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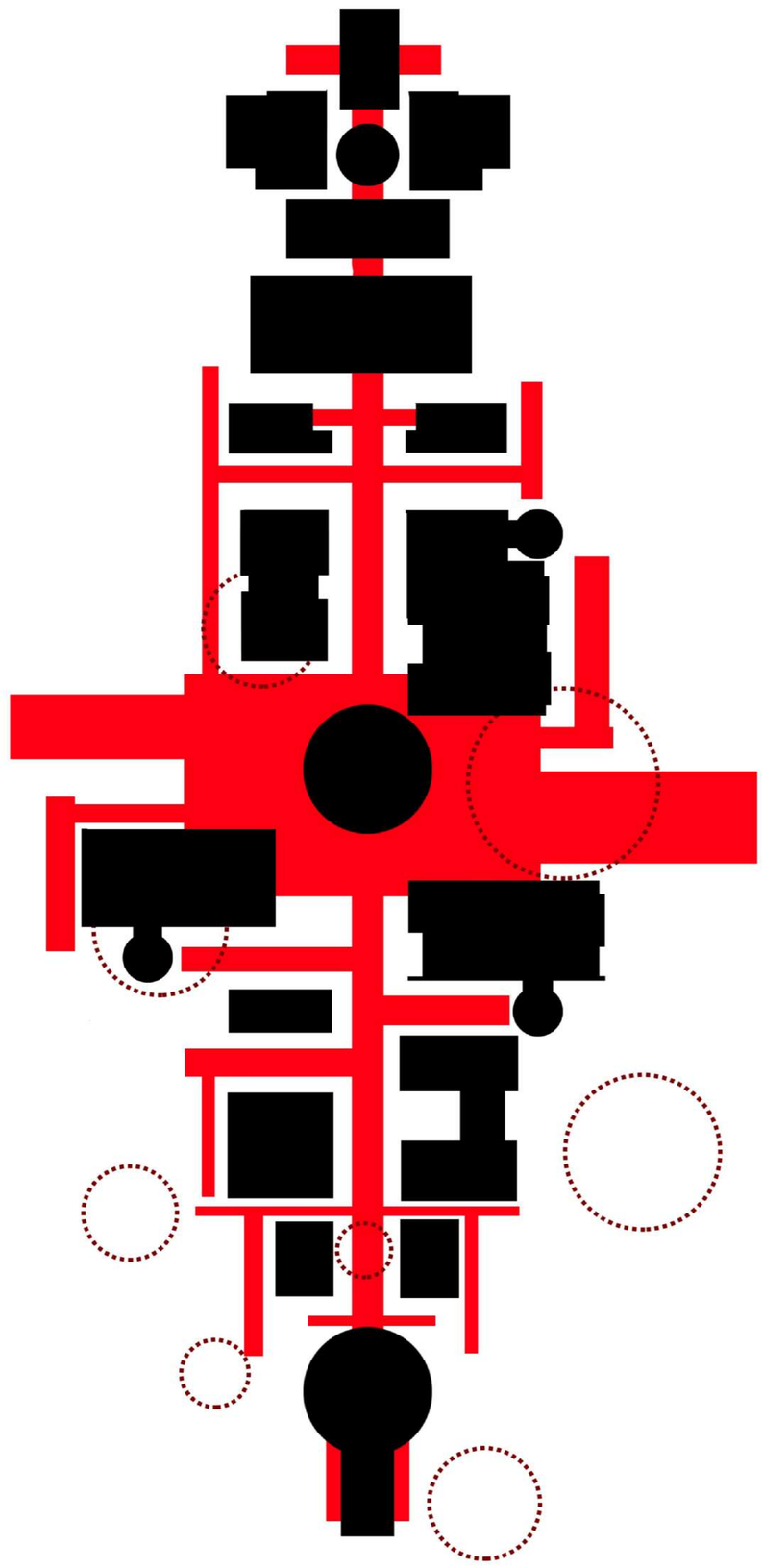

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SUPERVISOR – COBUS BOTHMA
DPD 801

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01 ABSTRACT

This dissertation stands to explore the validity of introducing a headquarters for technological innovation and emergence for South Africa's built environment that makes deliberate connections with existing greenspaces and the surrounding social fabric.
South Africa's built environment has become slow in its technological development due to: the lack of required skills, existing research on the matter having a global focus, and an overall separation of design and construction processes. South Africa's built environment also seems to be becoming placeless and homogenized due to the lack of identity portrayal in correspondence with its places. With limited research on how the South African built environment could benefit from solving both problems simultaneously, the intention is for the proposed headquarters for technological innovation and emergence to become an alleyway for a possible solution. This dissertation aims to investigate what aspects of hybrid high-tech and low-tech emerging building technologies could become a catalyst for revitalizing the South African built environment while prioritizing the instantiation of a relevant local identity in accordance with its places.

With spheres of industry, ecology, and social fabric all being simultaneously present, Silvertondale presents an ideal opportunity for the development of a place that actively considers the integration of greenspaces, and the social realm within a mono-focused industrial setting. The intended headquarters for technological innovation and emergence focuses on generating a strong economic contribution through industrial processes similar to those within the surrounding context, however, its economic contributions will be heavily determined by how well social and ecological elements are integrated and utilized.

From a tectonic point of view, the final architectural intervention explores the realm of flexible and interchangeable spaces where each architectural element of the final intervention can be perceived and understood as a single entity. The collection of designed counterparts work together in order to create a system that allows for an array of programs to take place. The culmination of patterns and systems designed for are not entirely revolutionary and can sometimes be seen within the existing buildings surrounding the new intervention. The innovation comes through in the reconsideration for these single entities, and how reorganizing system patterns can result in a more pleasant environment for participants. Therefore, the final intervention becomes a collection of interchangeable processes and systems that work together to create a synergized architectural experience that simultaneously considers the industrial realm, as well as social and ecological integration.

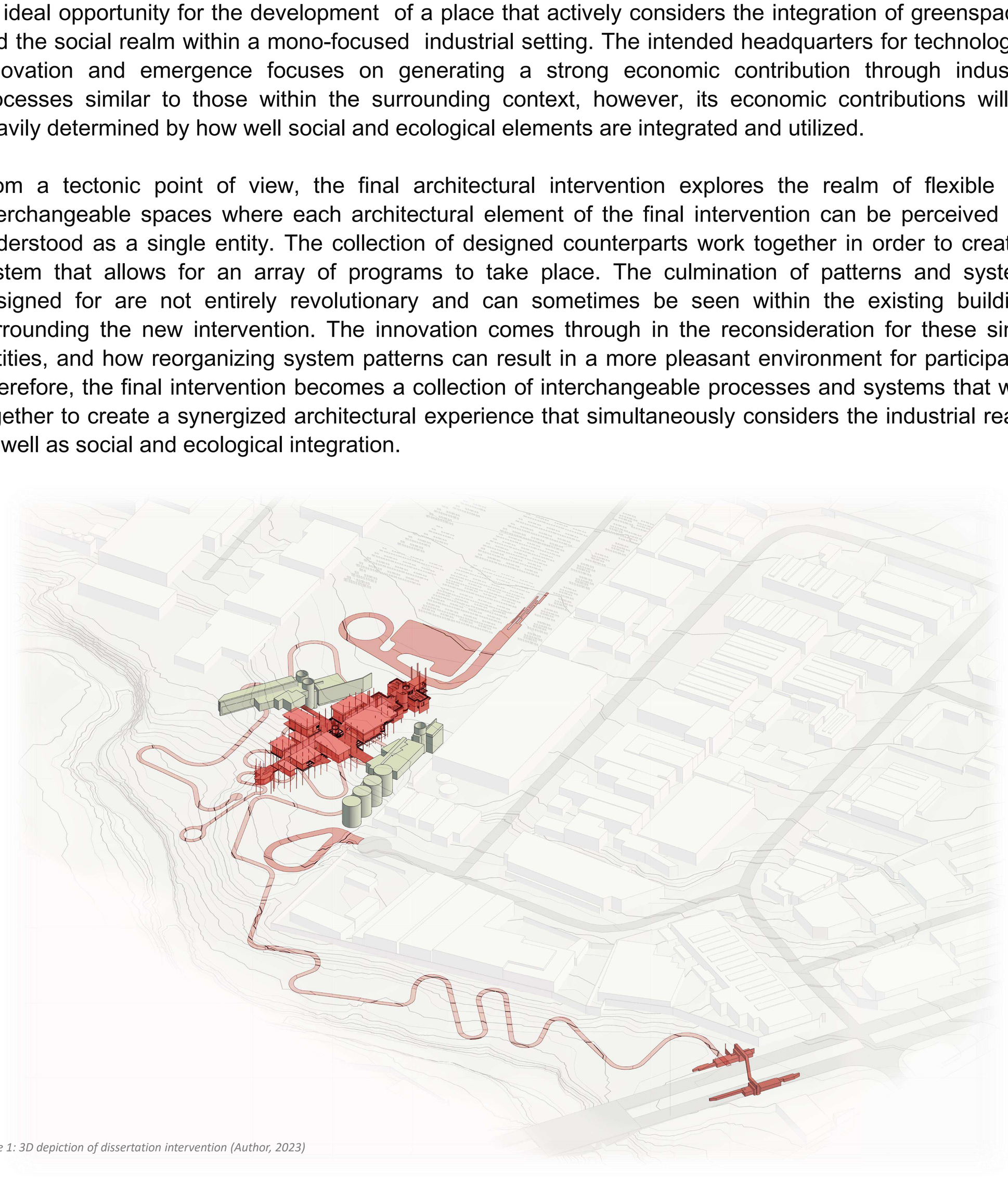

Figure 1: 3D depiction of dissertation intervention (Author, 2023)

02 PROJECT DESCRIPTION

Site and development rationale

The region of Silvertondale introduces itself as a matured industrial area heavily focused on the manufacturing and development of a multitude of building materials and building accessories predominantly made from steel and timber.

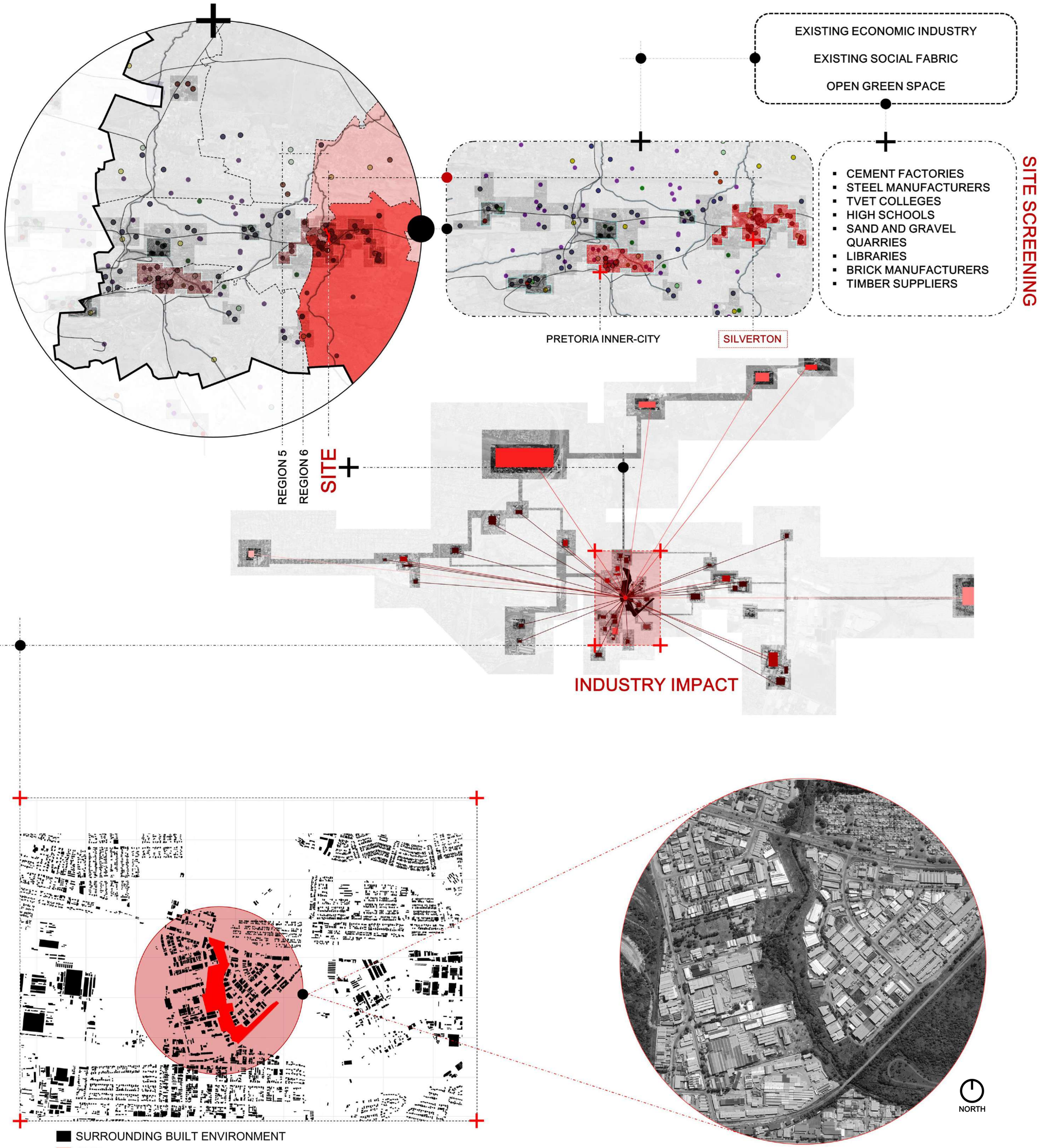

Figure 2: Integrated image depicting site choice and location (Author, 2023)

Upon closer inspection, the region of Silvertondale also features a spine of greenspace, housing the Moreleta Spruit, that splits its industrial fabric into two readable segments. Furthermore, Silvertondale features pockets of residential areas in close proximity to the above-mentioned greenspace and industrial areas.

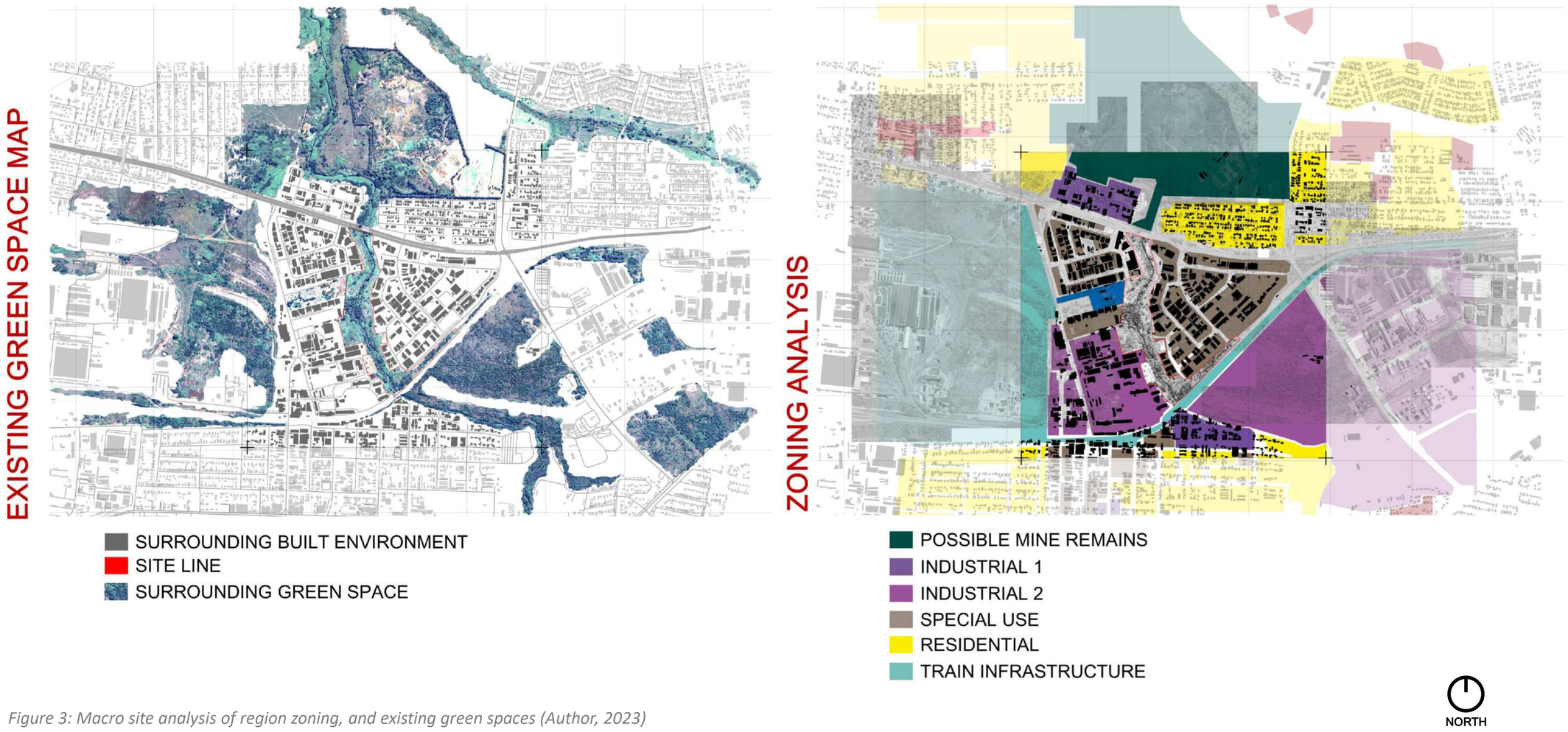

Figure 3: Macro site analysis of region zoning, and existing green spaces (Author, 2023)

Due to Silvertondale's main economic driver being inline with industrial manufacturing and commerce, the existing architecture displays a clear bias towards the "warehouse" typology. The existing context is rather cold in nature, with most of the industrial built environment segregating itself from flanking greenspaces, and residential areas.

Figure 4: Adapted pictures taken on site visit (Author, 2023)

With spheres of industry, ecology, and social fabric all being simultaneously present, Silvertondale presents an ideal opportunity for the development of a place that actively considers the integration of greenspaces, and the social realm within a mono-focused industrial setting.

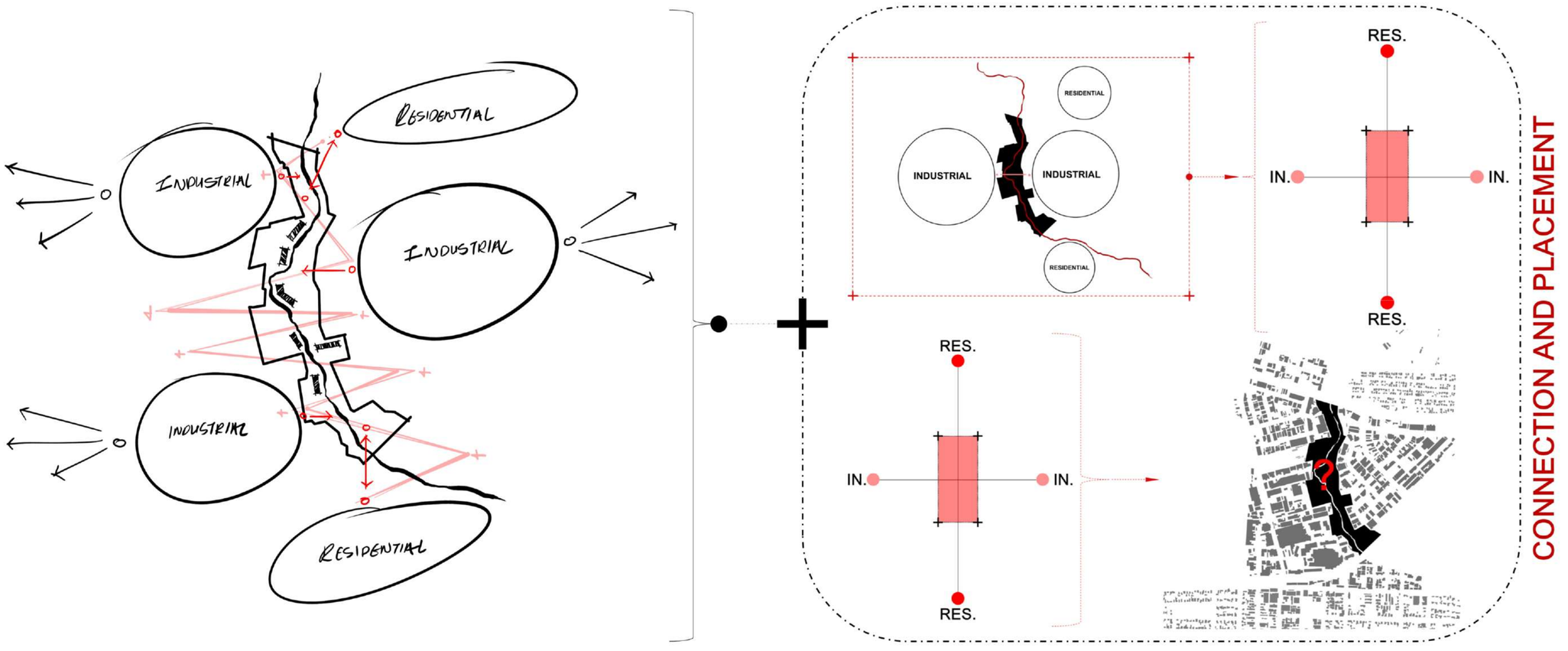

Figure 5: Industrial and residential integration over green space ideogram set (Author, 2023)

As a solution to the opportunity at hand, this design dissertation introduces an architectural intervention defining itself as a headquarters for technological innovation and emergence for South Africa's built environment. The development of this headquarters stands to challenge the existing context on its norms associated with industrial commerce by actively integrating itself with neighboring greenspaces and existing residential areas. The intended headquarters for technological innovation and emergence focuses on generating a strong economic contribution through industrial processes similar to those within the surrounding context, however, its economic contributions will be heavily determined by how well social and ecological elements are integrated and utilized.

Site programming

The intended headquarters for technological innovation and emergence will feature a plethora of supporting facilities that propagate along the spine of greenspace. Building orientations and movement patterns will be strongly informed by the flow of the Moreleta Spruit, and critical connections between its light industrial programs and surrounding residential areas will be instantiated through activating the greenspace as a socio-economic element that strengthens the overall economic contribution towards technological innovation and emergence for South Africa's built environment.

