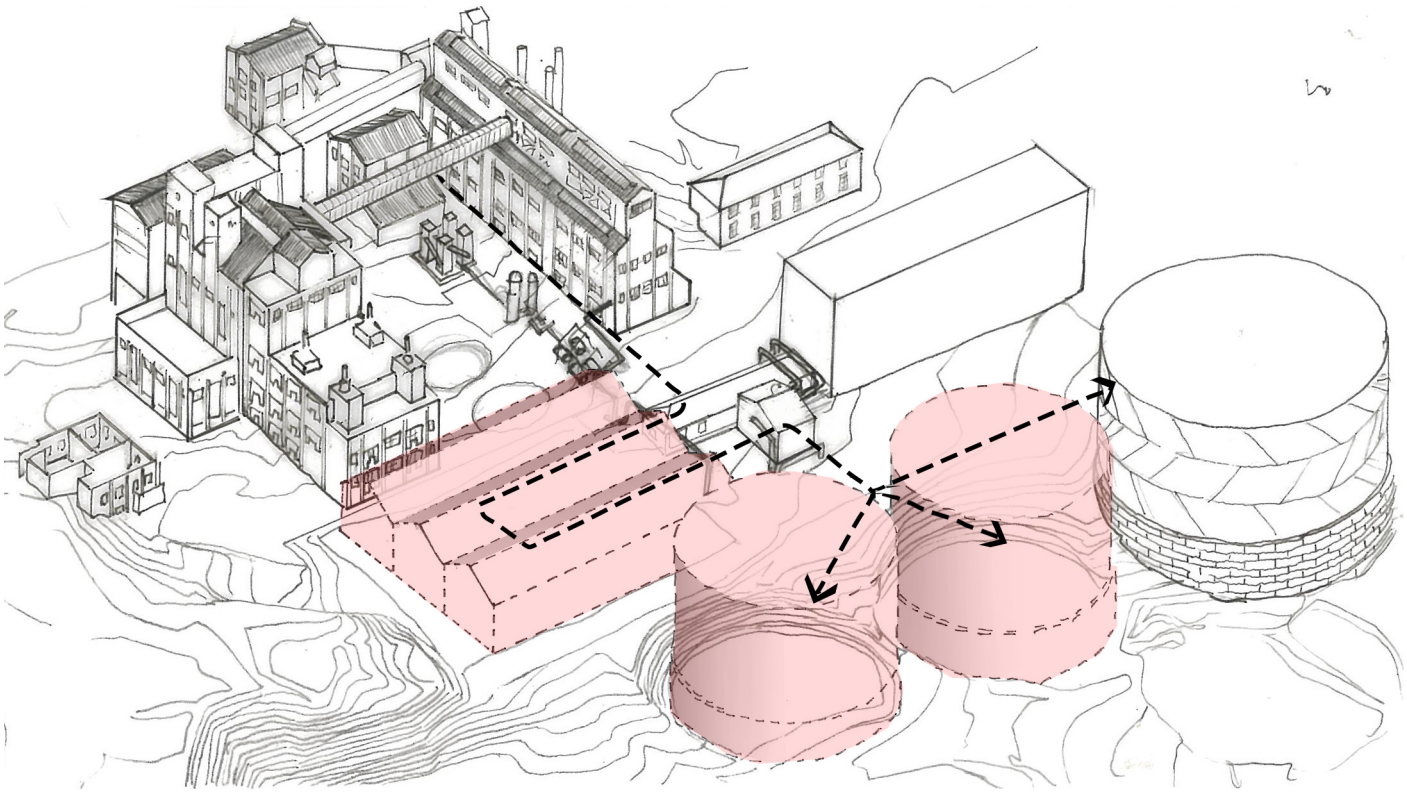


Figure 32 Demolished structures and their role within the sequence of the industrial process (Author, 2017)

2.7.2 Broken coherence

The five structures shown highlighted above, the three purification plants and the No 1 and 2 gas tanks, are the five significant structures of which there are still legible remains. Their presence signifies the last two steps of the coal to gas process. All that remains of the purification plants are the foundations and stub columns that protrude from the ground. The uniqueness of the Johannesburg Gas Works site as an industrial artifact is that it has the quality of a living museum, where the process of gas production follows a legible, linear sequence towards the North-East. Therefore, remaining conscious of the presence of these structures will ensure that the heritage and story behind the gasworks will remain legible on the site.