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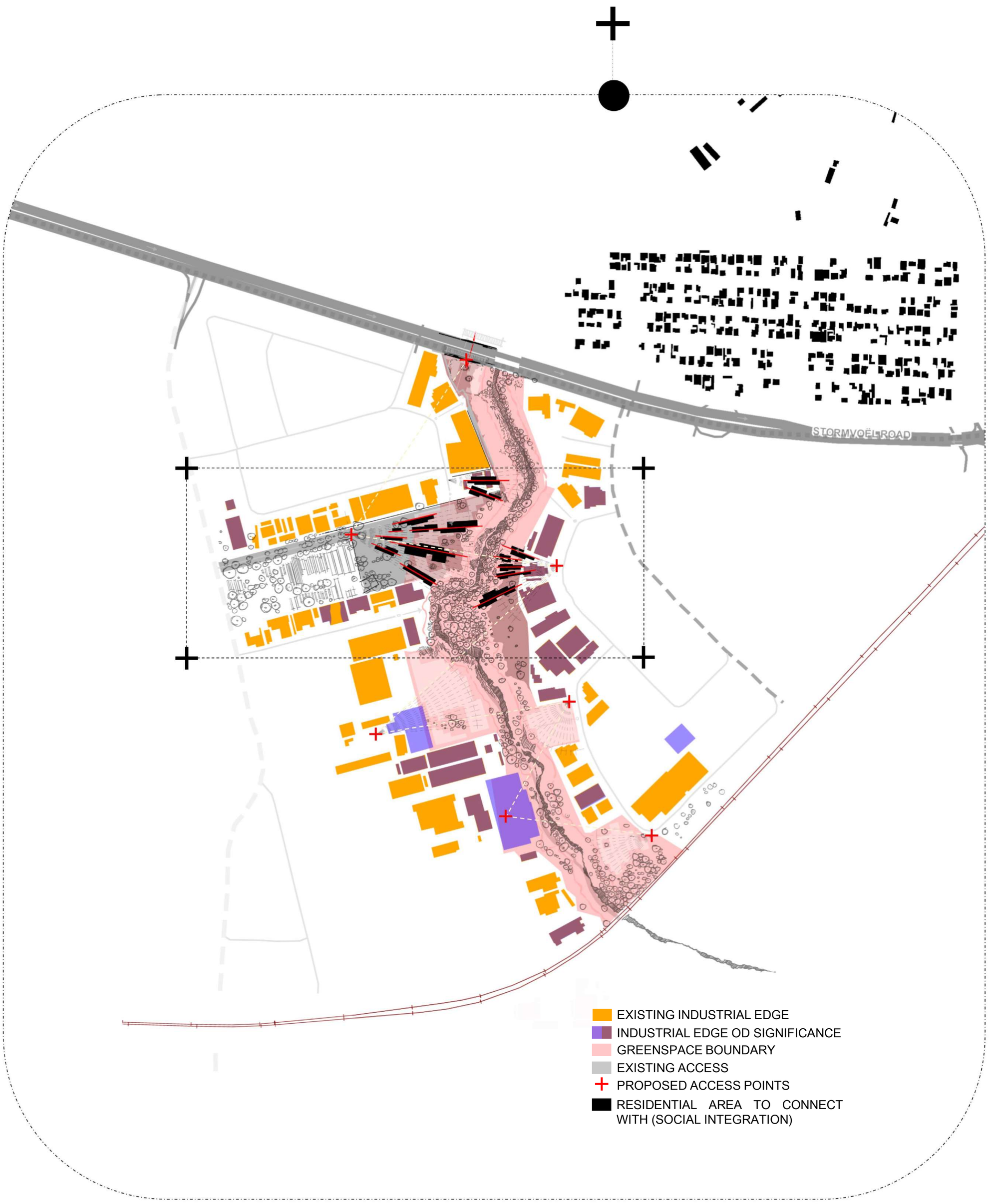


Figure 6: Final urban vision (Author, 2023)

Proposed infrastructure along the spine of greenspace will consider the following programs:
- Physical skills development (Technical collage facilities for new and innovative construction methods)
- Soft research and digital development simulation spaces (Offices and computer labs)
- Scaled material prototyping and simulation labs
- Protype display spaces
- Controlled grow rooms and grow spaces for indigenous flora
- Accommodation spaces for researchers visiting from abroad
- Accommodation spaces for ground staff
- Informal walkways and movement connections
- Mixed use building typologies that cater for retail and recreational facilities e.g. Cafes, bike hire, and hiking pay points for people to enjoy the greenspace.

Due to the intended headquarters mainly being geared at technological innovation and emergence, there will be a number of different soft research and digital development facilities, along with scaled material prototyping and simulation labs, as well as client contact spaces that propagate along the spine of the greenspace. These building typologies will be programmed as “wings” for dedicated material development and technological innovation and will be defined as follows:
- Timber innovation and emergence wing
- Brick innovation and emergence wing
- Steel innovation and emergence wing
- Bio-integration innovation and emergence
- Concrete innovation and emergence wing

It was decided to create dedicated testing and research spaces for each building material/ system under question in order to accommodate for appropriate lab infrastructure and equipment needs, thus streamlining research and development programs in turn allowing for projects and experiments to run congruently without interrupting one another.

Service provision and client base

At this point it was decided to name the proposed headquarters as the Built Environment Revitalization Headquarters of South Africa (BERH-SA).

In terms of service provision for South Africa’s built environment, BERH-SA’s efforts towards technological innovation and emergence are defined by the following values and intentions:
- Sustainable construction methods
- Upliftment of degraded landscapes
- Ecological integration
- Social cohesion
- Attaining architectural longevity
- Appropriate tectonic integration

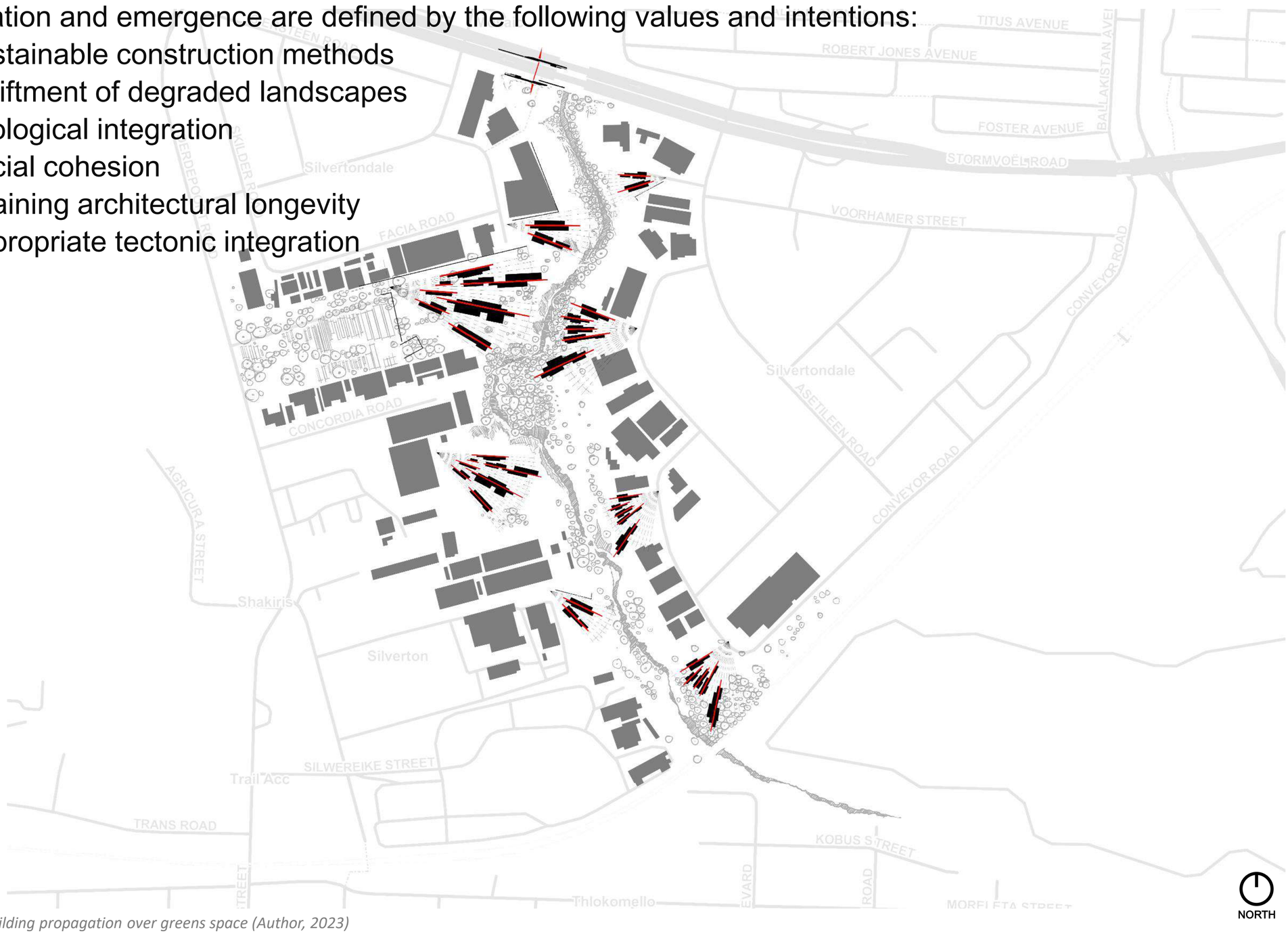


Figure 7: Building propagation over greens space (Author, 2023)

Market relevance

BERH-SA's service provision goals are set on creating a strong relationship between existing greenspaces, people, and technology throughout South Africa's built environment.

Through pushing an agenda associated with technological innovation, research development, material testing and prototyping, BERH-SA stands as a construction and technology innovation collective that provides custom framework and policy layouts, as well as access to the latest material research and prototyping available for both small and large scale clients within the built environment. Prospective clients will have access to custom frameworks which outline detailed site approaches, integration programs, and appropriate building technology suggestions based on the site and project brief disclosed upon meeting.

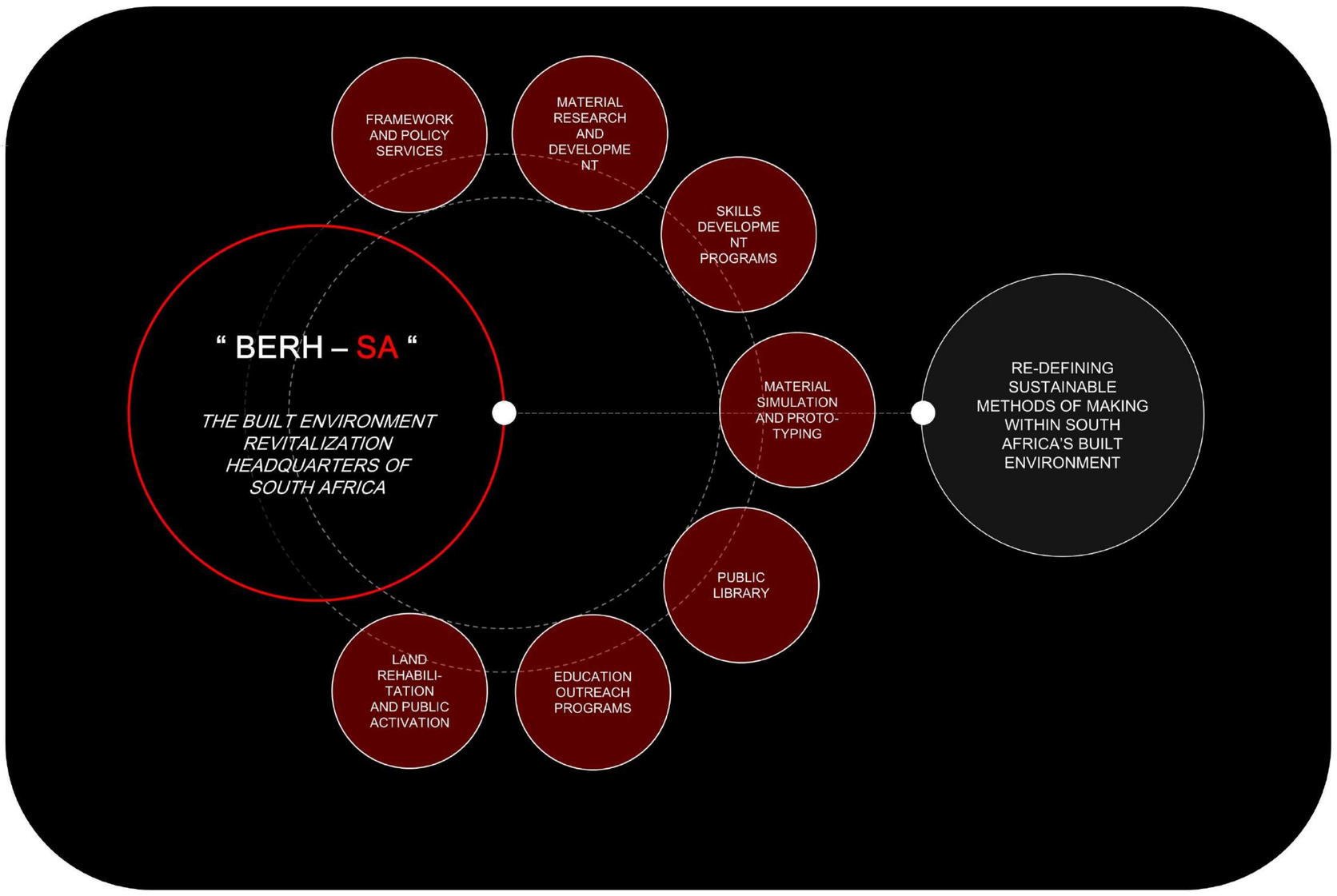


Figure 8: Building program bubble diagram (Author, 2023)

With BERH-SA's main intention being geared towards having new information on construction and emerging building technologies penetrate the market as quickly as possible so that South Africa's identity re-instantiation can happen at a larger scale, the collective intends on serving a wide variety of prospective clients. These prospective clients include but are not limited to: Developers, Homeowners, Architects, Engineers, Government entities (outsourcing town planning and research services), Contractors, Universities etc.

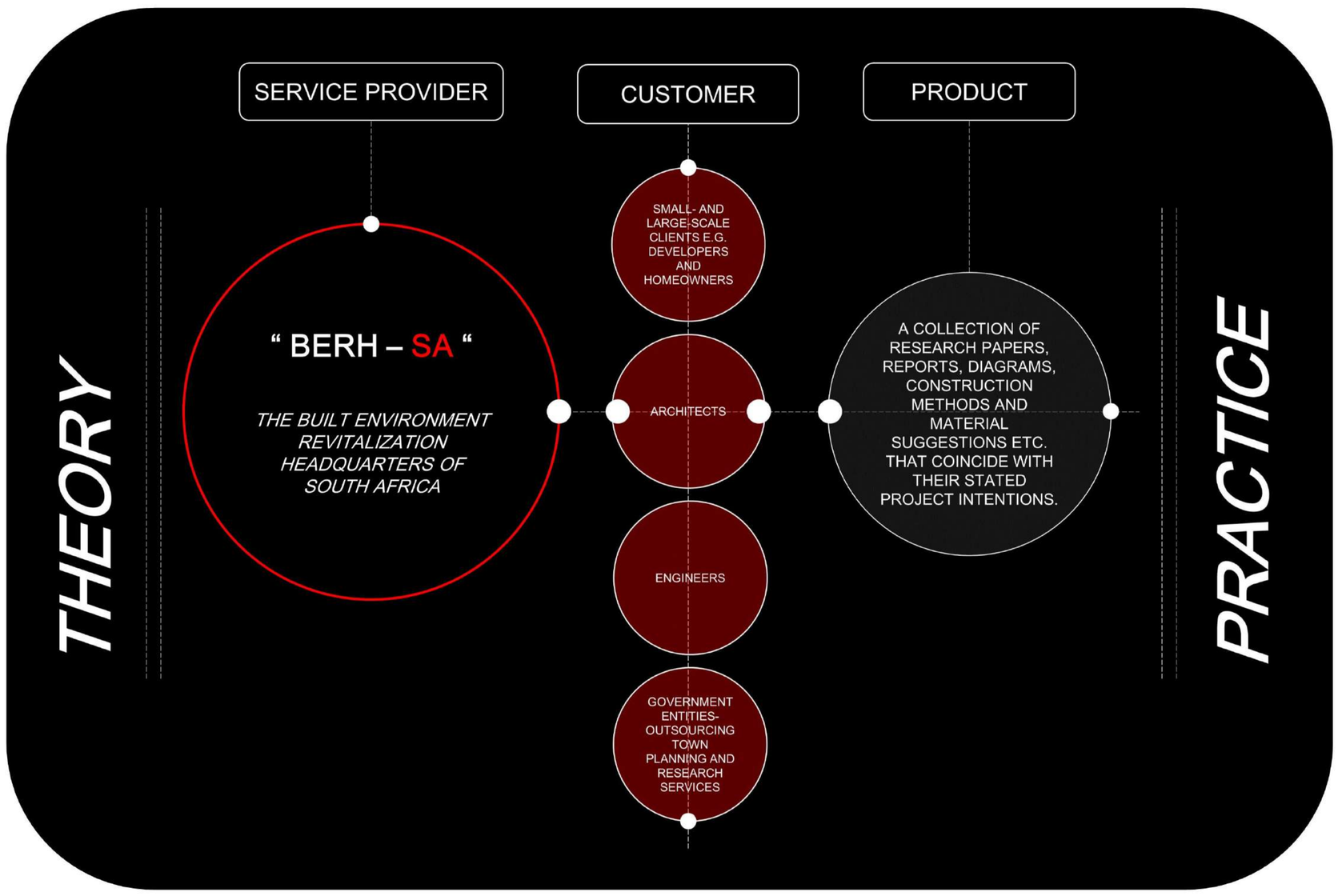


Figure 9: Service provision bubble diagram (Author, 2023)

Professionals required

For the best results concerning building technology emergence and innovation BERH-SA's staff group will be made up of a variety of professionals and specialists. The following professionals and specialists will be considered for the research and development of building technology emergence and innovation:

- Engineers
- Architects
- Artists
- Traditional craftsman
- Carpenters
- Artisans
- Botanists
- University professors
- Construction experts and contractors
- Town Planners

Among the above-mentioned professionals and specialists required, further considerations could be made on outsourcing other needed professionals and specialists based on the project/ experiment requirements outlined by prospective clients. BERH-SA intends on pushing an agenda that makes space for high tech and low-tech developments in order to produce new knowledge on emerging building technologies that are appropriate for the South African Built Environment. The intention is to have a diverse mix of professionals and specialists that work closely with one another so that a dynamic system of knowledge transfer happens on a continual basis.

Social integration education and outreach

As previously mentioned, BERH-SA's propagating collection of building facilities along the Moreleta greenspace spine do not only serve the intentions of building technology emergence and innovation, but have also been designed in such a manor that the greenspace in which they sit gets revitalized, reactivated, and integrated into the industrial setting.

As a means for social integration, the Moreleta greenspace will be equipped with pedestrian pathways inspired by the sinuous line. Along these lines of movement, indigenous plant life will be incorporated with intentions of diversifying and strengthening existing ecologies. As it stands the moreleta greenspace is currently severely overgrown and inaccessible. Therefore, the maintenance and upkeep of the sinuous line, and greenspace in general will serve as space open for public leisure, driven by an outreach program that intends on creating jobs for the less fortunate in the area. Candidates that thrive within the intended outreach program can then be integrated into BERH-SA's building technology emergence and innovation ecosystem where they can be trained as sub-contractors for newly developed building materials and technologies that are on the verge of attaining market acceptance.

Target user

The BERH-SA collective intends on having an “open source” professional space where projects and experiments can be seen by the general public. Therefore, through responsible levels of access control, BERH-SA’s grounds and built facilities will be open for visiting by anyone who is interested. Through instantiating this socio-technological relationship, the intention is to create a didactic atmosphere where the knowledge transfer on building technology emergence and innovation is fast tracked for both professionals and visitors. BERH-SA intends on having processes of technological innovation on display so that it becomes an inclusive socio-economic experience.

Tectonic concept

Due to BERH-SA’s technological innovation and emergence programs being focused on the amalgamation and development of both high tech and low-tech building technologies, it becomes appropriate to say that their intentions lie behind developing an appropriate hybrid high-tech and low-tech emerging tectonic language that is specific to South Africa’s built environment. Therefore, it would make sense for BERH-SA’s built facilities to display a hybrid tectonic language that sports both high tech and low-tech emerging building technologies appropriate for the context of Silvertondale. In terms of the tectonic concept, the end architectural product should be one that displays a hybrid tectonic language whereby technological advancement and appropriate identity implementations are simultaneously considered. The employed technologies and spatial design strategies should nurture an ever-growing relationship between people and technology.

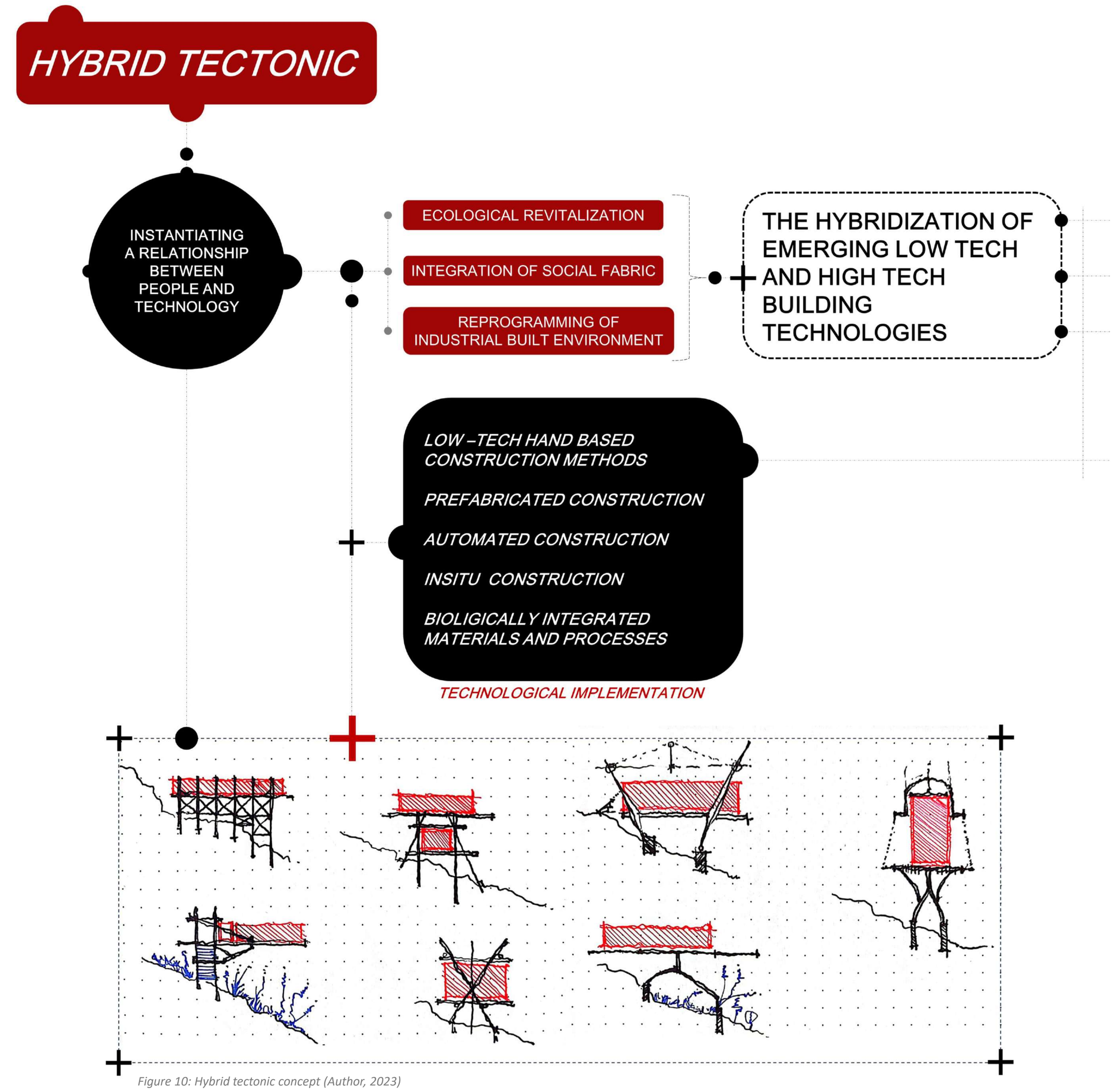


Figure 10: Hybrid tectonic concept (Author, 2023)

Site Focus Area

This dissertation will focus on one building out of BERH-SA's collection of interventions along the moreleta greenspace. . The site focus area features the Moreleta spruit to the east, industrial fabric to the North and South, and the Silverton cemetery to the west. More about the site focus area will be unpacked during the micro-analysis segment of this paper under the section titled *"Itterative Design".*

Figure 11: Site focus area for development (Author, 2023)

03 THEORETICAL DISCOURSE

The conception of BERH-SA as a relevant problem-solving entity was inspired by: the current state of South Africa's built environment, South Africa's sporadic architectural history, and how instantiating a hybrid tectonic language could become a vehicle for both technological innovation, and developing a relevant architectural identity.
The following theoretical discourse stands to validate the necessity for an architectural intervention such as BERH-SA. This theoretical discourse intends on serving as a contextual element for the development of BERH-SA's narrative and physical execution as described in the project description.

● PROBLEM CONTEXT

Challenges influencing performance development and growth of the building industry in South Africa

In accordance with Low's Architecture in Africa: Situated Modern and the production of locality, it is highlighted that "the absence of a progressive and advanced construction industry" finds its proportional relations within the continent's lag in technological advancement (2014:294). Therefore, Africa's rate of technological development is directly proportional to the rate of development of its construction industry which in turn affects South Africa's construction industry. Windapo & Cattell touch on consequent sub-threats that are linked to the above-mentioned phenomenon. These sub-threats include "the mismatch between available skills and required skills." which links to the secondary sub-threat of local research methods and patterns (Windapo & Cattell, 2013:70) where most of the literature published on building material development has a global focus instead of a local one (Windapo & Cattell, 2013:75). Therefore, the documented "mismatch between Available Skills and Required Skills." becomes the result of an evident misalignment between theory and practice (Windapo & Cattell, 2013:70).

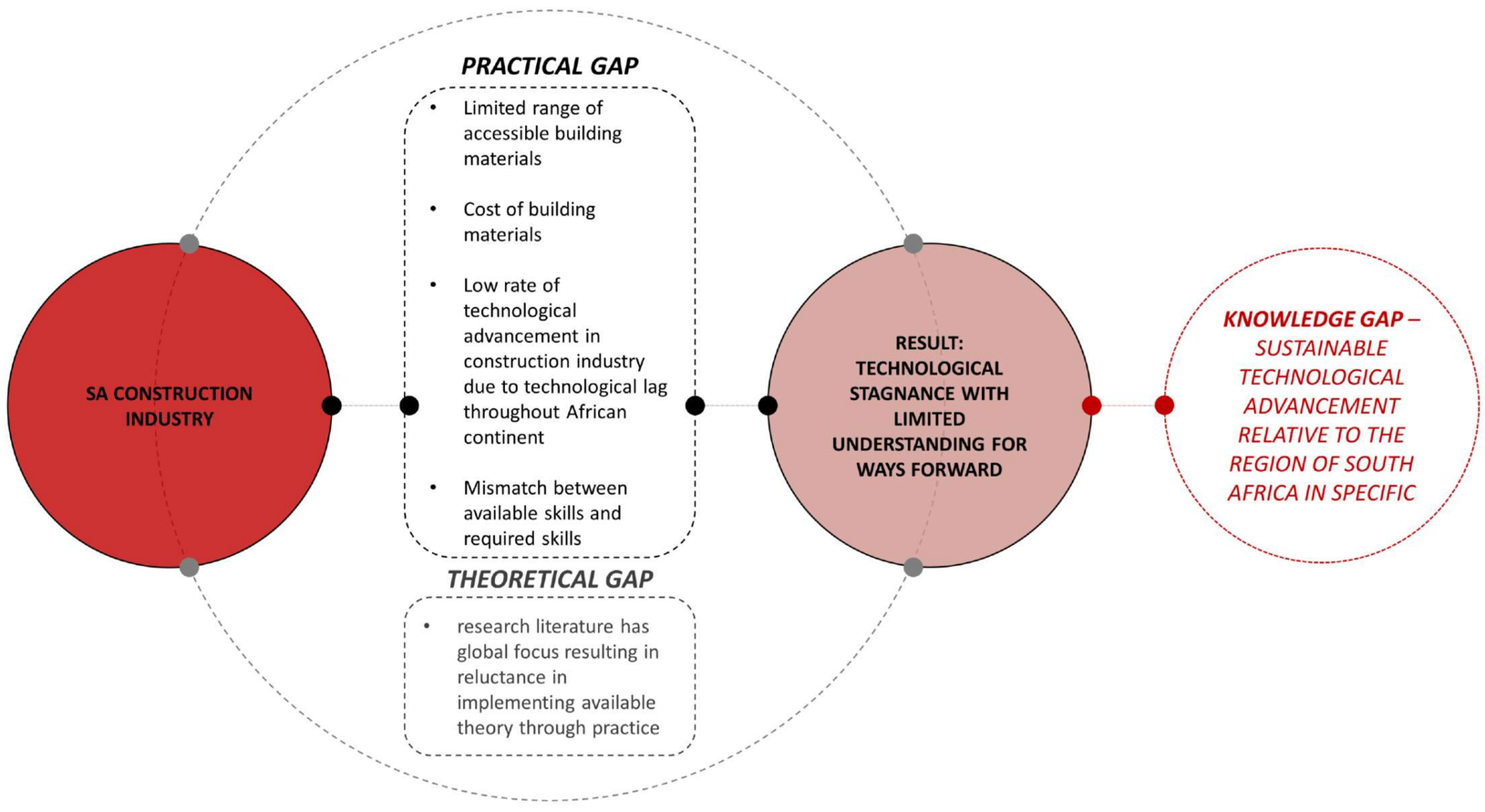


Figure 12: Problem context, the resultant practical and theoretical gaps, and identified knowledge gap (Author, 2023)

South Africa – What identity?

At its present state, the architectural identity of South Africa's Built environment still seems sporadic and undecided with many of its features being reminiscent of foreign influences. In Marschall and Kearney's Opportunities for Relevance: Architecture in the New South Africa (2000) architect mentors including Jo Noero, Peter Rich, and Ora Joubert voice their concerns with the state of South Africa's urban and sub-urban realms in saying that they come across as Indistinguishable from the likes of Northern America and Western Europe (Marschall and Kearne, 2000). Furthermore, in Retief's essay A Distinctive Architecture for VISI 2001, a plethora of questions are posed for the reader to consider - "Who of us hasn't driven through a typical South African city landscape and wondered: What on earth is going on here? What country am I in? On which continent? On what planet?" (Retief, 2001)

Louw suggests that this phenomenon could potentially be the result of “conflicting rationalities” in architectural thinking between the global north and the global south (Louw, 2021: 251). Therefore, the uncertainty experienced within South Africa’s built environment in terms of identity could be due to fundamental differences in the value systems and worldviews associated with the global north and global south which ultimately filters through to the architecture produced in the global south when these two realms collaborate (Watson 2003: 396).

In addition to this, South Africa’s architectural discourse seems to have been susceptible to the adoption of many polarising identities ever since the first records of civilization. Its identity has been influenced by a diverse mix including “indigenous domestic architecture (Zulu, Tswana, Khoi), Afrikaner (Dutch) and English settlements, Cape Dutch architecture, Malay architecture (Hindu and Islamic), Republican, Victorian, and Edwardian architecture subsequently ending in explorations of local modernisms, including Brutalism and the International Style” (Okoye, 2002: 382).

Understanding South Africa’s complex architectural lineage begs the question – How do practitioners within the built environment design for the new South Africa?

SOLUTION VALIDITY

The value of tectonic theory

Tectonic theory is dynamic and integrational standing to express an “interwoven relationship between space, function, structure, context, symbolism, representation, and construction where no single definition exists to convey the full meaning of the term” (Schwartz, 2016: xxxii). Due to the theory’s “symbiotic relationship between architecture and structure” (Oxman, 2010: 3), and its strong consideration for structural expression “by encompassing the act of making” (Louw, 2021:xi), its theoretical adaptability becomes the consequence of considering value parameters associated with region, culture, tradition, and historical narratives (Schwartz, 2016: xv). Tectonic theory is all about critical technological implementation in relation to human beings and their most pressing needs.

Human beings, technology, and the environment

As human beings, we “behold, touch, listen to, and measure the world with our entire bodily existence” (Schwartz, 2016: xxvi). As a consequence, the “experiential world becomes organised and articulated around the centre of the human body” (Pallasmaa, 2007:64) through architectural expression. Considering that the implementation of a Tectonic architectural language instantiates a tight relationship between human beings and technology, it becomes the grounding element for authentic architectural experiences (Schwartz, 2016: xxvi).

Therefore, the architectural design process cannot be separated from the process of construction (making and crafting) and human perception (Indrawan et. al., 2019: 69).

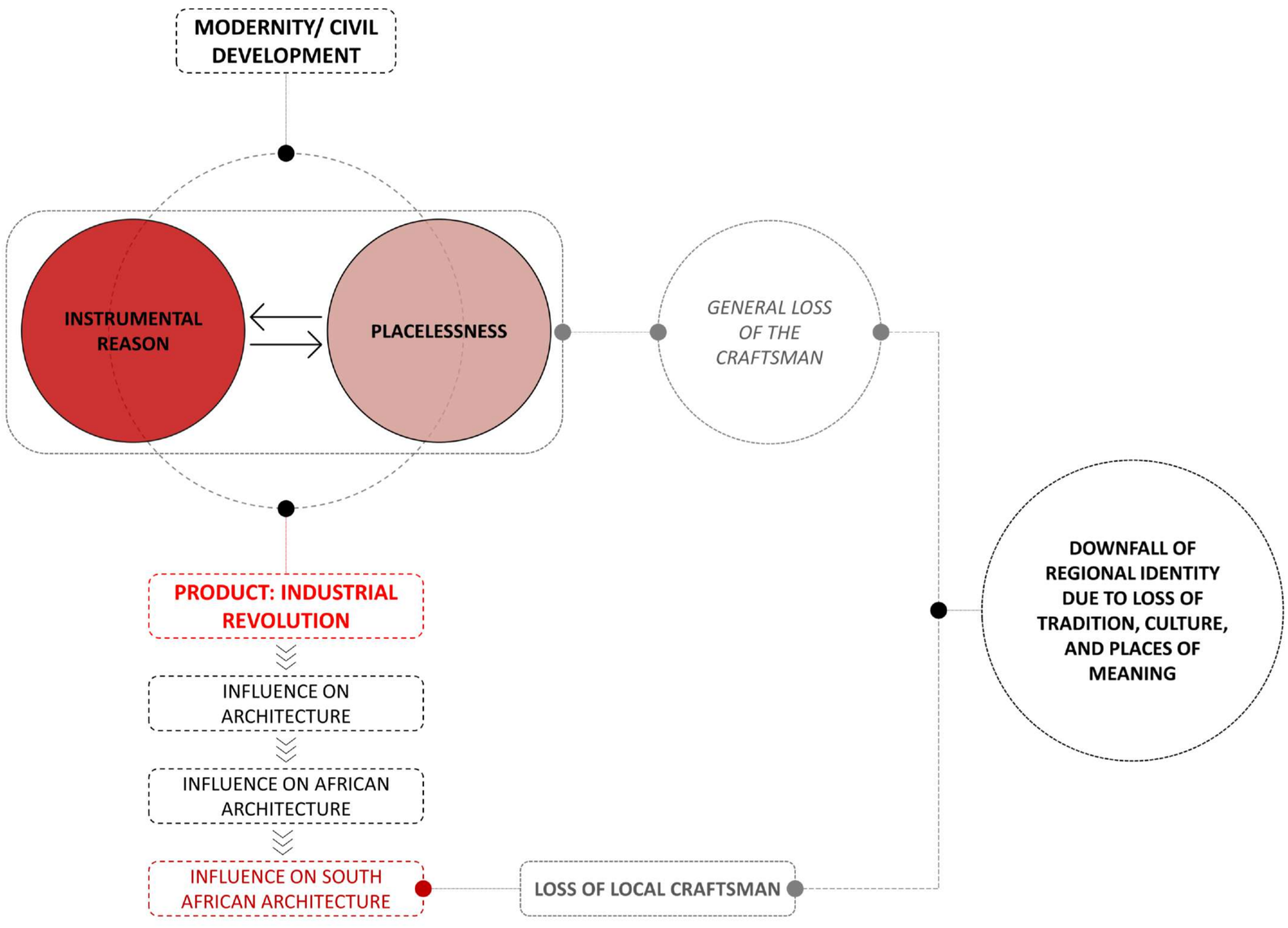


Figure 13: The relationship between instrumental reason and placelessness and how it results in the loss of tradition, culture, and places of meaning (Author, 2023)

Unique technological opportunities for South Africa

In order to make way for the development of cultural identity and technological advancement, the validity behind implementing a hybridised architectural language that considers the synthesis of low-tech and high-tech building solutions seems to become plausible. Through unpacking the realm of technological advancement in combination with tectonic theory, a multitude of opportunities become apparent for trial in South Africa, however, it is pertinent that innovation happens with respect to its local context. Seeing that South Africa's rich historical narrative is one that includes a detailed indigenous knowledge base considering these teachings in tandem with careful reinterpretations of the global standards for technological development might serve as a promising means for innovation within South Africa's built environment.

Wienecke's perspective on South Africa's technological advancement trajectory ties in with Jekot's conceptions in that "Culture consists of the ideas, tradition, knowledge, technology, intellect, and art that is produced or shared by a particular community. It is important to understand the regional culture in order to create architecture that has roots, functions well and is long-lasting." (Jekot, 2007: 70).

However, it must be remembered that "the regional and global" perspectives do not have to be paradoxical (Jekot, 2007: 70). This therefore suggests that South Africa's technological development strategies within the built environment could benefit from understanding and reinterpreting the developmental trajectories implemented by first world entities.

Steenkamp's research on The Benefits of Applying Vernacular Indigenous Building Techniques In Self-Help Construction for Sustainable Livelihoods and Human Settlements concludes that "encouraging the implementation of vernacular building methods and indigenous knowledge improves the livelihoods of communities and encourages pride within." (2012: 3). Furthermore, Steenkamp suggests that the implementation of vernacular building methods "may well play an essential role in guiding architects and the built environment through the past in order to navigate back to the present and future." (2012: 3). However, the implementation of vernacular building methods cannot serve as a strict means for innovation in isolation as Low in his Architecture in Africa: Situated modern and the production of locality argues that "the situated modernism that arises from producing our own locality is not necessarily confined to low-income projects in rural areas that employ local skill and materials!" (2014: 296). Low further suggests that due to Africa's lower developmental status, an opportunity arises in the "possibility of producing localities that are primarily rooted in relational and contextual exigencies, as opposed to simply the spatial and the scalar.", thus resulting in building typologies that are "demonstrative of a peculiar local interpretation of a global trend"(2014: 297).

The importance of architectural identity

When technological advancement is void of human nature (history, culture, and tradition) (Frampton, 1983: 269, and Taylor, 1999: 4), the resultant architecture becomes a "placeless" manifestation of a functional machine (Chiu, 2009:493) with no route to its tangible and intangible context ultimately being reduced to a universal sameness (Auge, 2008: xii).

In Smith's lecture on How Architecture can Revive Identity, Community and Purpose he suggests a correlation between community ownership and architectural longevity. He states that longevity is achieved through the provision of 3 main semantic values: Identity, community, and purpose (Smith, 2019,0:53). These 3 semantic values coincide with the top 3 tiers of Maslow's hierarchy of human needs: esteem, belonging, and self-actualization (McLeod, 2007). Smith goes on to state that successful architecture should work to provide opportunities for the community and reflect its existing identity, therefore insinuating that architectural success is found through responsible cultural integration (2019,07:05).

Community strength is complex due to its integrity being mostly based on semantic values such as culture and heritage, a sense of belonging and ownership, and an overall sense of safety. Although the built environment needs a strong economic system to sustain it, without a community that invests in the cyclical process of economic success that contributes to the built environment's progression, the physical built fabric faces severe threats of dilapidation and disfunction.

(Smith, 2019,10:00 – 12:35)

Therefore, one can deduce that if there is no correlation between the human value system and the built environment, architectural longevity is unattainable. This is why tectonic theory becomes so important. Through prioritising the human narrative in conjunction with steady technological development, an archetype categorised by the relationship between people and technology is produced, therefore sustaining architectural longevity through a strong contextual identity. To solidify this statement, Frampton suggests that the "phenomenological presence of an architectural work and its literal embodiment of form" is perhaps one of the main elements that "grounds architecture in a cultural tradition that is collective rather than individual through ways of building and place-making that are inseparable from our material history." (Frampton: 1903-1994: 375)

PROJECT AIM

South Africa's built environment has become slow in its technological development due to: the lack of required skills, existing research on the matter having a global focus, and an overall separation of design and construction processes. South Africa's built environment also seems to be becoming placeless and homogenised due to the lack of identity portrayal in correspondence with its places. With limited research on how the South African built environment could benefit from solving both problems simultaneously, the intention is for BERH-SA to become an alleyway to a possible solution. This dissertation aims to investigate what aspects of hybrid high-tech and low-tech emerging building technologies could become a catalyst for revitalising the South African built environment while prioritising the instantiation of a relevant local identity in accordance with its places.

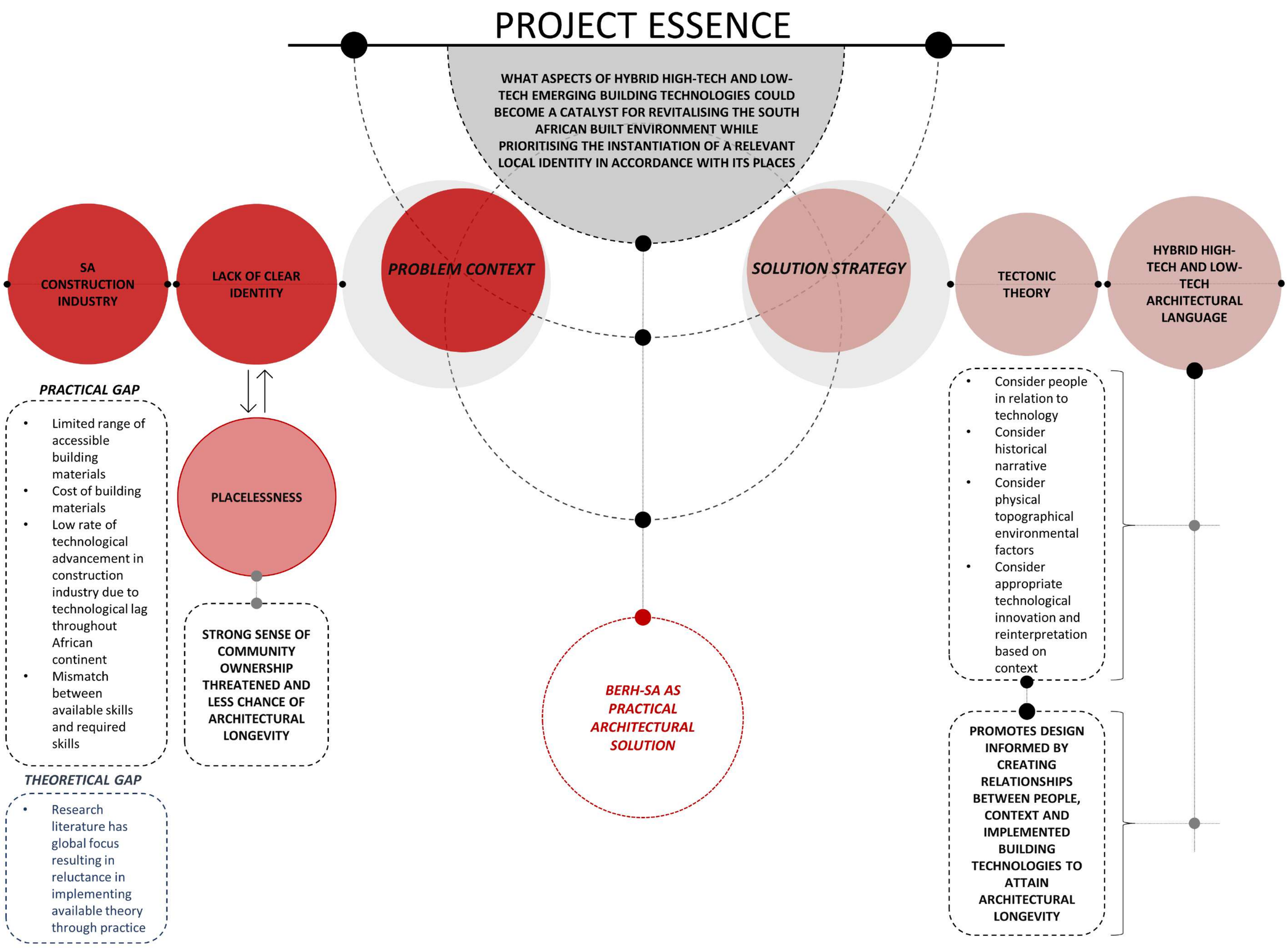


Figure 14: Project essence (Author, 2023)

04 ITERATIVE DESIGN

URBAN VISION

The itterative design process for the development of BERH-SA started off at a macro scale during the considerations for an appropriate urban vision. For a rich urban vision, Silvertondale was scanned for a location that that presented the most opportunity for a place like BERH-SA to exist. The following aspects were considered: Silvertondale's built fabric, zoning richness, accessibility and mobility, greenspace presence and ecological status. After considering these aspects, a focus map for urban vision development was established.

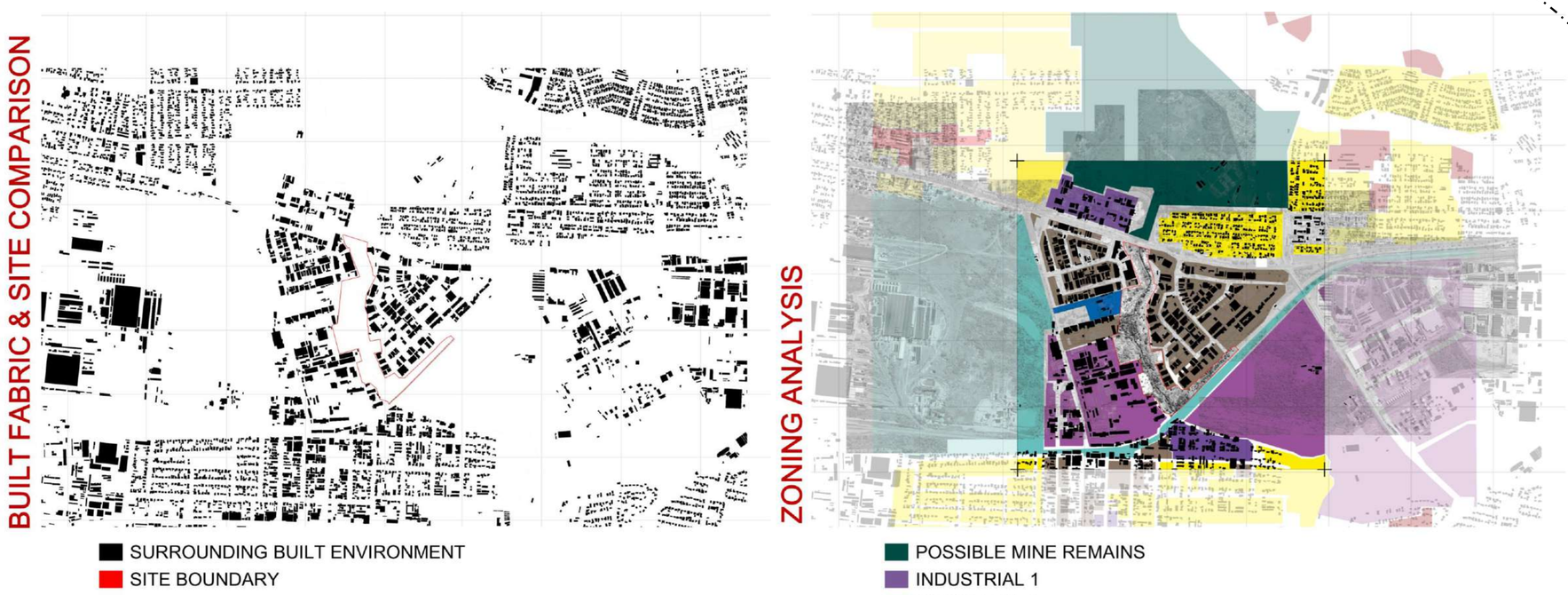


Figure 15: Macro analysis for urban vision (Author, 2023)

04 ITERATIVE DESIGN

URBAN VISION

After establishing an area for urban vision development, further informants were considered that would ultimately play as opportunities for the future development of BERH-SA. These informants included: A 50m river buffer for the Moreleta spruit, the nature of mobility and access in accordance with the RSDF, the existing industry edge, an edge of industry significance that could uplift BERH-SA's programs, possible focus areas, and all opportunities for development along the Moreleta spruit.