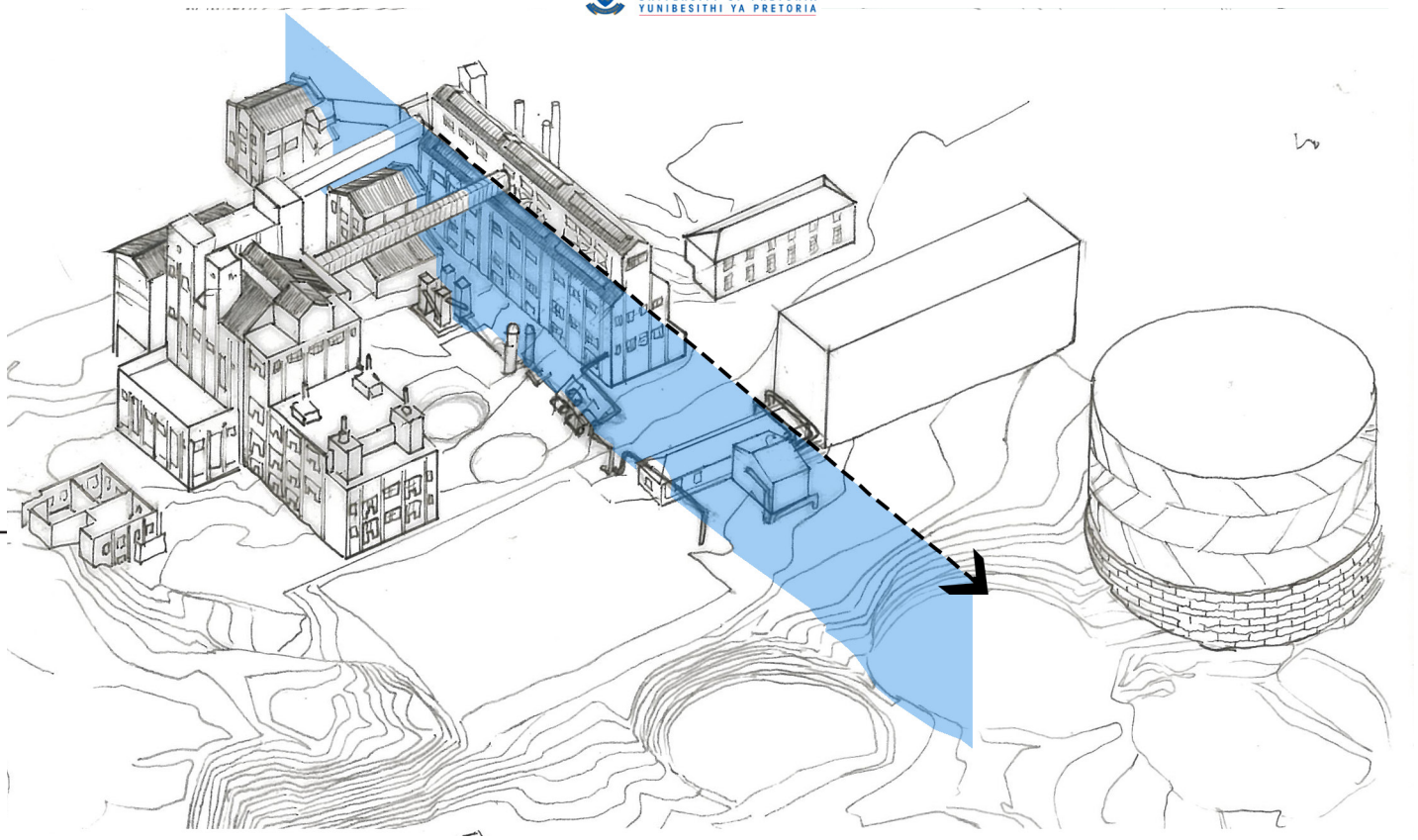


Figure 33 The linear sequence of the original coal to gas process (Author , 2017)

Figure 34 View towards Retort 1 through No 1&2 gas tanks (Tsica archives, 2017)

2.7.3 The Spatial logic of Industry

The blue line across the terrain illustrated in Figure 33 indicates the location of Retort No 1, the condensers, the exhausters and detarrer, the Livesey and Multifilm Washers, the distribution plant and the first two gas tanks. This linear arrangement was the original layout in 1928 whilst retort No 2 and the three other gas storage tanks were built from the 1950s onward. Therefore, this line of movement entails the most informative experience with regard to the Gas Works heritage.