BERH-SA

URBAN VISION INFORMANTS

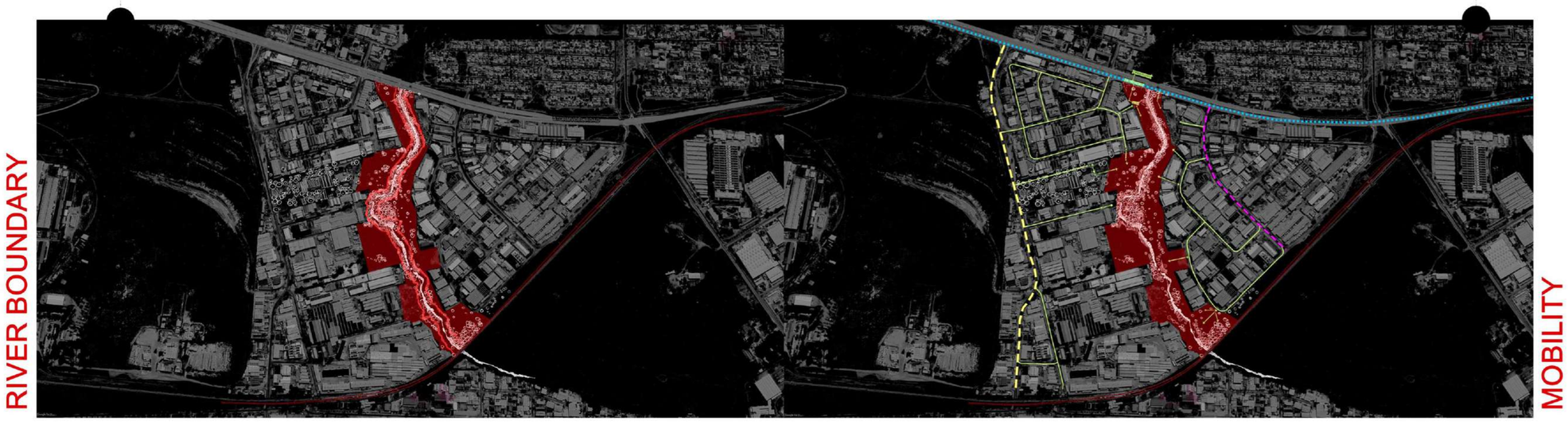


Figure 16: Macro informants for urban vision (Author, 2023)

04 ITERATIVE DESIGN

URBAN VISION

From here, an explorative process on how BERH-SA's buildings would propagate along the Moreleta greenspace was considered in correspondence with the existing industry edge, possible connections to the social fabric, and the Moreleta spruit buffer.

BERH-SA

URBAN VISION INFORMANTS

DRIVERS FOR DEVELOPMENT

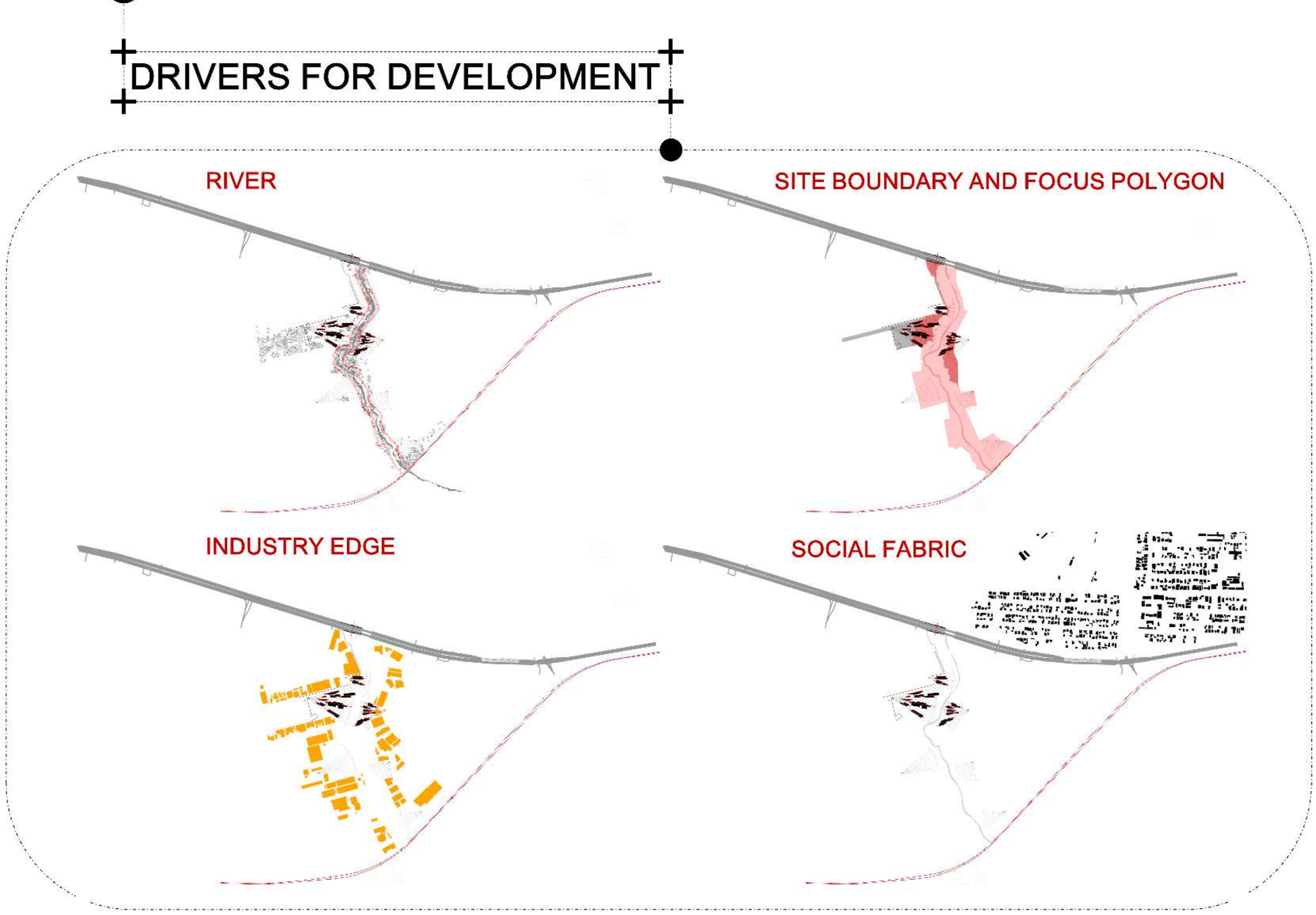


Figure 17: Urban vision fabrication process (Author, 2023)

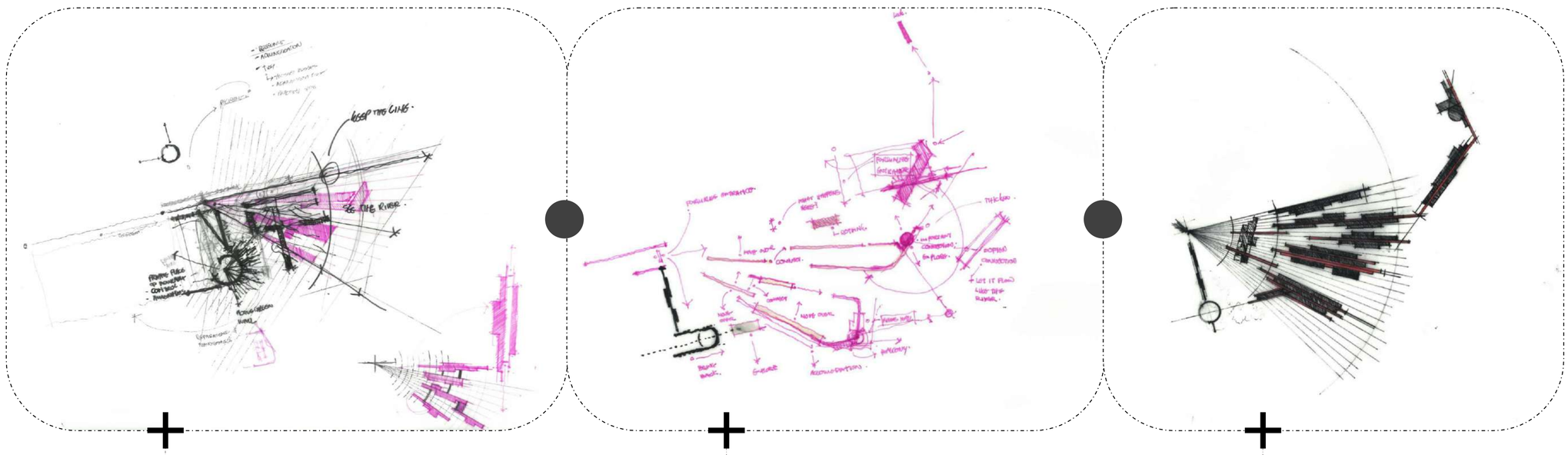
NORTH

04 ITERATIVE DESIGN

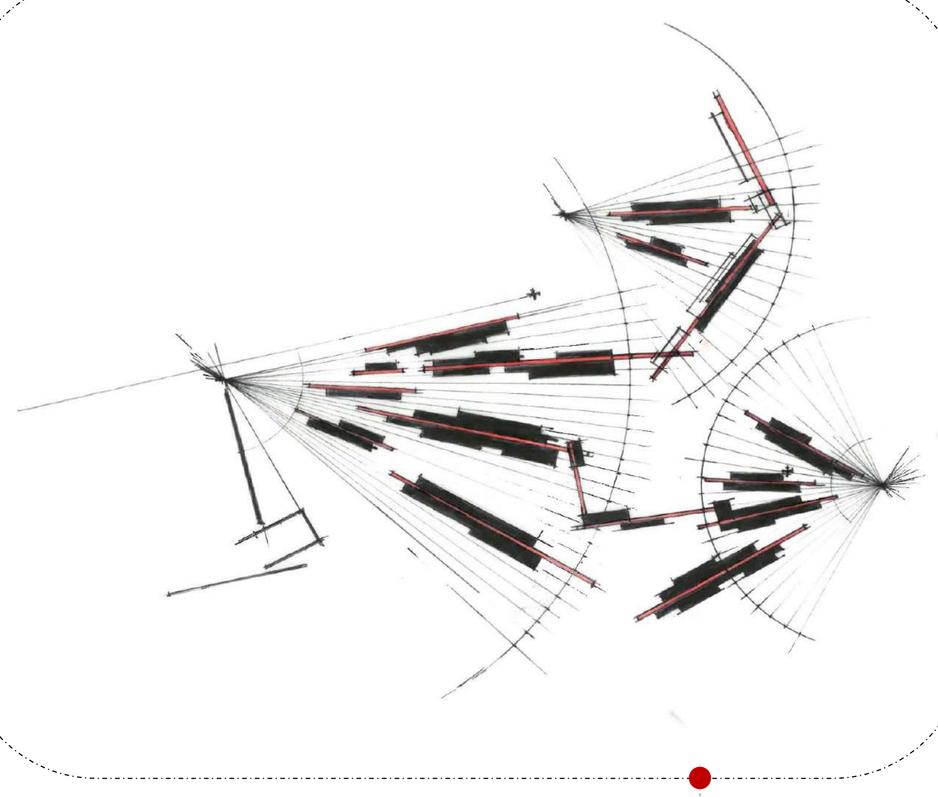
URBAN VISION

PRELIMINARY DESIGN CONSIDERATIONS

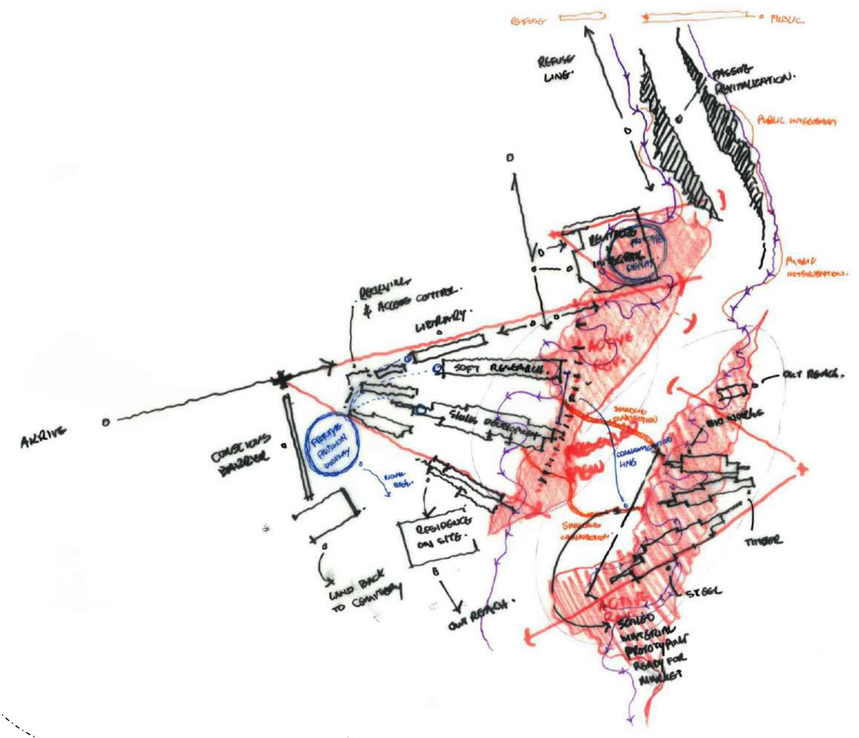
BUILDING "FEATHERING" PROCESS



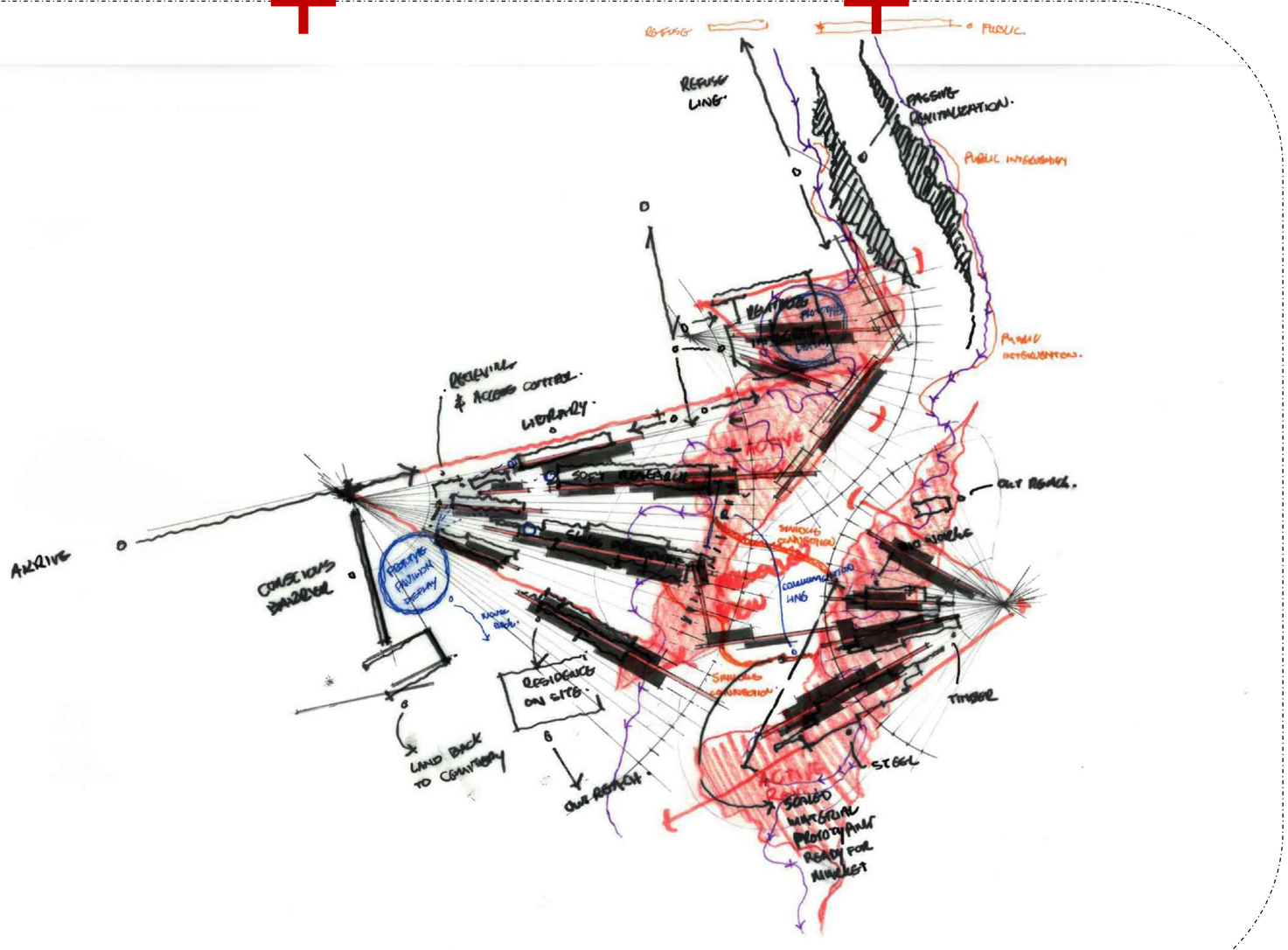
BUILDING PROPAGATION



SITE CONSIDERATIONS



INTEGRATED PRODUCT



NORTH

Figure 18: First hand drawings for developing an appropriate urban vision (Author, 2023)

04 ITERATIVE DESIGN

URBAN VISION

This iterative process resulted in the urban vision seen below.

Figure 19: Urban vision final exploration and final product (Author, 2023)

04 ITERATIVE DESIGN

UNDERSTANDING THE SITE FOCUS AREA

As previously explained, this dissertation will focus on one building out of BERH-SA's collection of interventions along the moreleta greenspace. . The site focus area features the Moreleta spruit to the east, industrial fabric to the North and South, and the Silverton cemetery to the west.

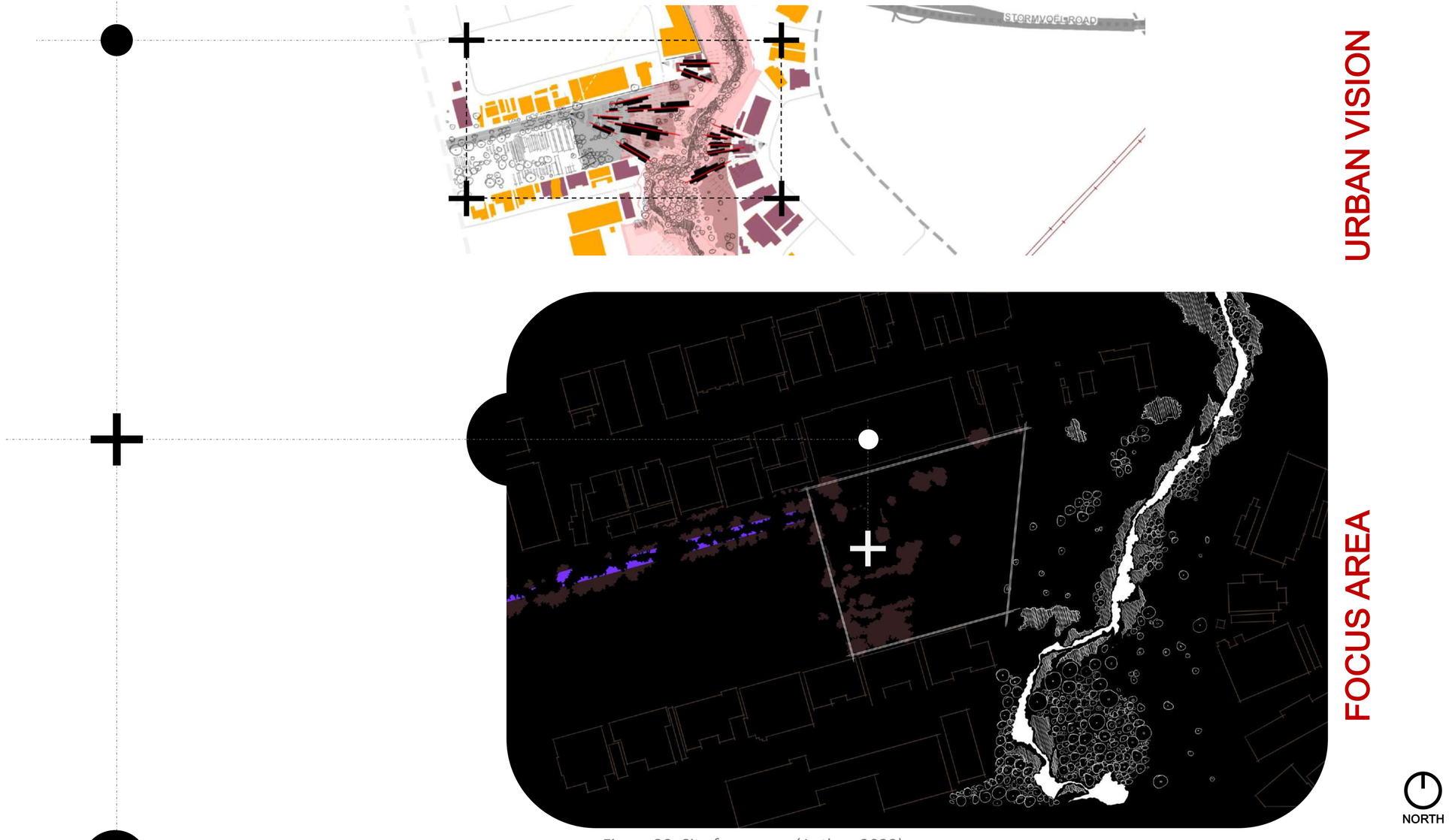


Figure 20: Site focus area (Author, 2023)

Figure 21: Photos taken on site visits (Author, 2023)

The chosen area for development is currently home to Tshwane's park depo where trees are grown for the city. In addition to growing trees, Tshwane's park depo is also in charge of maintaining protected greenspaces and parks within Pretoria. On site, the existing infrastructure stands to store equipment such as woodchippers, tractors and other heavy machinery associated with tree felling, large scale landscaping and the production of natural fertilizers. A small portion of the existing infrastructure also serves as office space for administrative, and managerial tasks.

04 ITERATIVE DESIGN

SITE FOCUS AREA

MICRO ANALYSIS

In order to further understand the site focus area, a secondary micro site analysis was carried out. The following aspects were considered: the site boundary with respect to the position of the river, existing buildings on site, existing trees on site, existing industrial buildings surrounding the site, existing industrial buildings where potential services can be out-sourced, existing cemetery location, and potential access routes to site.

SITE BOUNDARY AND RIVER

EXISTING BUILDINGS

SITE BOUNDARY AND RIVER

SITE BOUNDARY AND RIVER
EXISTING BUILDINGS

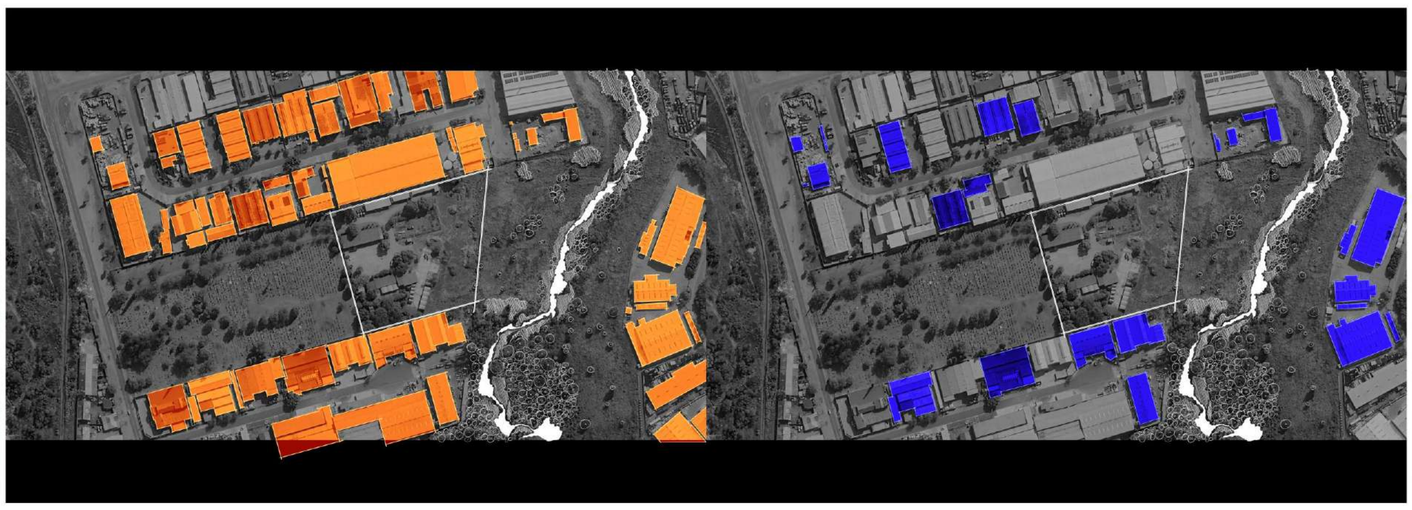
EXISTING TREES

LAND REJUVENATION

SITE BOUNDARY AND RIVER
EXISTING TREES

"DEAD" LAND
REJUVINSTED LAND

INDUSRTY EDGE



EDGE SIGNIFICANCE

SITE BOUNDARY AND RIVER
EXISTING INDUSTRIAL BUILDINGS

SITE BOUNDARY AND RIVER
EXISTING INDUSTRIAL BUILDINGS WHERE POTENTIAL SERVICES CAN BE OUT-SOURCED

EXISTING CEMETERY

EXISTING ACCESS

SITE BOUNDARY AND RIVER
SILVERTON CEMETERY

SITE BOUNDARY AND RIVER
POTENTIAL ACCESS ROUTES TO SITE

NORTH

Figure 22: Micro site analysis (Author, 2023)

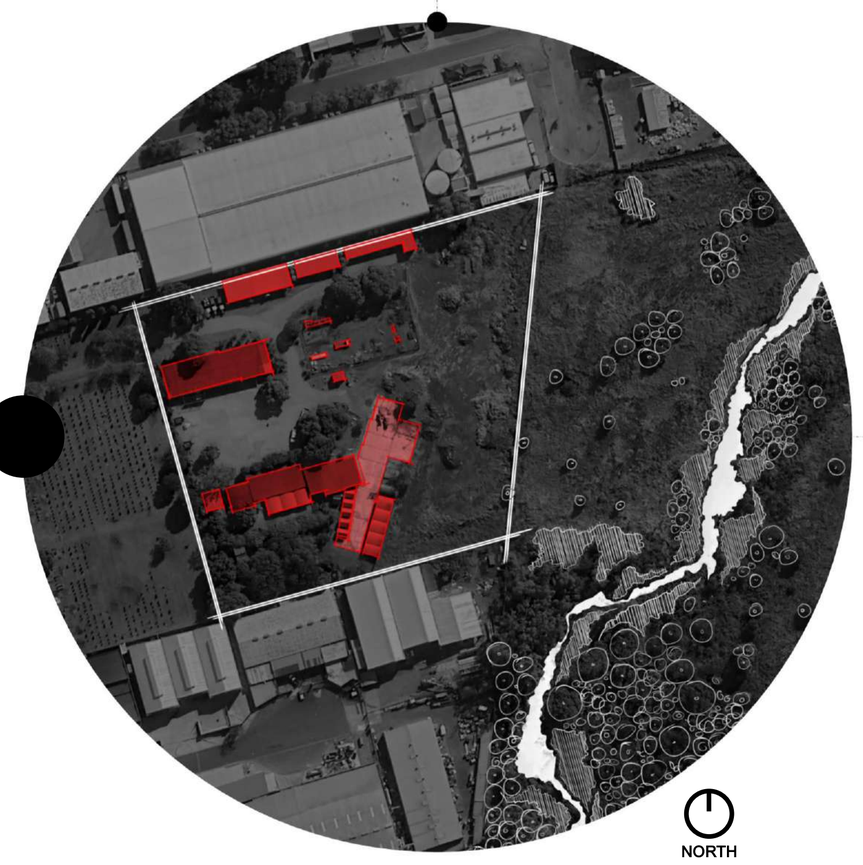
04 ITERATIVE DESIGN

SITE FOCUS AREA

HERITAGE STANCE

Expanding on heritage, after speaking to the Tshwane park depot employees on site it was found that the buildings present are more than 60 years old, however, there are no plans and there have been multiple undocumented changes done to the buildings over the years making it almost impossible to decern what is new or not. The main elements worth saving are the bricks and roof timber which can then be recycled for new development.

HERITAGE STANCE



OVERALL VALUE IN BRICK AND TIMBER

EXISTING BUILDINGS TO BE DEMOLISHED

Figure 23: Heritage stance (Author, 2023)

04 ITERATIVE DESIGN

SITE FOCUS AREA

DESIGN APPROACH

All aspects considered, the resultant site strategy becomes one that actively consideres softening the barrier between industry and the Moreleta spruit, while considering sensitive social activation closest to the river, and how other parts of existing industry can follow the same language over time. Further more the development considers a sensitive barrier between itself and the cemetery in the form of a memorial wall while existing vegetation is preserved and existing access routes are utilized and expanded upon

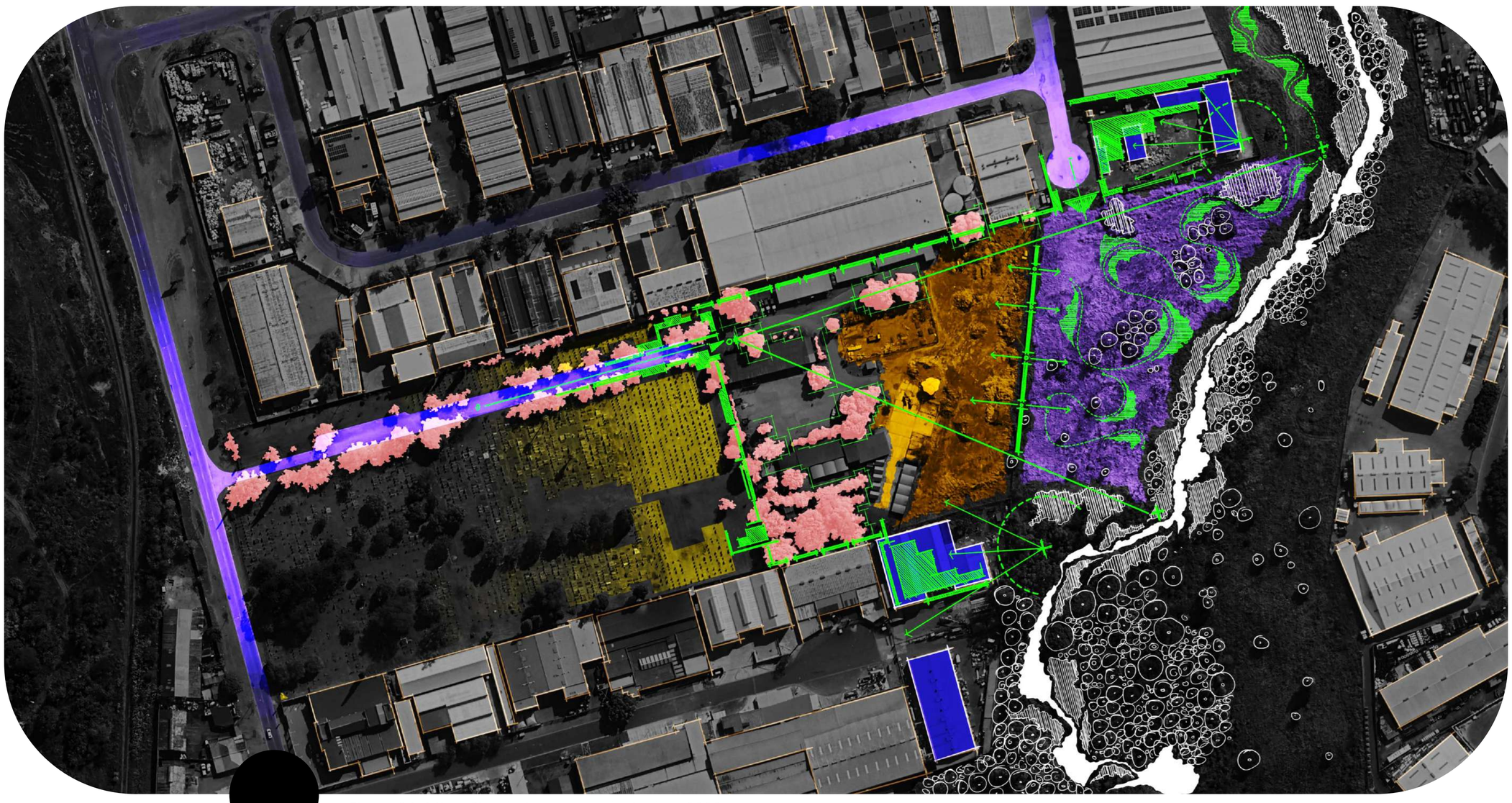
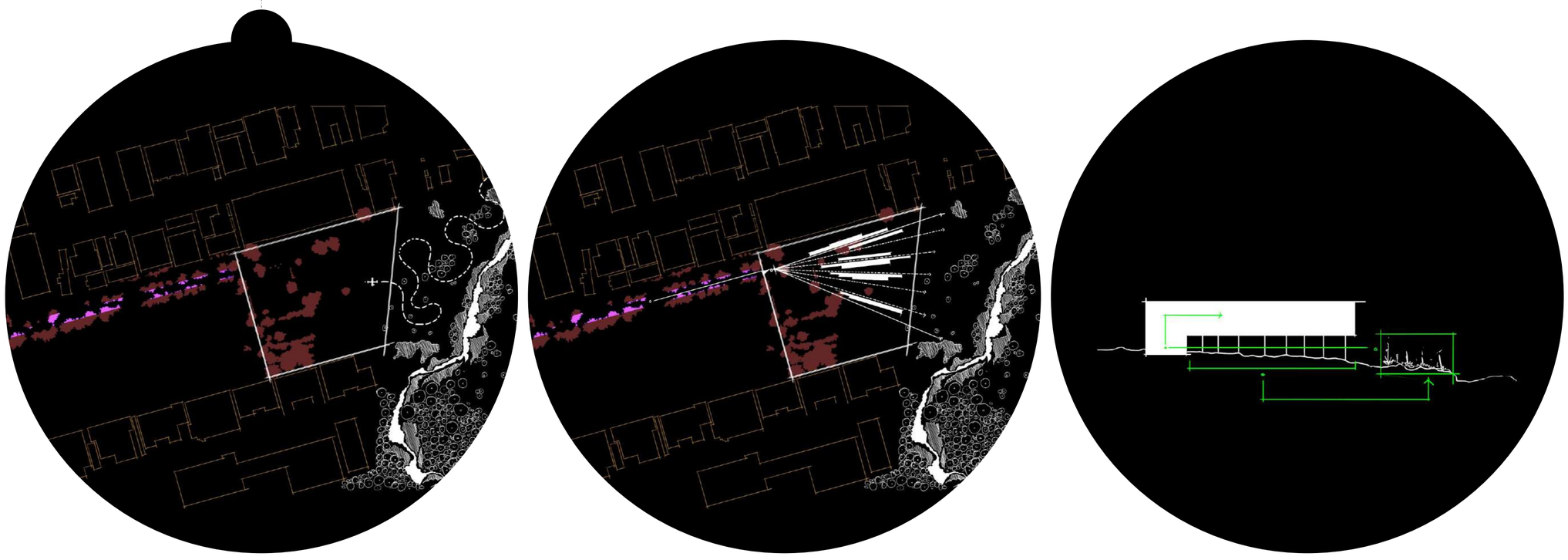


Figure 24: Micro Site design approach (Author, 2023)



SINUOUS LINE

FEATHERING BUILDINGS

ECOLOGICAL INTEGRATION

Figure 25: Site development ideograms (Author, 2023)

Three main design informants become pertinent for the success of each of BERH-SA's buildings along the Moreleta greenspace namely: the instantiation of a sinuous line as a pedestrian connection to the greenspace, the feathering building orientation so that BERH-SA's buildings respond more to the presence of the Moreleta spruit than the existing industrial grid, and an overall lifted building typology in order to expand, rejuvenate, and integrate adjacent greenspaces.

04 ITERATIVE DESIGN

SITE APPROACH DEVELOPMENT

In order to activate the Moreleta greenspace, a pedestrian movement path was considered. This path implements a sinuous line strategy with intentions of creating a slower meandering experience allowing the user to become fully immersed within the greenspace. The primary function of this path is to create a connection between the existing social fabric, the greenspace, and the industrial fabric. This path also helps soften the existing barrier between industry and ecology.

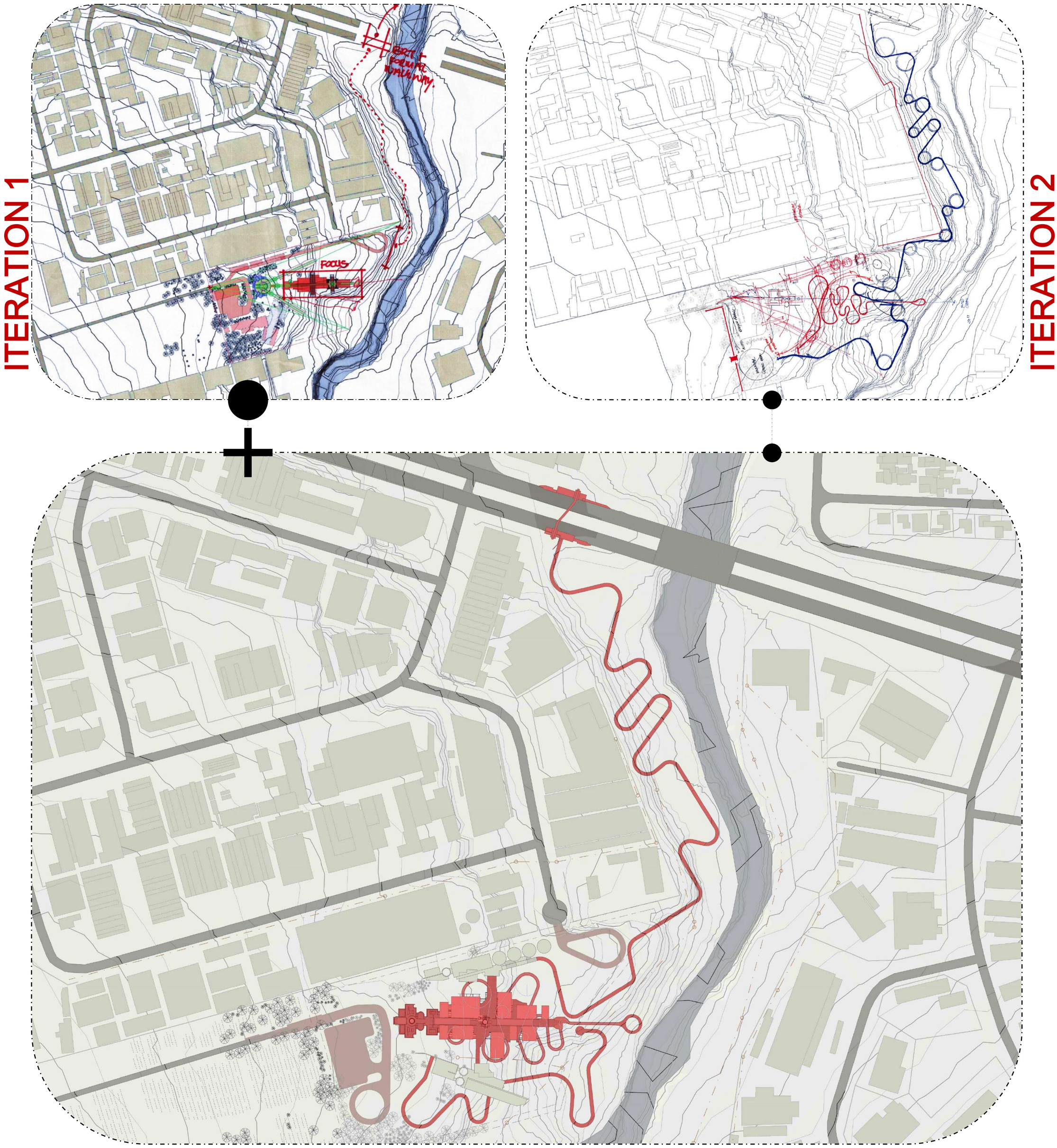


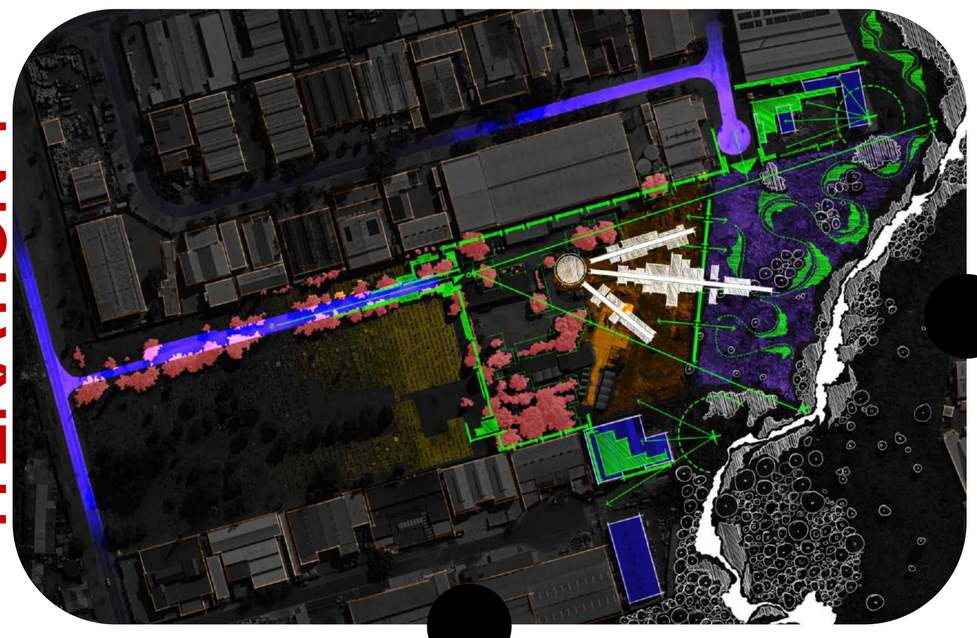
Figure 26: Site approach development iterations 1-3 (Author, 2023)

04 ITERATIVE DESIGN

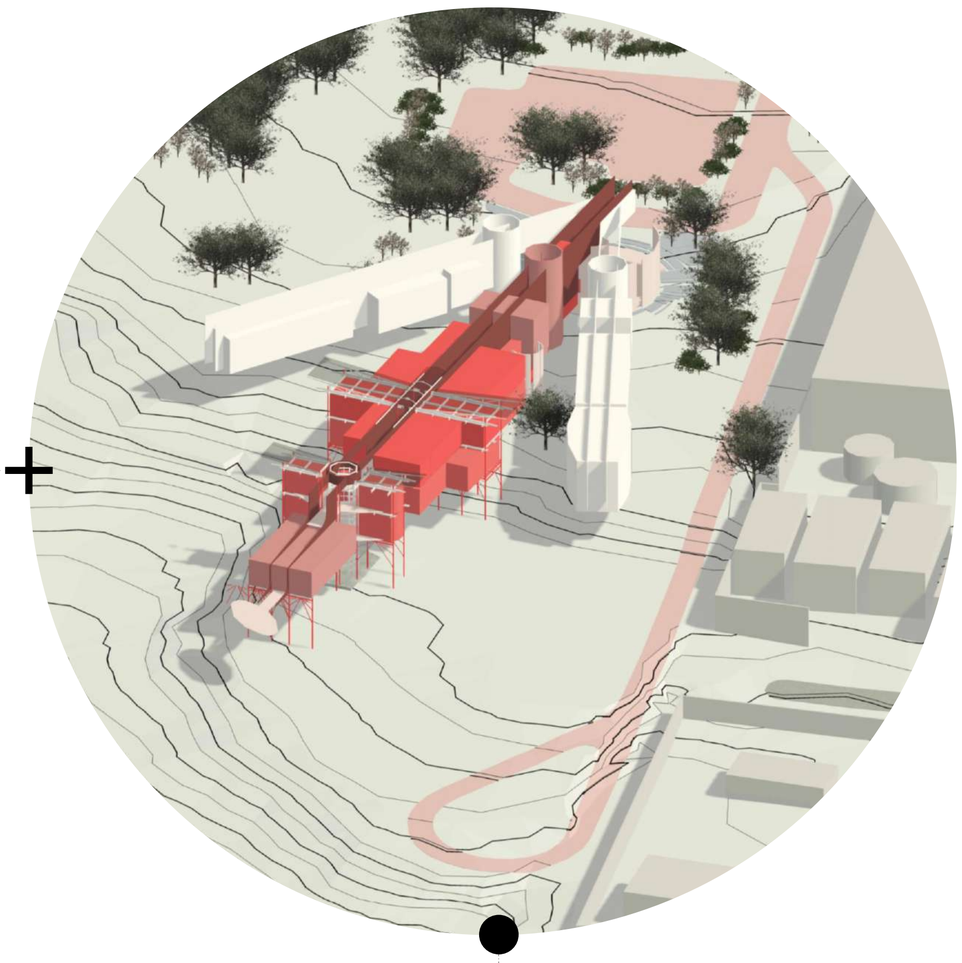
01 SITE PLAN DEVELOPMENT

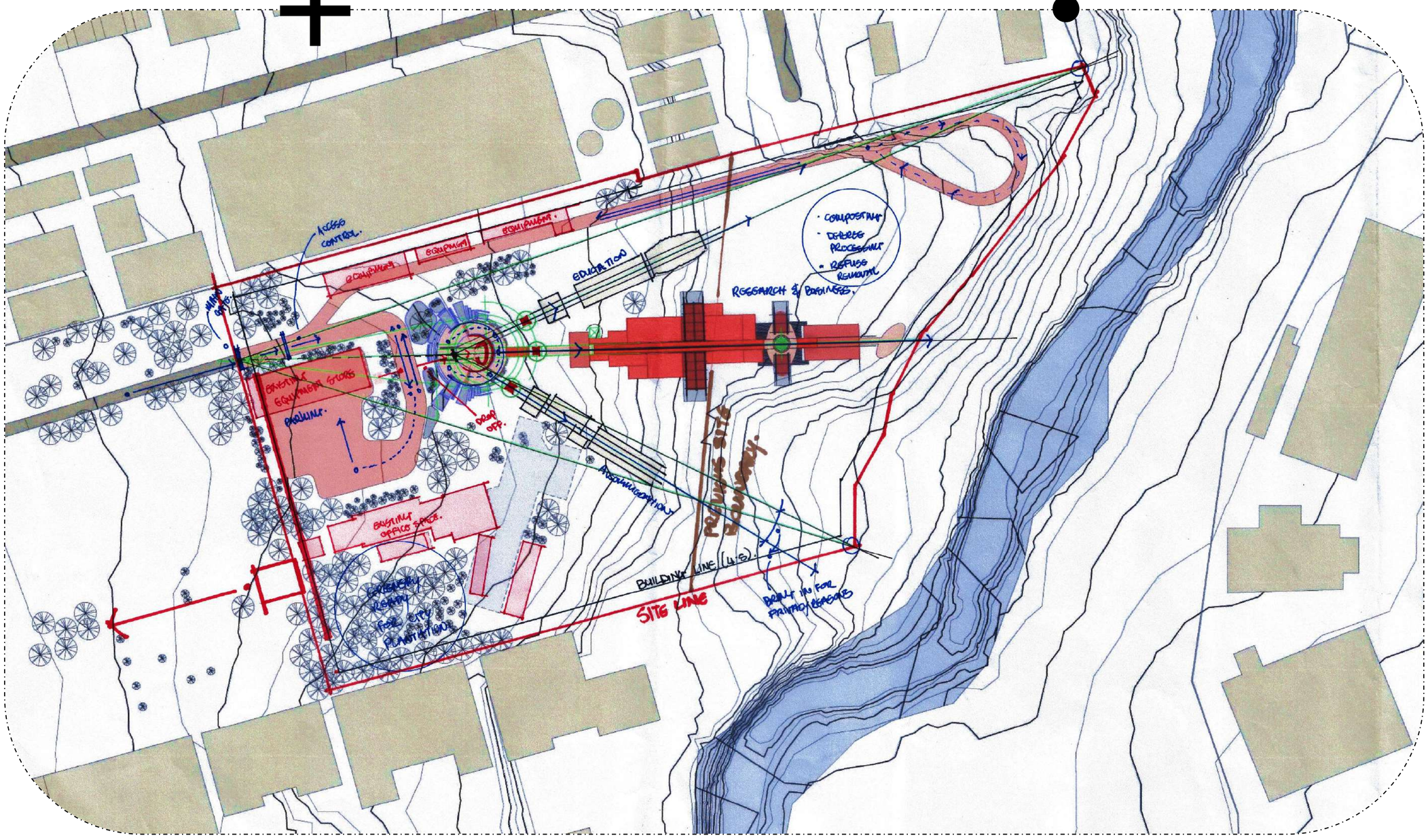
The first site plan iteration included a collection of 3 lifted buildings connected at the entrance by a cylindrical receiving space. Programs associated with these buildings includes educational and training facilities, on site accommodation, and digital and physical material research development and prototyping facilities (as depicted by the red building). The red building depicts the building of focus for this dissertation and the intention is for it to become the Bio-integration innovation and emergence wing of the BERH-SA building collective.