The sequence followed the fall of the topography in order to assist in the flow of industrial fluids and gas. In that sense, the industrial process has a close relationship to the landscape since it arranges and stretches itself according to the site. Since gas tanks No 1&2 were the final destination of the gas produced, the line ends in between the two tanks and this was also a line of movement for staff working on the site as can be seen in Figure 34.

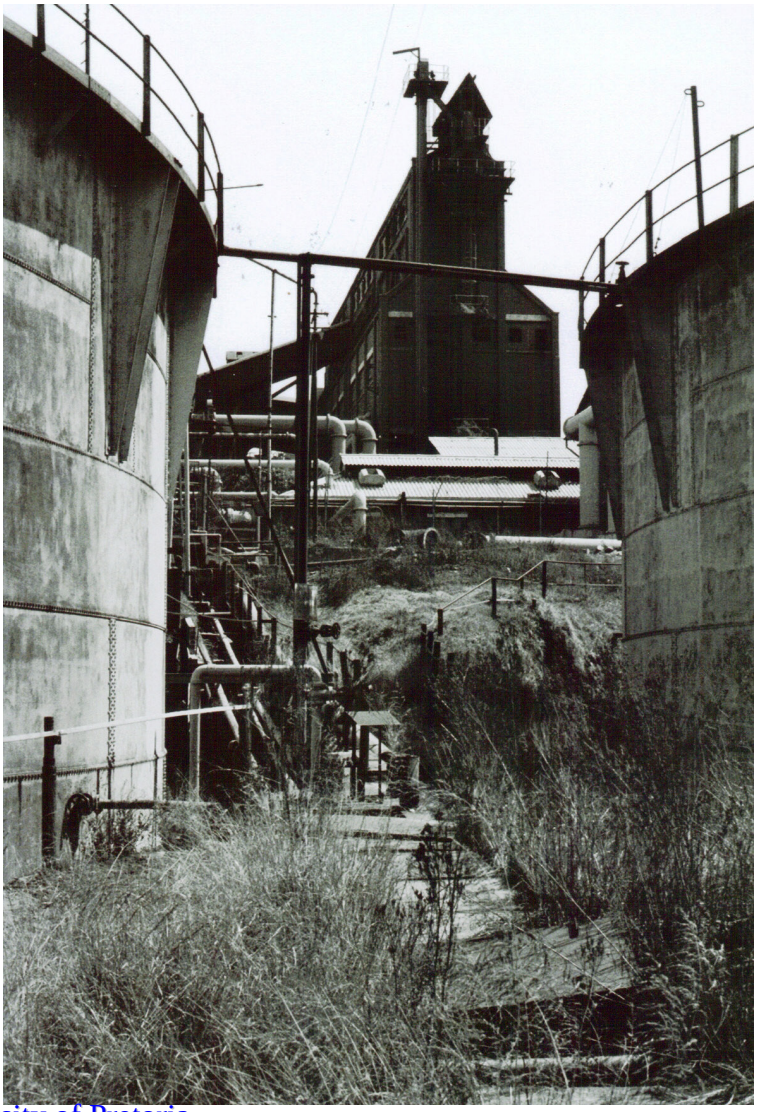


Figure 35 The urban context in contrast (Author, 2017)

2.8 Understanding the urban condition

Reading the story of the Gasworks as an isolated entity is important in as much that it contributes to our understanding of its uniqueness. However, the uniqueness and heritage value is put under pressure when one understands the context in which the Gasworks finds itself today, almost 90 years after its inception. One can easily surmise an initial identity and value from the aforementioned historical account as follows: The Gasworks was a major contributor to industry in the mining camps; it was intended to be inconspicuous in its urban environment; the public was engaged through its fertilizer provision and cooking demonstrations and it is the only remaining example of a coal to gas plant in South Africa.