ITERATION 1



DEVELOPMENTAL BLOCK MODEL





ZONING AND BUILDING PLACEMENT

Figure 27: Site plan development iteration 1 (Author, 2023)

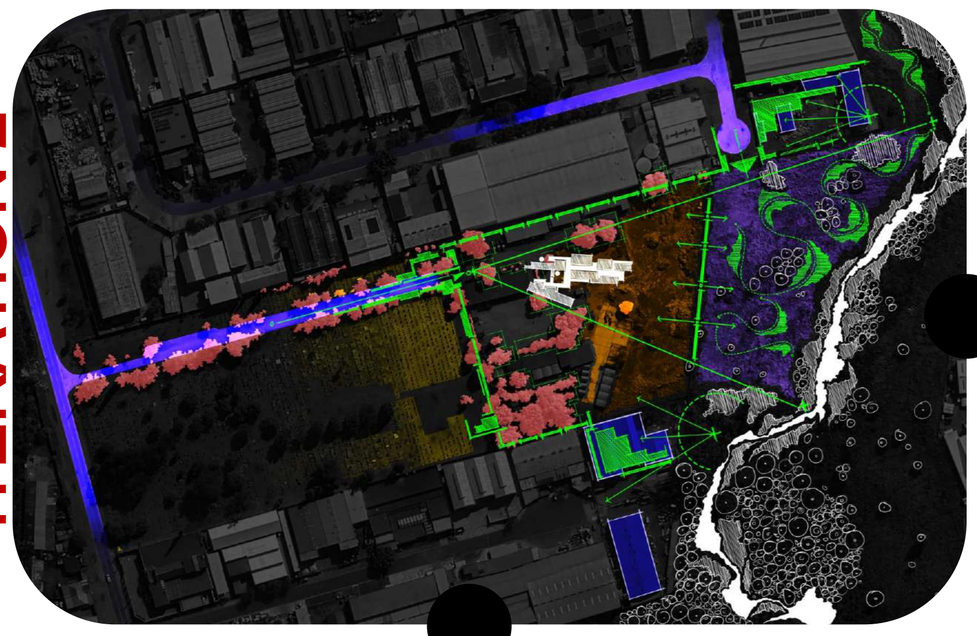
04 ITERATIVE DESIGN

SITE PLAN DEVELOPMENT

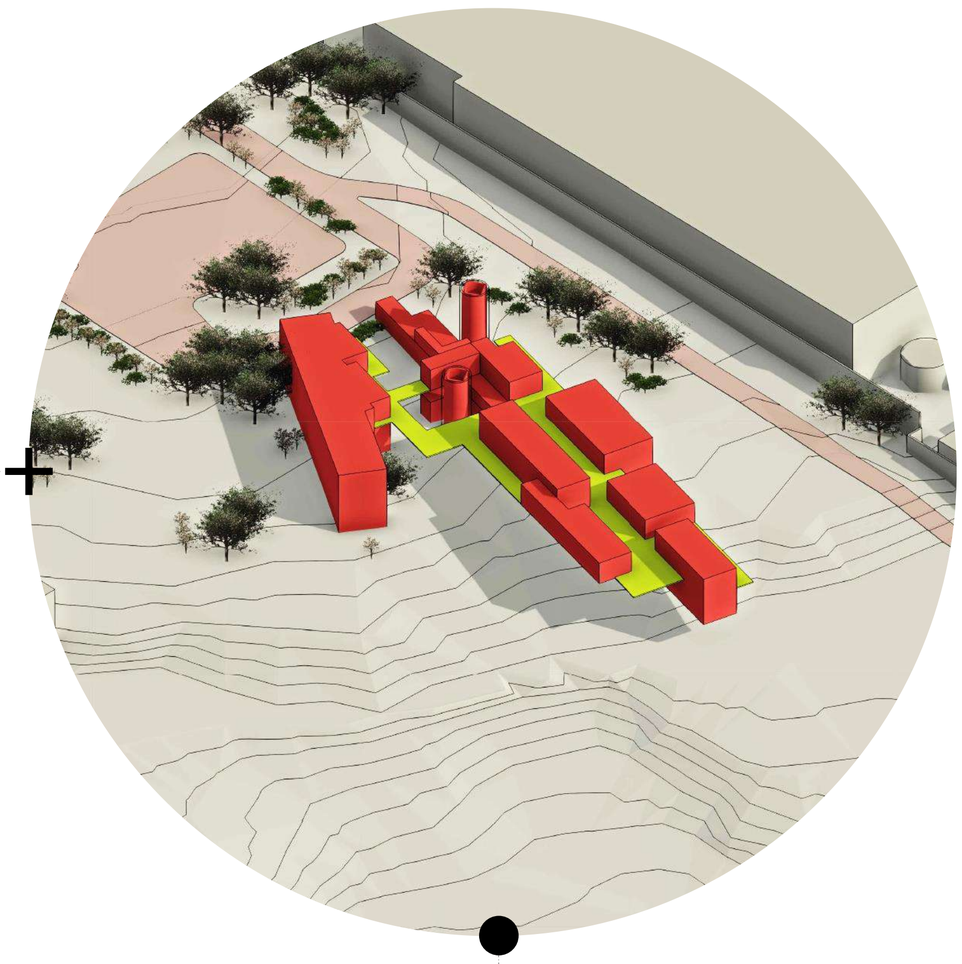
02

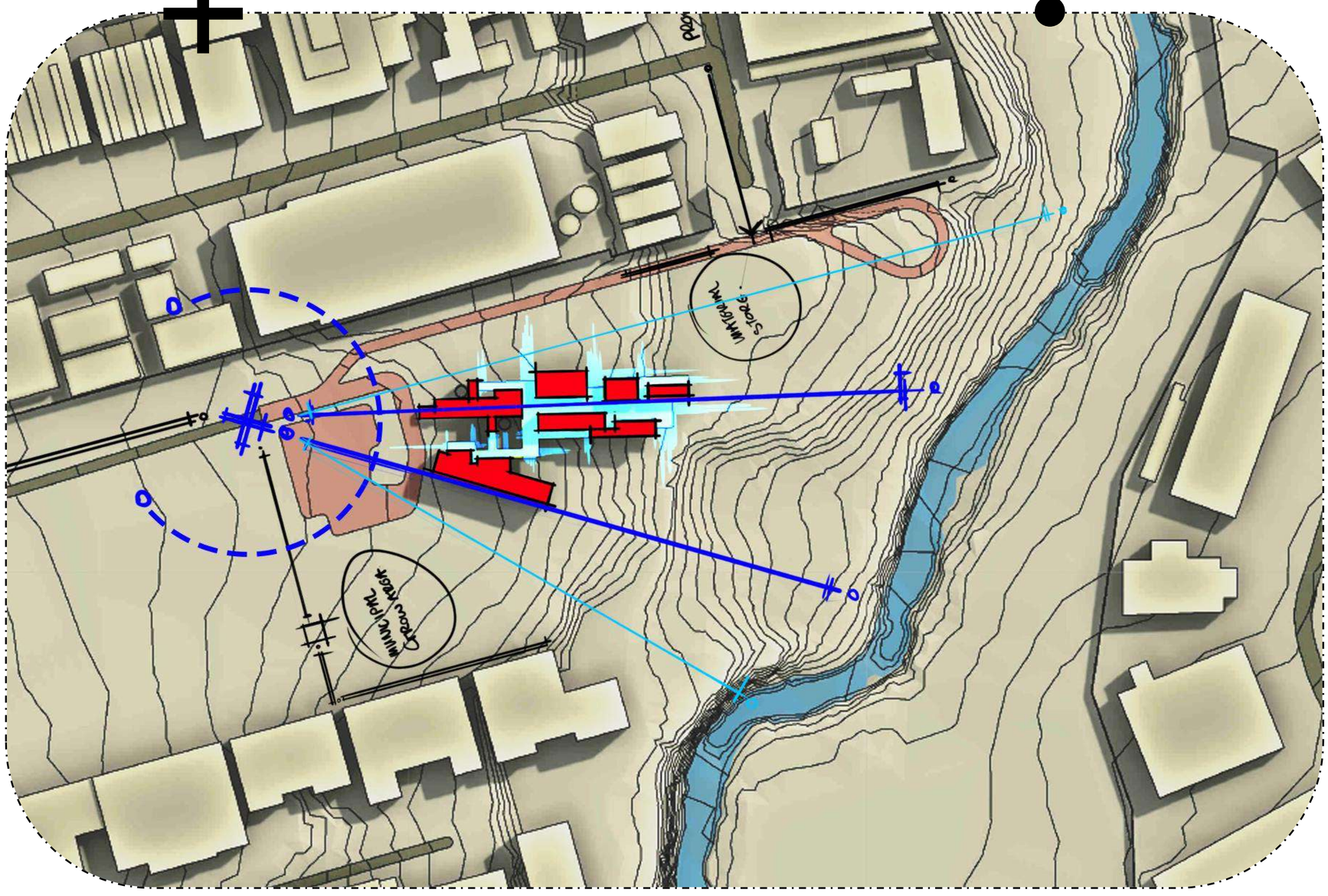
Site plan development iteration 2 served as a brief iteration that considered expanding the amount of circulation in and between the intended spaces as depicted in red. This was in response to the segregated nature of the first iteration which depicted 3 buildings with no formalized connections between themselves or the greenspace below.

ITERATION 2



DEVELOPMENTAL BLOCK MODEL





ZONING AND BUILDING PLACEMENT

NORTH

Figure 28: Site plan development iteration 2 (Author, 2023)

04 ITERATIVE DESIGN

03 SITE PLAN DEVELOPMENT

Site plan development iteration 3 reverts back to a typology that considers 3 buildings feathering out from a common point, however, each building is a stand alone building with its own receiving spaces. The red building depicting BERH-SA's Bio-integration innovation and emergence wing now makes deliberate connections with the proposed flanking buildings where its ground floor intervention responds to the design language associated with the sinuous line pedestrian path.

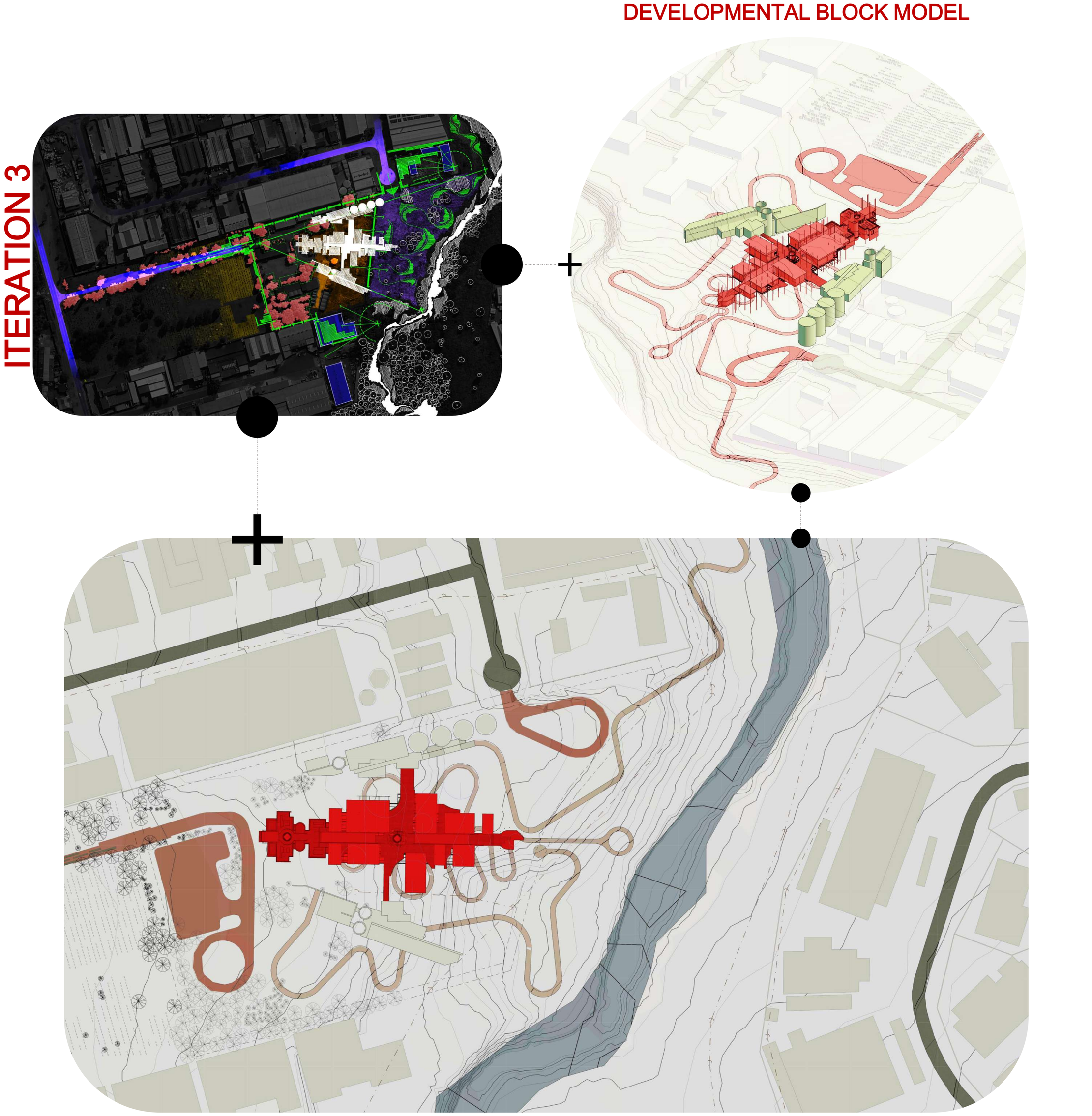


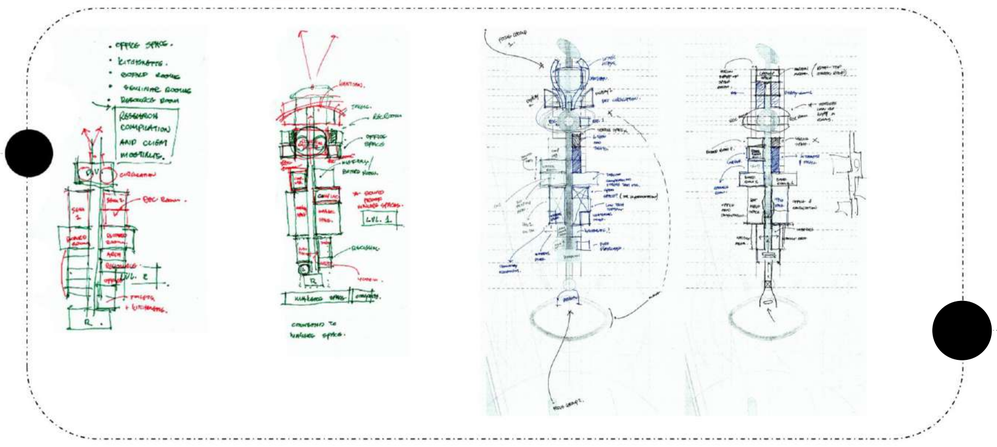
Figure 29: Site plan development iteration 3 (Author, 2023)

04 ITERATIVE DESIGN

PLAN DEVELOPMENT 01

Plan development iteration 1 coincides with site plan development iteration 1, and depicts a long narrow building with its spaces tightly packed together, and connected by one single internal walkway. The tightly packed spaces do not consider an inside-outside relationship, thus causing the users to feel segregated from the site once they are in the building.

PLAN ITERATIONS



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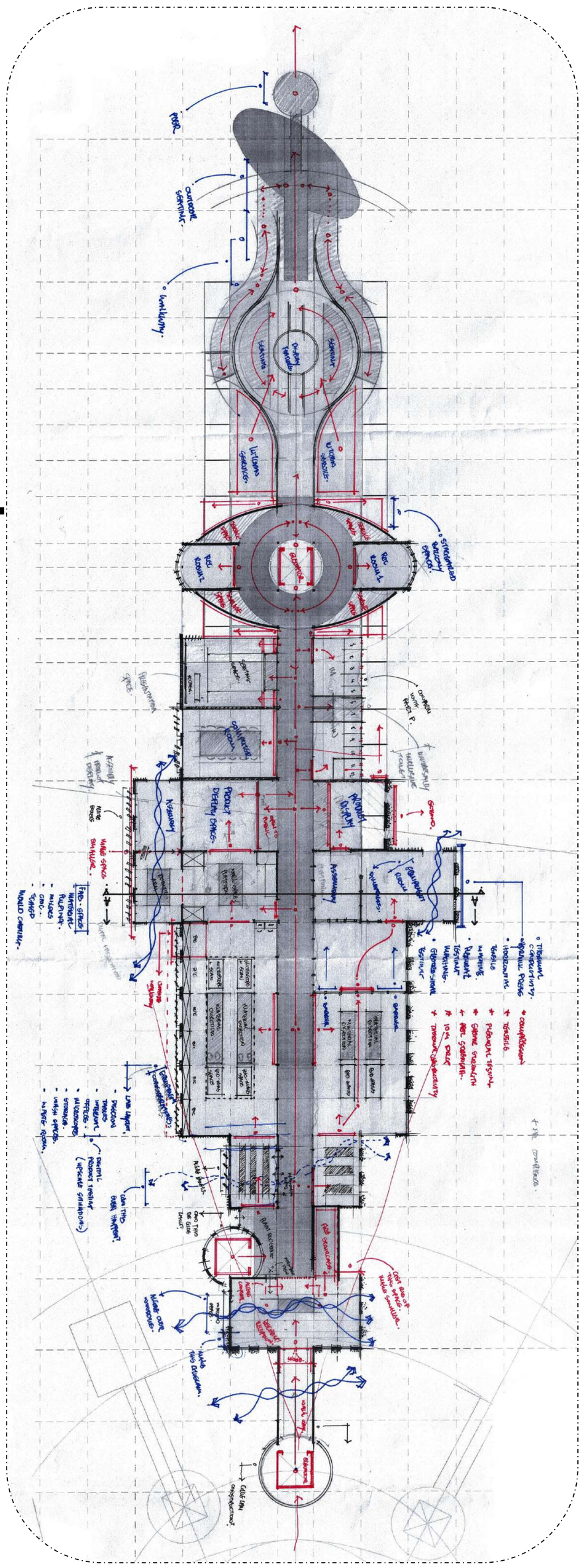


FIRST FLOOR LAYOUT

NORTH

Figure 30: Plan development iteration 1 (Author, 2023)

04 ITERATIVE DESIGN

02 PLAN DEVELOPMENT

Plan development iteration 2 coincides with site plan development iteration 2, and the main goal was to create a more deliberate connection between internal and external experiences. This begins to happen through creating a more generous circulation route that allows for the user to navigate in and around the designed spaces as depicted on the floor plans in red.

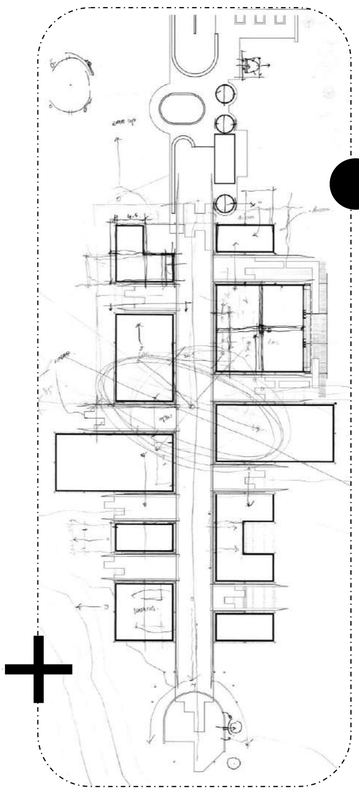
Figure 31: Plan development iteration 2 (Author, 2023)

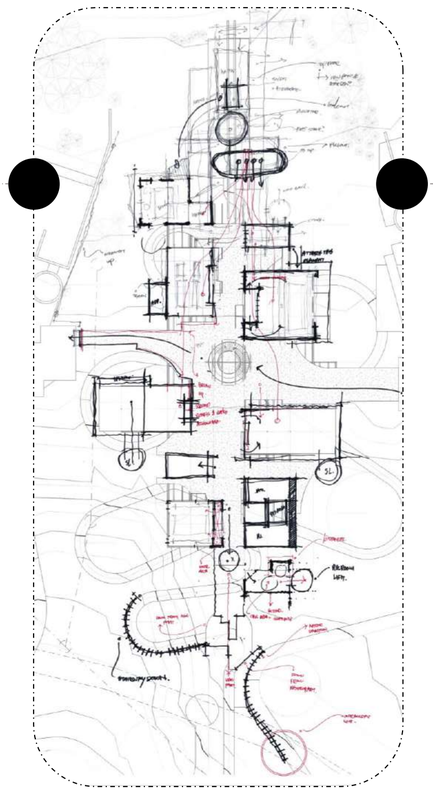
04 ITERATIVE DESIGN

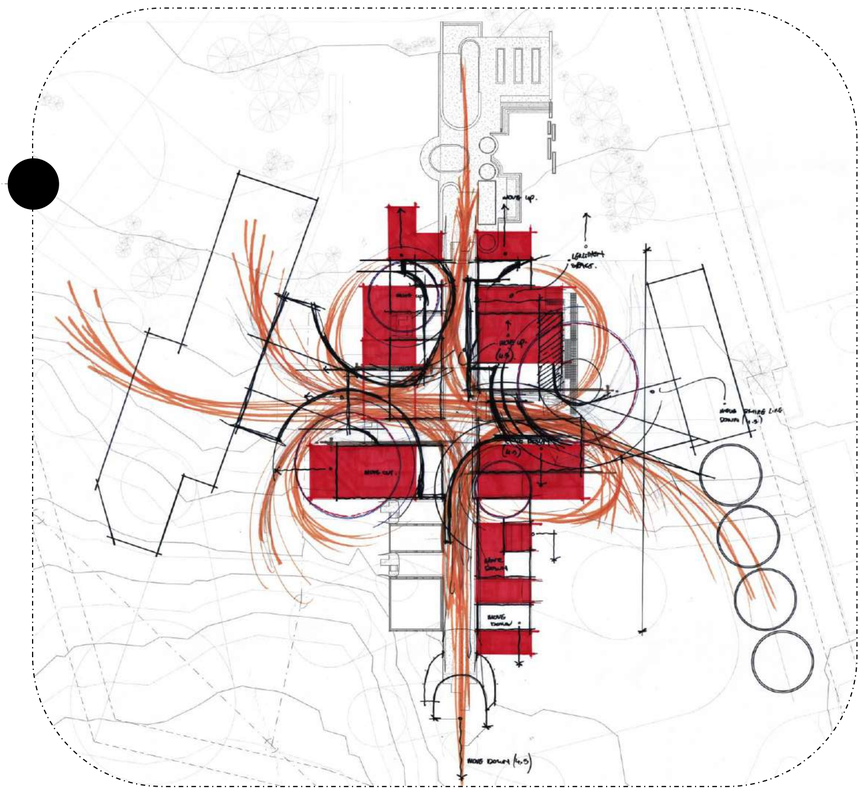
03 PLAN DEVELOPMENT

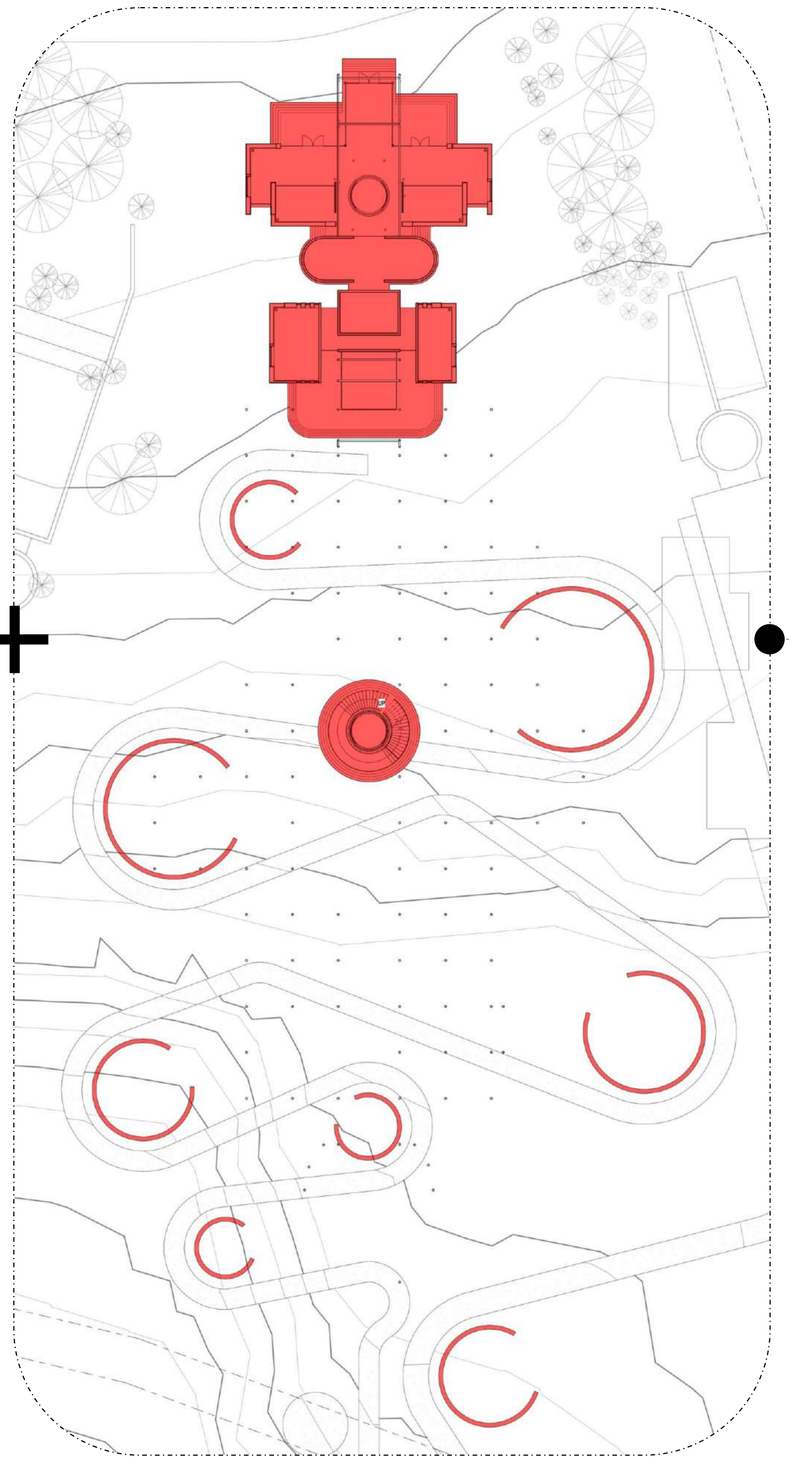
Plan development iteration 3 coincides with site plan development iteration 3, and circulation patterns were once again reconsidered. BERH-SA's Bio-integration innovation and emergence wing now makes deliberate connections with the proposed flanking buildings where its ground floor intervention responds to the design language associated with the sinuous line pedestrian path. The user experience can now happen between all 3 proposed buildings simultaneously with the ground intervention becoming an important linking space in terms of ascent and decent.

3RD PLAN ITERATION PROCESS

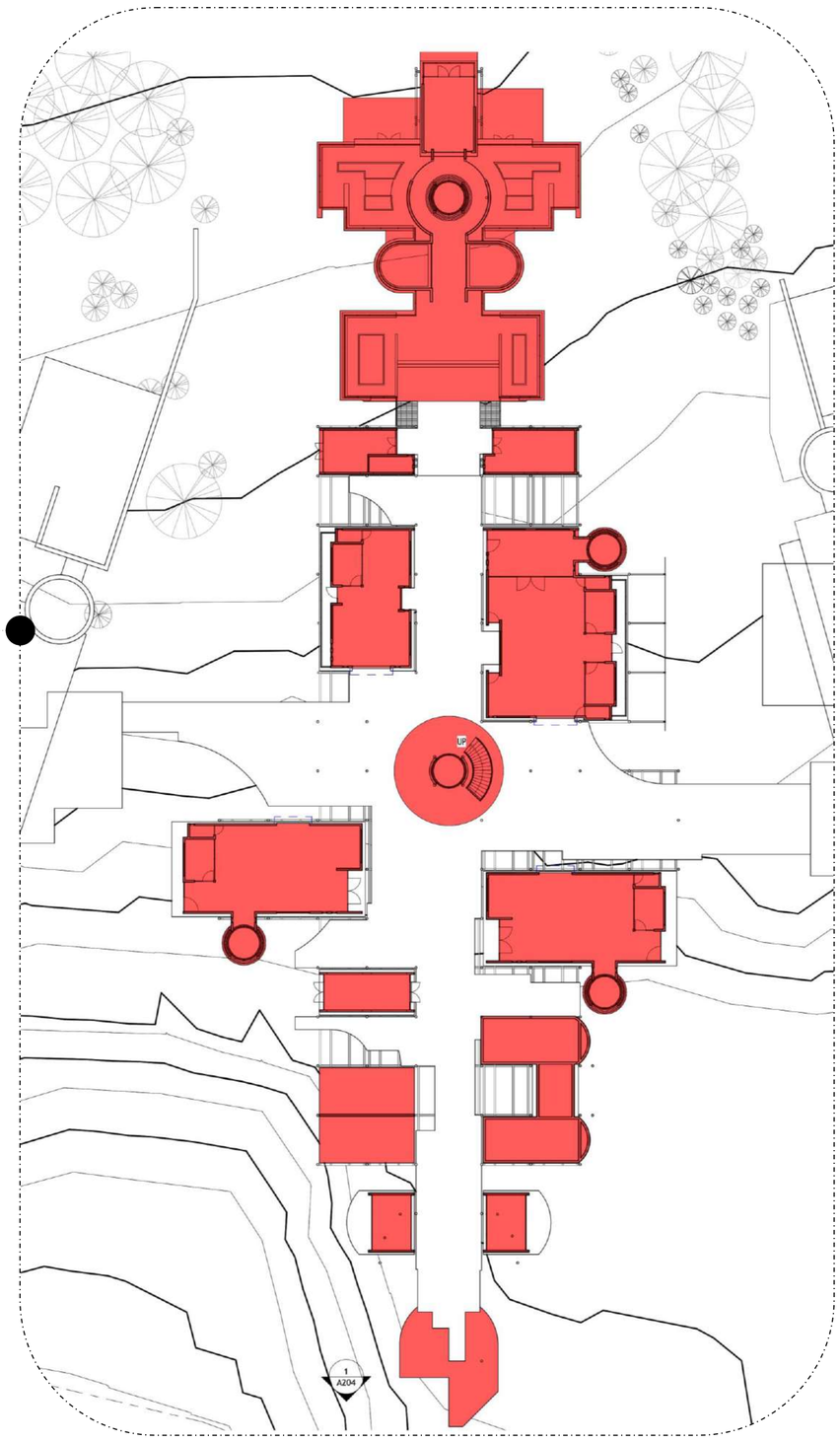








GROUND FLOOR



FIRST FLOOR

NORTH

Figure 32: Plan development iteration 3 (Author, 2023)

04 ITERATIVE DESIGN

01 SECTION DEVELOPMENT

Section development 1 coincides with plan development 1 and begins to show the nature of the intended material development and prototyping facilities. Furthermore, Section development 1 shows how the structure that lifts the building becomes a space where indigenous plant life can be grown, cared for, and cultivated. This sectional iteration also begins to make gestures at the intentions for tectonic articulation between architectural elements.

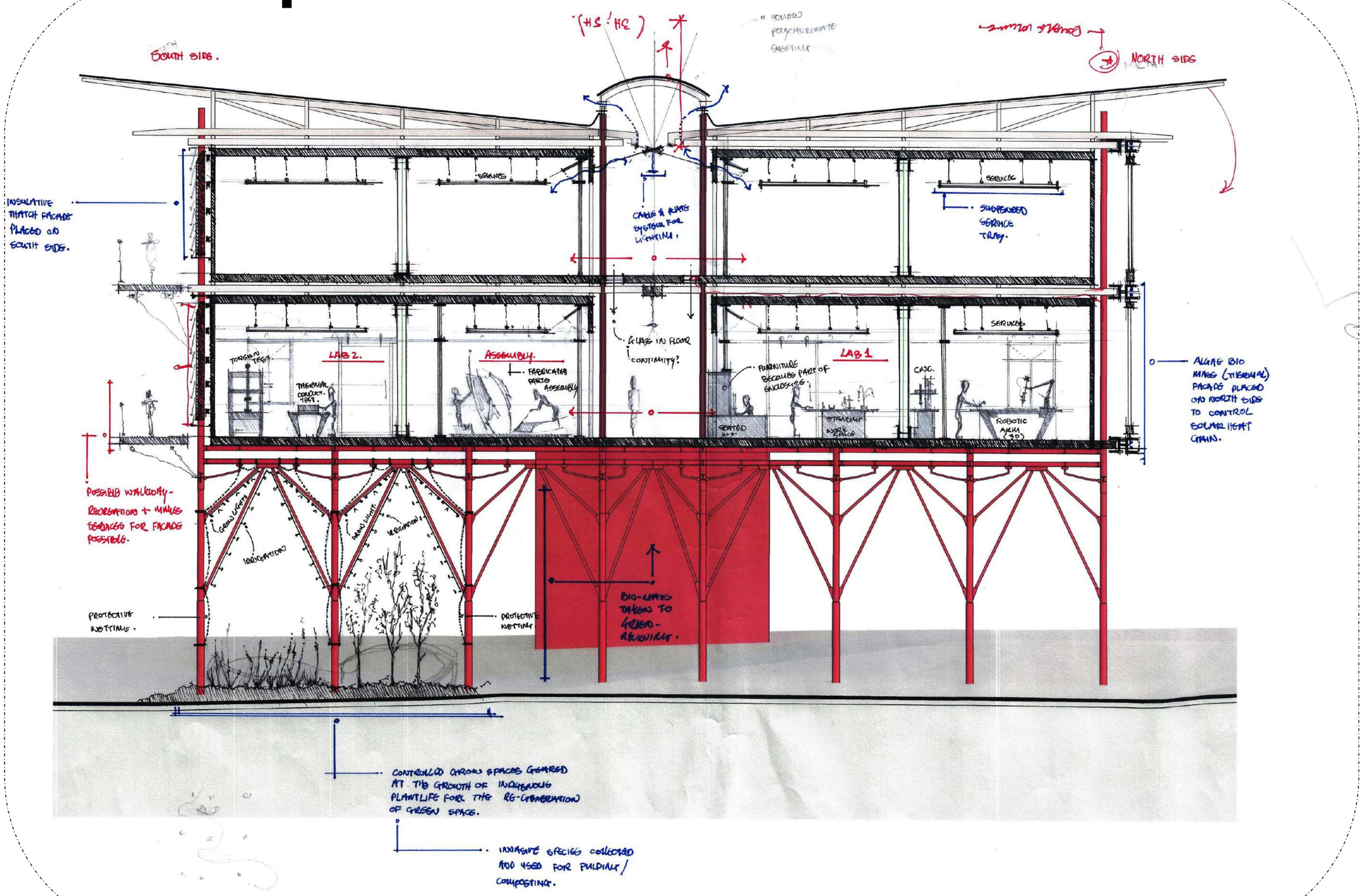


Figure 33: Section development iteration 1 (Author, 2023)

04 ITERATIVE DESIGN

02 SECTION DEVELOPMENT

Section development 2 coincides with plan development 2, and depicts a wider circulation route with its own enclosing element, as well as single story spatial elements (clt boxes) that differ in height with response to the intended programs. This sectional iteration reconsidered the façade intervention where the goal was to design as flexible of a façade as possible. The façade in this iteration is designed to be deconstructed and reconstructed as needed hence its modular design. Façade modules are removable which allows professional staff to test new material developments on the building itself – adding to BERH-SA's intended didactic experience (more about this in the technical investigation and design integration section of this dissertation).

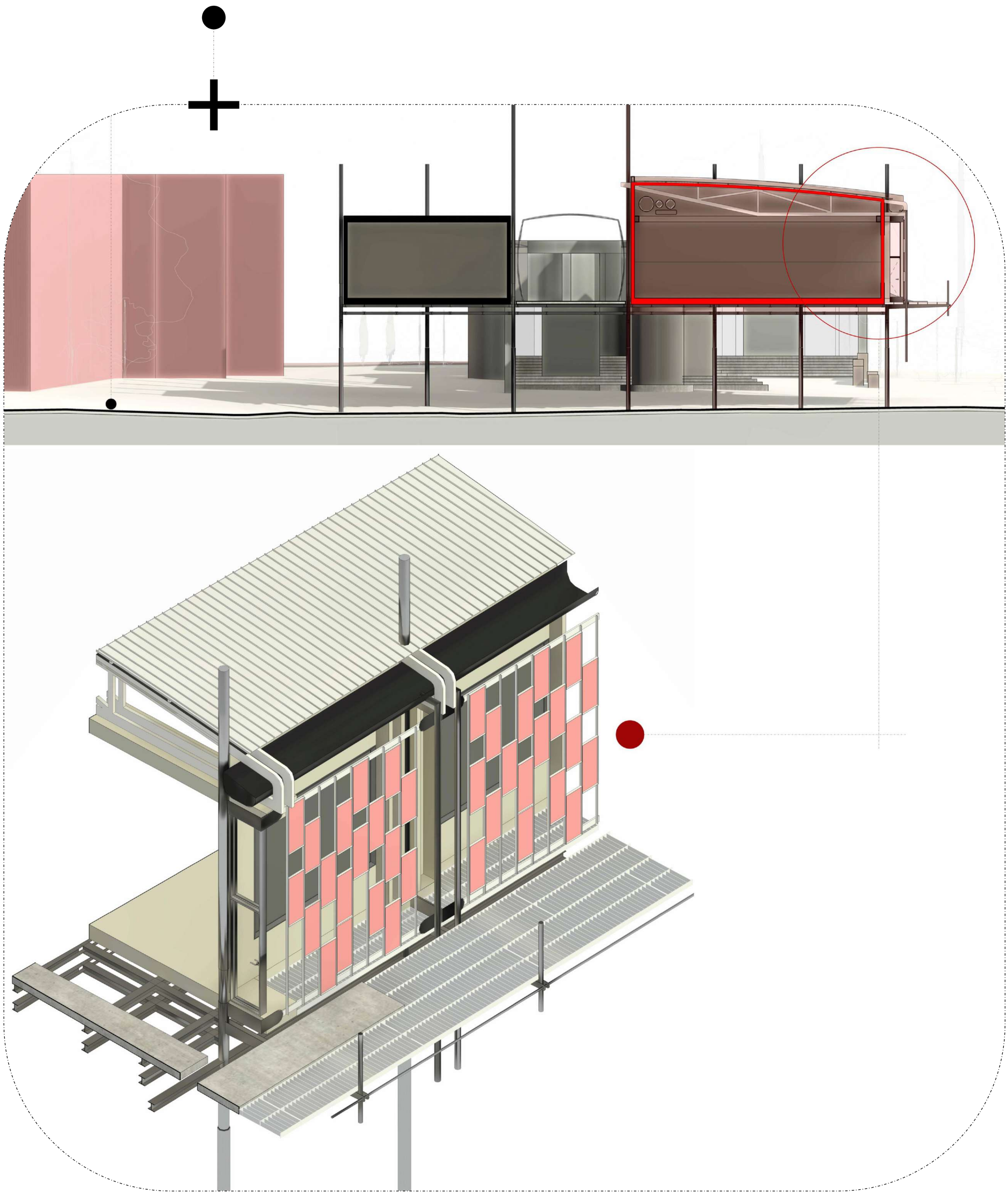


Figure 34: Section development iteration 2 (Author, 2023)

04 ITERATIVE DESIGN

03 SECTION DEVELOPMENT

Section development iteration 3 coincides with plan development iteration 3 and depicts a more complete version of section development iteration 2. Internal spaces have been articulated, and the intention is to apply façade and roofing principles applied in section development iteration 2.

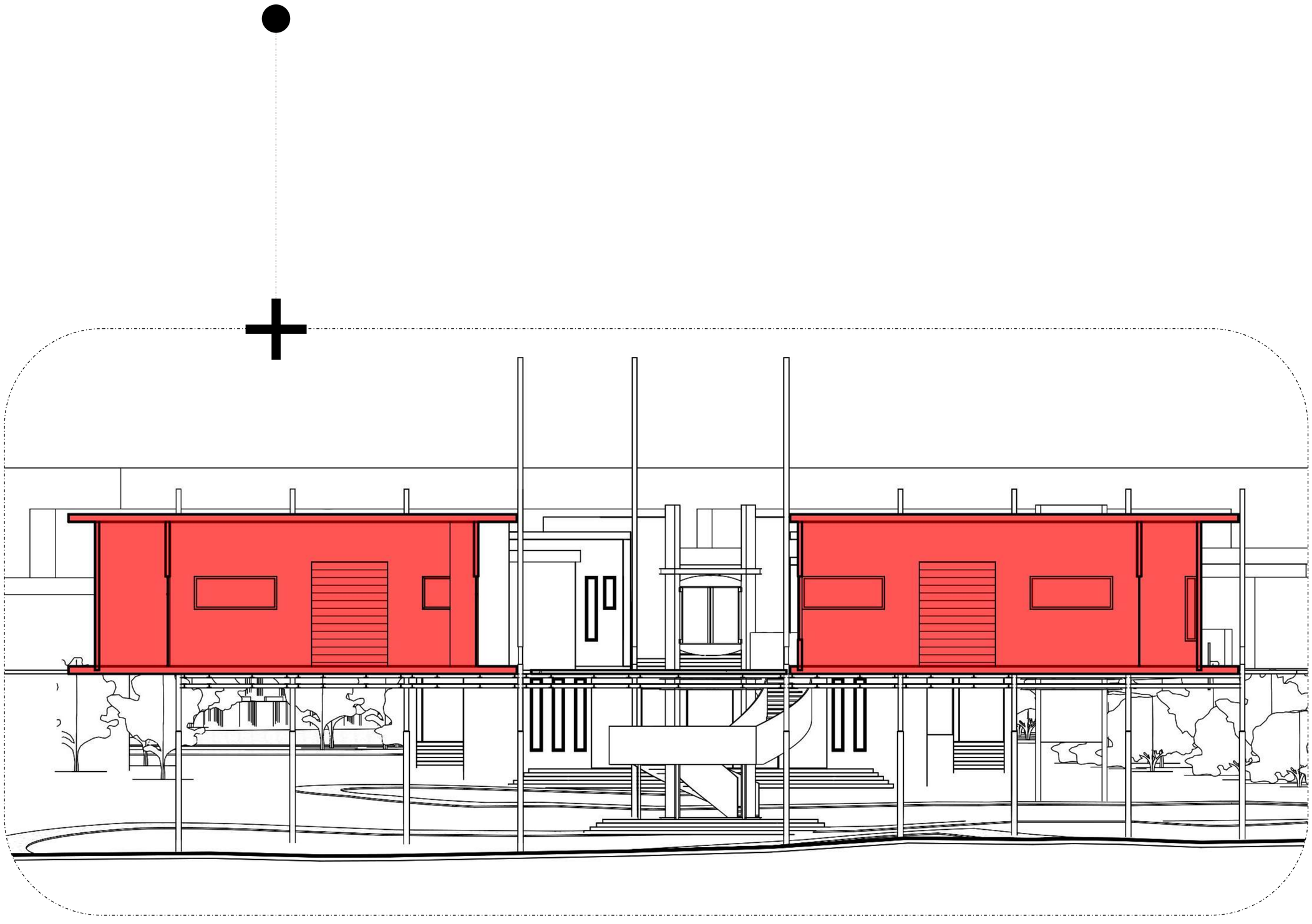


Figure 35: Section development iteration 3 (Author, 2023)

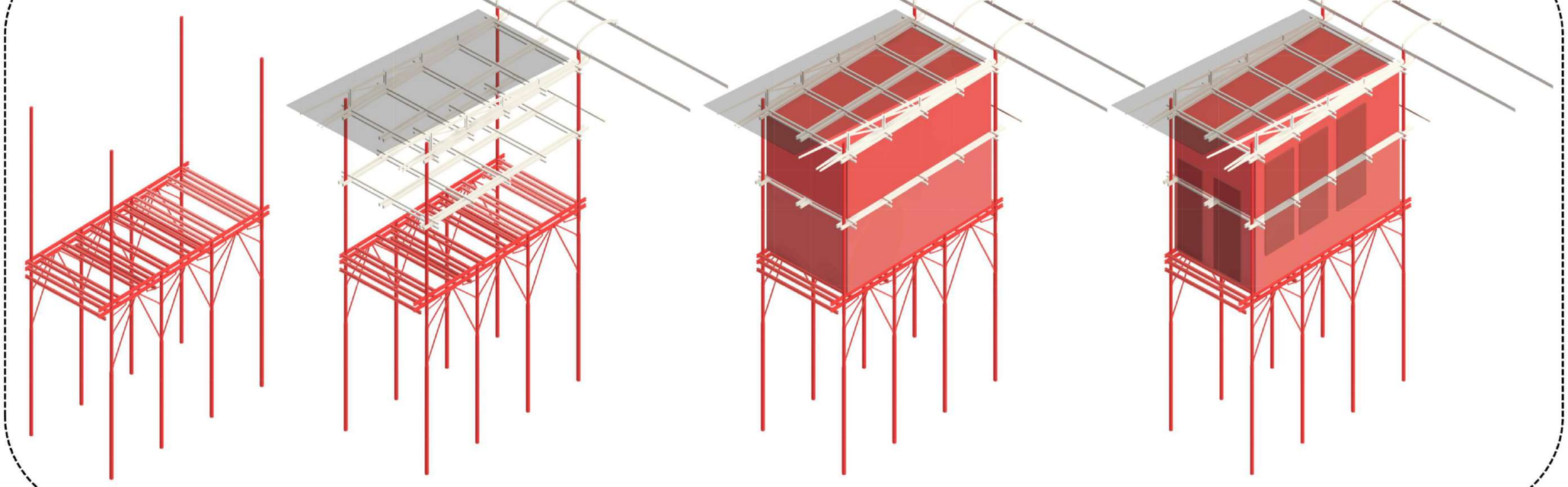
04 ITERATIVE DESIGN

TECTONIC DEVELOPMENT

In line with the hybrid tectonic, there are 3 spheres considered for technological implementation.
Primary – lifting the building off of the floor
Secondary – spatial definition and integration
Tertiary – Movement patterns which solidify a socio technological relationship