The threat of insensitive development lies in the demand and tempo of development of its current context. Initially intended to be on the outskirts of the city, the Gasworks has become surrounded by a dense and rapidly growing Braamfontein. The site has the University of the Witwatersrand to the East and the Bunting Road campus of the University of Johannesburg to the West and together with the John Orr Secondary school and the collection of restaurants and artisan shops in the 44 Stanley compound to the North, the 14 hectare site is surrounded with daily, buzzing activity. One can see why this site would be best developed as a dense urban development, however there are two lenses through which the contextual influences and demands can be seen, each lens suggesting a different approach. After these two issues have been understood, it will be apparent why an understanding of appropriate theories on developing post-industrial sites in urban areas is necessary. Since this section of the dissertation deals with the contention regarding developing post-industrial sites and the seemingly opposing demands of development and heritage conservation, the site will be viewed through two lenses: context as a threatening informant to heritage and context as a protective informant of heritage.

Context as threatening informant to heritage

The Johannesburg Spatial Development Framework (SDF) is a well-intentioned document of Johannesburg's future development, however when the Egoli Gasworks site is considered in relation to the Johannesburg SDF, it is evident why dense development of the Gasworks site would seem appropriate. The site is located a mere 500 meters south of the Empire-Perth arterial, which is a significant route within the Corridors of Freedom strategy that seeks to "reap the full benefits of transit investments" (City of Johannesburg 2016:57) by increasing the urban intensity (job, residential and built density) along this route. Spatial inequality in Johannesburg or the vast distances between residential areas and job opportunities is addressed in the Johannesburg SDF : "providing housing for low-income households that is well located regarding public transport, hard and soft services and jobs, is imperative" (City of Johannesburg 2016:45).

The motivation behind proposing a dense, mixed use development for a site so close to both the Johannesburg Metro station 1km to the South and significant road connections to the North, certainly could solve some of the various problems that Johannesburg currently faces such as "urban sprawl and limiting densities; high levels of spatial inequality and a mismatch between jobs and housing" (City of Johannesburg 2016:49) Johannesburg's population is still growing at a rate of about 2% per annum, albeit that the rate is decelerating.
The city model that is supported by the SDF to address the sustainability of a growing Johannesburg is the polycentric city which is defined as "clustering of population and jobs with polycentricity at two scales: compact polycentricity in a limited hyper-core (transformation areas), and metropolitan polycentricity with compact and mixed use satellite 'cores..." (City of Johannesburg 2016:66) In a practical sense this would increase residential density near the city and transit nodes and also bring job density to high density residential areas such as Soweto.
When one considers that the size of the Johannesburg Gas Works site is the same as 18 inner city blocks, it is evident why the provision of housing along with mixed use buildings would seem to outweigh any ecological or heritage concerns. Other demands that stem from differing points of departure will challenge the needs laid out in this paragraph - that being the need for ecological green space in dense urban fabrics and the significance of the heritage of the Gas Works. Can density be reconciled with these two demands? In cases where heritage structures are significant insofar as their facades can be retained, residential density can easily be accomplished without compromising their value.
But in a site such as the Johannesburg Gas Works where industrial artifacts, the interior spaces of the two large red-brick Retort buildings as well as spaces of narrative that are essential to understanding the story behind the site's industrial period inhibit dense retrofitting; are these demands then mutually exclusive or is mid-way compromise of all three demands (public space, heritage and density) possible?

Context as protective informant to heritage

The rapid expansion and high urbanization rate of Johannesburg have placed such developmental pressures on open spaces that the city has inherited a fragmented open space system that fails to provide the benefits and potentials of a Metropolitan Open Space System (MOSS) (Strategic Environmental Focus, 2002:2). In order to be a successful MOSS that contributes to biodiversity, ecological systems and the recreational needs of citizens (all of which affect quality of life) the city of Johannesburg needs its ecological open space to be 33% of the city's 164 458 Ha area. Currently it is a mere 18% (Strategic Environmental Focus 2002:37).

The site has a specific environmental value, being located in a basin that facilitates the flow of the Braamfontein Spruit although it is currently channeled below the ground surface in a storm-water channel. Being of such value the site should be appreciated for the environmental services that it can provide. Fortunately, this value is also mentioned in the Johannesburg SDF. These ecosystem services are provisioning services, regulating services, cultural services and supporting services. In the case of the Gas Works site, the most crucial benefits that can be unlocked lie in the cultural services that can be provided by it as a open green space. Cultural services can be defined as follows "cultural services are the benefits people obtain from ecosystems such as reflection, recreation, inspiration, and aesthetic enjoyment, and include cultural diversity and educational values" (City of Johannesburg 2016:61).When one considers the large concentration in population surrounding the site from two tertiary educational institutions and one secondary educational institution, the potential for using the site with such rich heritage for educational purposes as mentioned under cultural services is immense. Not only this, but the potential of integration and mingling of students, working professionals and the public is not as easily realized in a less prime site. Furthermore, the site's specific post-industrial condition supports the transformation of the site into a park typology since soil pollution caused by tar distillation on site necessitates remedial actions such as phytoremediation and soil capping. The site's soil would have to be fully ameliorated before dense development could even be considered.

On a larger scale, it is important to consider the effects of climate change on African cities. As the sub-region is warming, the following issues are important for all African cities to avoid: "unguided urbanization, degradation of freshwater resources, lowered levels of food security and failure of climate change adaptation strategies..." (City of Johannesburg 2016:34). Considering the pervasive drought that South Africa is still recovering from in 2017 as well as the danger pertaining to freshwater resources and food security in densely populated cities, exploring the potential of the Gasworks site to be innovative in terms of water and food security can inform the nature of any intervention on the Gasworks site.
When the site is also seen within the family of open green spaces in Johannesburg, with the Peter Roos Park 2,2 km to the East and the Kingston Forest Park 1,8km to the West, the site's potential as essential contributor to the JMOSS can be seen. Maintaining the site or rather significant portions of it as open green space also poses no threat to reading and appreciating the rich industrial heritage since privatization and land development could be controlled more vigorously.

Figure 36 Gas Works urban vision plan. Johannesburg Gas Works group (2017)

2.9 Responding to the urban condition

Restitution Park - An Urban Vision

For the Gasworks site, an urban vision or precinct plan was required that could balance the various demands on the site whilst prioritizing the industrial legacy of the Gasworks. The urban vision stemmed from addressing various relationships that were in need of restitution. It was essential to re-establish the relationships between the public and the site (via accessibility); the heritage of industry to the public (via educational heritage commemoration), ecology to industry (via ecologically sensitive buildings of production) as well as the city to the site (via appropriate responses to the urban and cultural setting of the city.

Spatially, this urban vision can be implemented by proposing a dense mixed-use development for about of quarter of the site's area to the North-West. This development will include residential, commercial as well as a business incubator focused on entrepreneurial start-up businesses. The motivation for this is to steer away from large corporate identities on the site but rather to establish the site-informed notion of innovation and technology that could easily partner with the two adjacent universities. For the most sensitive heritage zone within the site, the two red brick retort buildings and their immediate surrounds, a nucleus of buildings that showcases ecologically sensitive industries is proposed, together establishing a central public heritage square as the foyer to the site. These proposed activities are textile, aquaculture and aromatic plant industries that contribute their public components to the central square. Towards the east a public park that highlights the remedial actions involved in tar polluted soil is proposed and occupies half of the total site area. By establishing these three precincts within the site the three priorities that address the site's potential is represented- ecology, the heritage of industry and the city. In order to implement the conceptual aims of restitution, the presence of water as well as recreational exploratory routes (such as cycle trails and sky bridges) are juxtaposed over the pragmatic circulation requirements of the site. With regard to formulating a heritage approach to the site's various heritage buildings, an analysis was done on the significance of each building on site with the help of Monika Lauferts Le Roux, author of *the Johannesburg Gas Works.*

It was found that apart from the two red-brick retort buildings and the three gas tanks, buildings could be altered or removed to the discretion of the design team. The heritage assessment concluded that the Gas Works showcased and still showcases the innovative process of producing gas from coal. This was a major point of pride for the 1920s South Africa and the Gasworks has been the provider of an essential service from 1928, although the means towards that service has left the site itself damaged. Therefore the heritage fabric should be handled with respect and the architecture proposed for the heritage square should seek to respond to the heritage fabric. In order to preserve the clear narrative of the site's history, alterations to the large retort buildings will be minimal and interior focused. The industrial artefacts standing in various locations on the site will be preserved and form part of the objects within the square and park. This dissertation gradually adjusts its focus towards a specific intervention within the heritage square and in addressing this particular site, an understanding is necessary of its unique condition. After understanding its condition, the appropriate theories will come to the fore in how to approach such a site.