Two iterations were explored considering tectonic make-up and articulation

ITERATION 1



PRIMARY

FOCUS: LIFTING THE BUILDING OFF OF THE FLOOR
CONSTRUCTION TYPE: IN-SITU
MATERIAL: TREATED MILD STEAL

SECONDARY

FOCUS: LEVEL TRANSITION AND STRUCTURAL CONTINUITY
CONSTRUCTION TYPE: PREFABRICATION
MATERIAL: GLULAM TIMBER

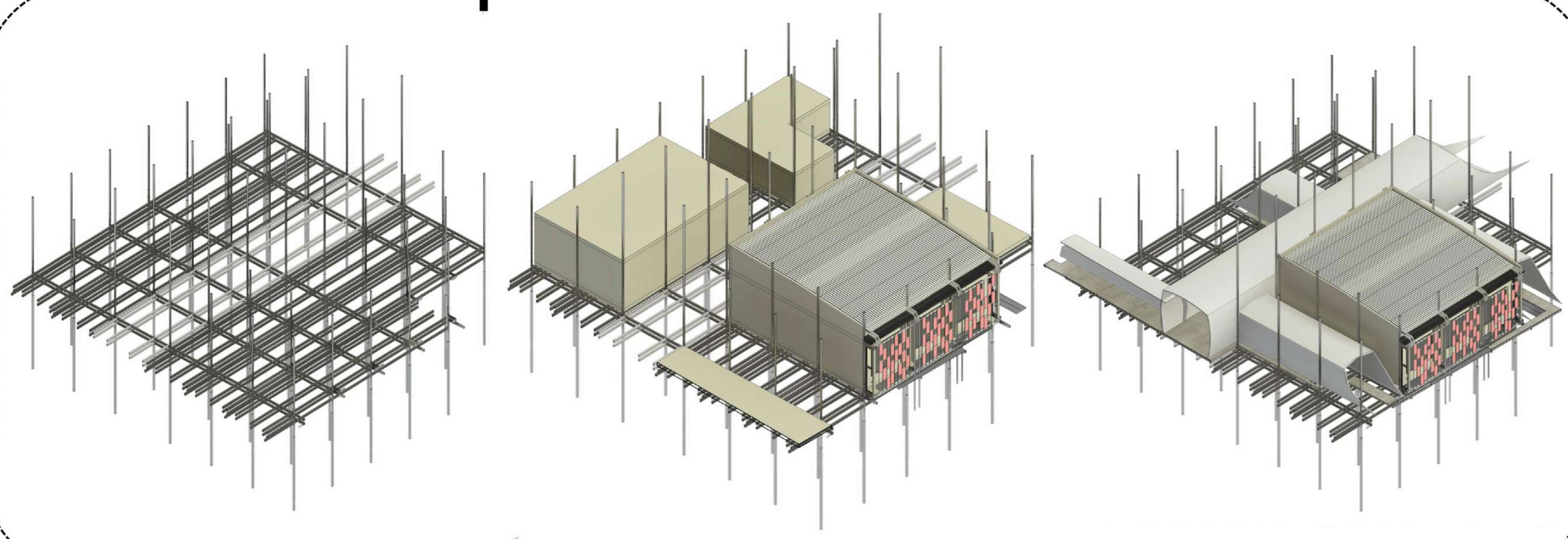
TERTIARY

FOCUS: SPATIAL DEFINITION AND INTEGRATION
CONSTRUCTION TYPE: PREFABRICATION
MATERIAL: CLT BOXES

QUARTERNRY

FOCUS: TECHNOLOGICAL EXPERIMANTATION AND EXPRESSION
CONSTRUCTION TYPE: IN-SITU HAND BASED AND PREFABRICATION
MATERIAL: THATCH AND ALGAE

ITERATION 2



PRIMARY

FOCUS: LIFTING THE BUILDING OFF OF THE FLOOR
CONSTRUCTION TYPE: IN-SITU
MATERIAL: TREATED MILD STEAL

SECONDARY

FOCUS: SPATIAL DEFINITION AND INTEGRATION
CONSTRUCTION TYPE: PREFABRICATION AND HAND BASED
MATERIAL: CLT BOXES AND DYNAMIC FACADES

TERTIARY

FOCUS: SOCIO TECHNOLOGICAL CONNECTION
CONSTRUCTION TYPE: IN-SITU HAND BASED AND PREFABRICATION
MATERIAL: GLAZING

Figure 36: Tectonic concept development iterations 1-2 (Author, 2023)

05 TECHNICAL INVESTIGATION AND DESIGN INTEGRATION

Defining a realm for performance testing

Considering that the main goal of BERH-SA's function is to have new information on construction and emerging building technologies penetrate the South African market as quickly as possible, there needs to be a strong emphasis on:

- Rapid technological experimentation
- Multi-scale technological display
- Real time building performance data capturing
- Designated professional access
- Designated Social access
- Deliberate movement patterns
- Research process display and transparency
- Integrated social and professional fabric
- Multi- dimensional ecological integration

Typically, a building's envelope is what makes it recognizable. It is the first point of reference people are presented with when visiting a place or space. Therefore, it would make sense to use the building's envelope as the primary tool in the transfer of knowledge for both visitors and professionals.
The following testing process will consider a performance indicator protocol that measures the flexibility of BERH-SA's envelope. The envelope will be tested against flexibility performance criteria outlined by (Geraedts 2015), (Carlebur 2015) , and (Geraedts et. al., 2016) extracted from Delft University of Technology's FLEX 3.0 - An instrument to formulate the demand for and assessing the supply of the adaptive capacity of buildings.

● DESIGNING A TESTING PROTOCOL FOR BUILDING PERFORMANCE ON ADAPTATION AND FLEXIBILITY

Testing strategy

The nature of testing considered revolves predominantly around the adaptability of flexible façade systems. In understanding this it was decided that the most appropriate testing protocol would be inline with a peer reviewed indicator list in order to quantify levels of façade flexibility. The indicator protocol implemented was extracted and adapted from Delft University of Technology's FLEX 3.0 - An instrument to formulate the demand for and assessing the supply of the adaptive capacity of buildings, and functions as follows:

TESTING FOR A SOCIO-TECHNOLOGICAL RELATIONSHIP							
LAYER	SUB-LAYER	NR.	FLEXIBILITY PERFORMANCE INDICATOR	Weighting	1-Bad 2-Normal 3-Better 4-Best	FINAL SCORE	Adapted from
SKIN	Façade	08(42)	Dismountable façade	3	1	3	(Geraedts 2015)
		24	Day light facilities	2	1	2	(Geraedts et. al., 2016)
		25	Location and shape of day light facilities	2	2	2	(Geraedts et. al., 2016)
		26	Façade insulation	1	2	2	(Geraedts et. al., 2016)
FACILITIES	Measurement & Control	09(53)	Customisability and controlability of facilities	3	1	3	(Geraedts 2015)
	Dimensions	12(65)	Disconnection of facilities components	3	1	3	(Geraedts 2015)
		10	Modularity of facilities	2	1	2	(Carlebur 2015)
SPACE PLAN/ FINISHING	Access	14(73)	Access to building: horizontal routing, corridors, gallery	3	1	3	(Geraedts 2015)
	Technical	15(77)	Removable, relocatable units in building	3	1	3	(Geraedts 2015)
		17(79)	Disconnecting/ detailed connection interior walls: hor/vert.	2	1	2	(Geraedts 2015)
					Unit Flexibility Score:	25	
					Maximum possible score:	96	

Figure 37: Delft University of Technology's FLEX 3.0 - An instrument to formulate the demand for and assessing the supply of the adaptive capacity of buildings (Geraedts et. al., 2016)

Façade performance is captured and quantified through a point based system (1-4), where 1 is a result of a façade system not being flexible at all (e.g. brick wall concreted into the ground), and where 4 is a result of a perfectly flexible façade (e.g. A façade that is dismantlable, interchangeable, becomes a spatial element for people to experience professionally and socially, and can be reused for a multitude of programs). Each testing segment (SKIN, FACULTIES, SPACE PLAN/ FINISHING) is broken up into sub-segments which have assigned weighting values (1-3), where 1 is somewhat important, 2 is moderately important, and 3 is very important.

The final score for each sub-segment is determined by multiplying the point-based system point based system (1-4) by the assigned weighting values (1-3). This produces a final score for each sub segment, which is tallied up at the end of the test.
BEST PRACTICE for this testing protocol coincides with the maximum achievable score (96/96).

TESTING PROTOCOL APPLICATION

Scenario types

The testing protocol was applied to 3 different scenario types:

Base case

The test protocol was applied here so that a variable baseline was established, the intention was to gain an understanding on what an inflexible, non-adaptive façade would look like.

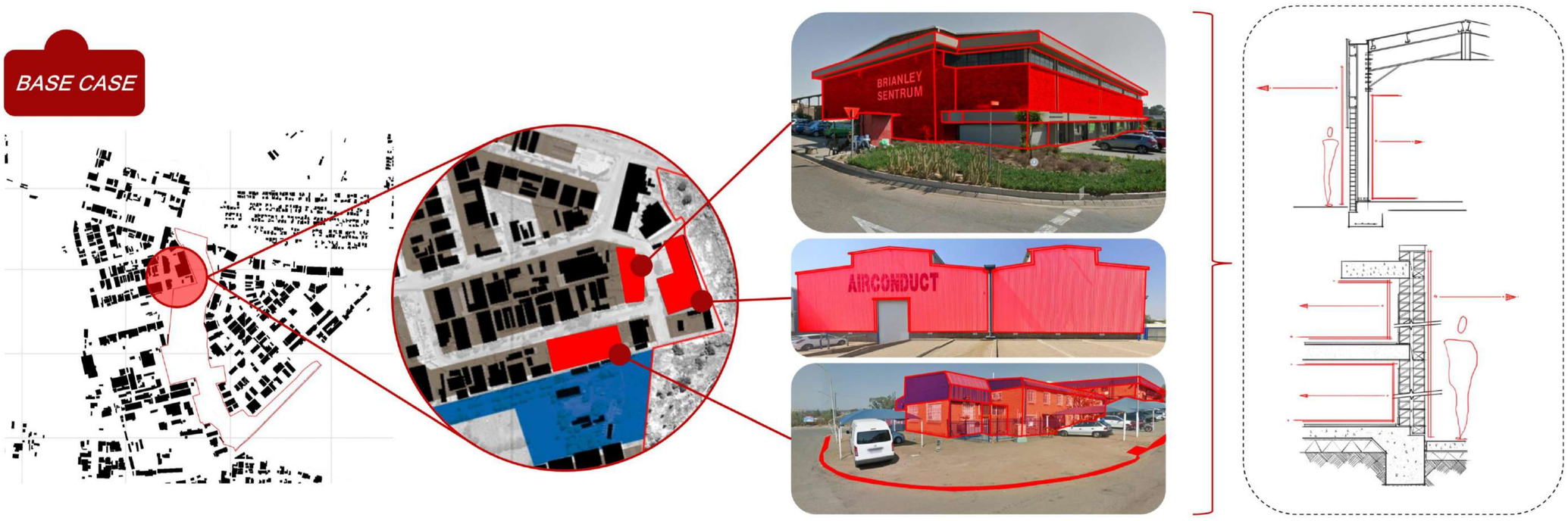


Figure 38: Base case test diagram (Author, 2023)

Pool of 3 adaptive façade precedent studies

The test protocol was applied here in order to gain understanding on what exists in the world of adaptive flexible facades, and what principles could be harvested and used for further design development.

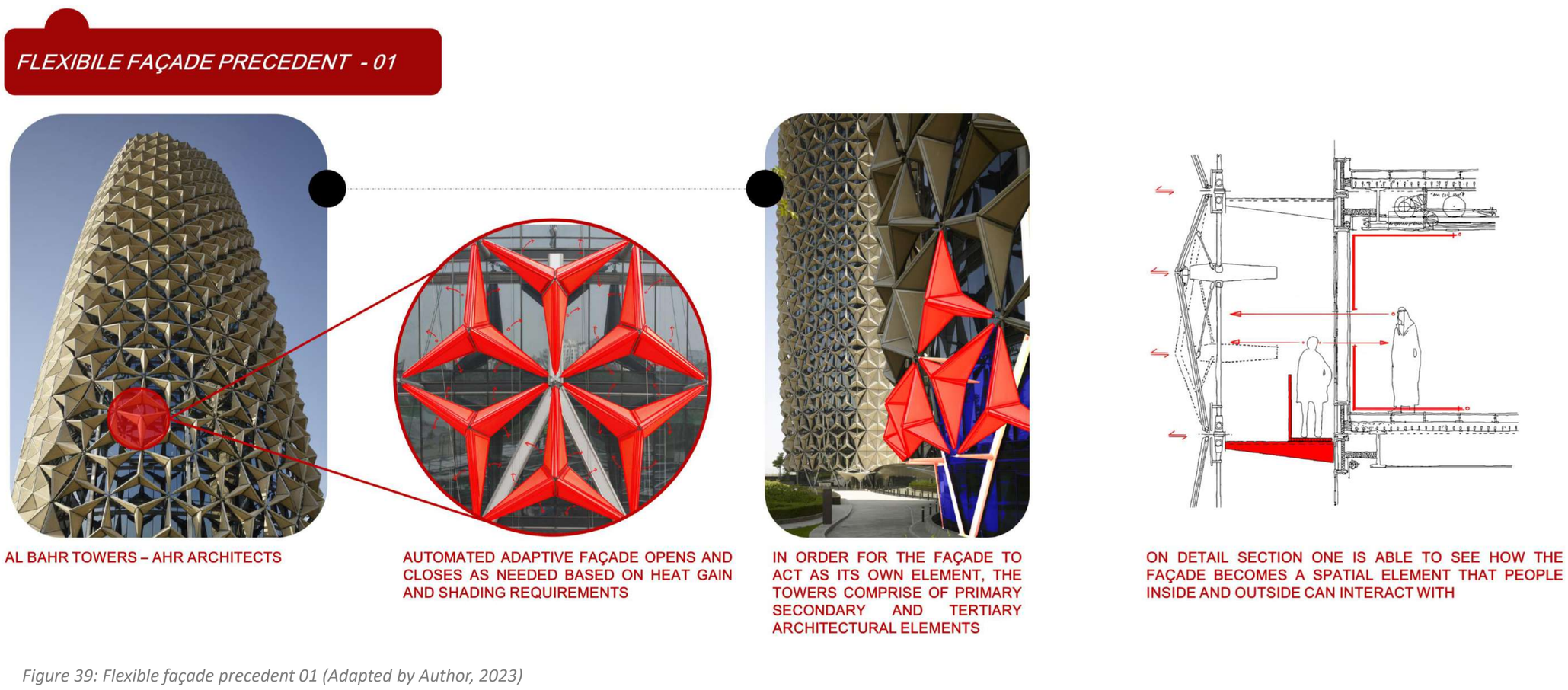
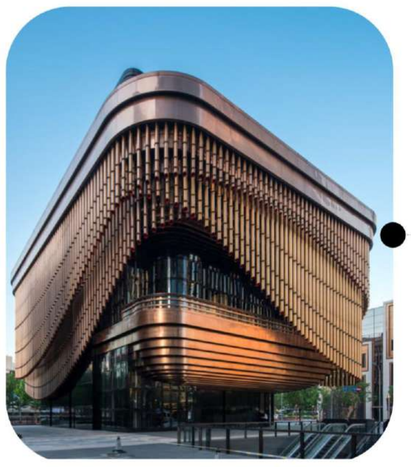


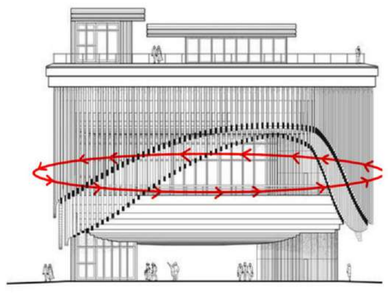
Figure 39: Flexible façade precedent 01 (Adapted by Author, 2023)

FLEXIBILE FAÇADE PRECEDENT - 02

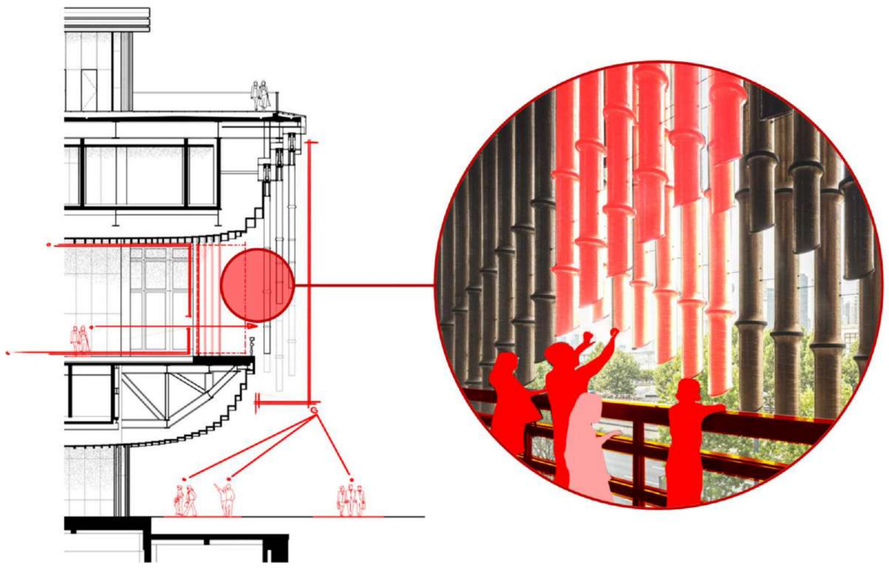


BUND FINANCE CENTER – FOSTER AND PARTNERS

THIS BUILDING FEATURES A FAÇADE MADE UP OF 4 LAYERS THAT ALL MOVE IN OPPOSITE DIRECTIONS



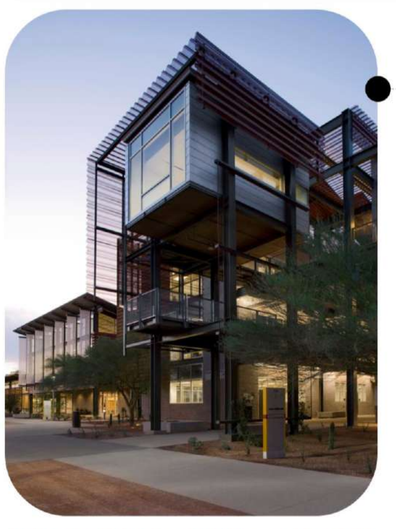
THE FAÇADE SYSTEM MOVES IN ACCORDANCE WITH SOLAR SHADING AND HEAT GAIN REQUIREMENTS



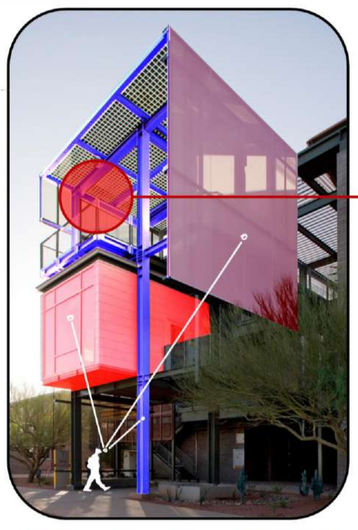
ON DETAIL SECTION ONE IS ABLE TO SEE HOW THE FAÇADE BECOMES A SPATIAL ELEMENT THAT PEOPLE INSIDE AND OUTSIDE CAN INTERACT WITH

Figure 40: Flexible façade precedent 02 (Adapted by Author, 2023)

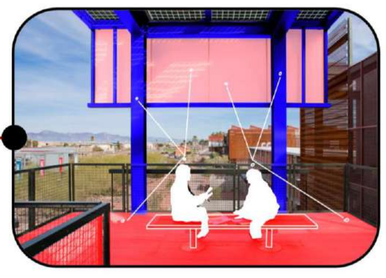
FLEXIBILE FAÇADE PRECEDENT - 03



ASU POLYTECHNIC CAMPUS LAKEFLATO ARCHITECTS + RSP ARCHITECTS



THERE IS A DELIBERATE SEPARATION BETWEEN STRUCTURE, SPACE AND FACADE



DUE TO THE SEPARATION BETWEEN THESE ELEMENTS, THE BUILDING FAÇADE BEGINS TO ACT AS MORE THAN ONE THING, AND IN SOME CIRCUMSTANCES, THE FAÇADE ELEMENT STARTS TO DEFINE SPACE

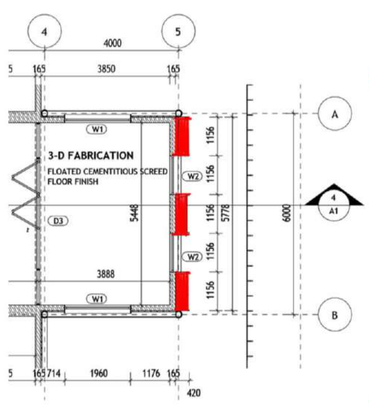
THE FLEXIBILITY BETWEEN FAÇADE STRUCTURE AND SPACE ALLOWS EACH BUILDING COMPONENT TO BECOME AN ACTIVE ROLE PLAYER IN GAINING ACCEPTABLE LEVELS OF PASSIVE THERMAL COMFORT

Figure 41: Flexible façade precedent 03 (Adapted by Author, 2023)

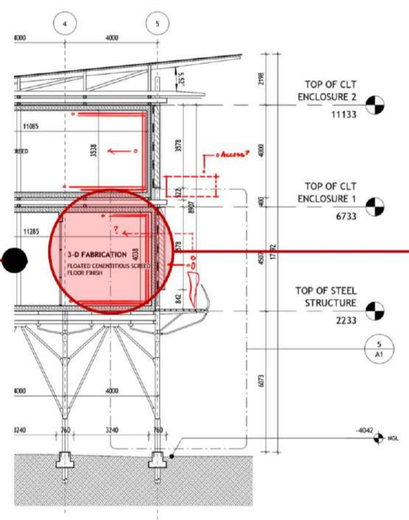
First iteration

The test protocol was applied to the first flexible façade iteration for the architectural project at hand in order to see whether or not the harvested flexible façade principles were adhered to. Applying the testing protocol also exposed the weaknesses and strengths of the first iteration and allowed for a focused set of improvements to be made on the following strategy.

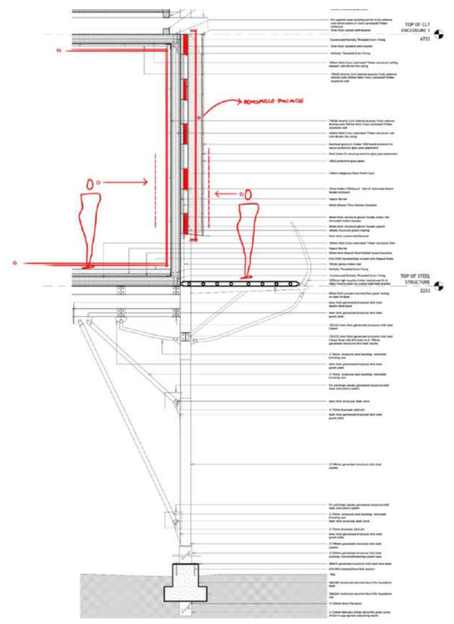
FLEXIBILE FAÇADE ITERATION - 01



ON PLAN THE FAÇADE SYSTEM READS AS AN INTEGRATED WALL ELEMENT WITH NO CONTRIBUTION TO HEAT GAIN AND LIGHT CONTROL



ON SECTION SOME INTERACTION WITH FAÇADE ELEMENTS ARE EVIDENT, HOWEVER, INTERIOR AND EXTERIOR SPACES ARE STILL SEGRIGATED



ON DETAIL SECTION ONE IS ABLE TO SEE THAT THE FAÇADE IS REMOVABLE TO AN EXTENT HOWEVER, IT IS NOT INTERCHANGABLE AND TRANSPARENCY BETWEEN INTERIOR AND EXTERIOR SPACES ARE LIMITED

Figure 42: Flexible façade iteration 01 (Adapted by Author, 2023)

Second iteration

The test protocol was applied to the second flexible façade iteration for the architectural project at hand in order to see whether or not the harvested flexible façade principles were adhered to. This time round the testing protocol showed major improvements on the overall flexibility of the flexible façade system implemented depicting a flexibility score of 77/ 96.

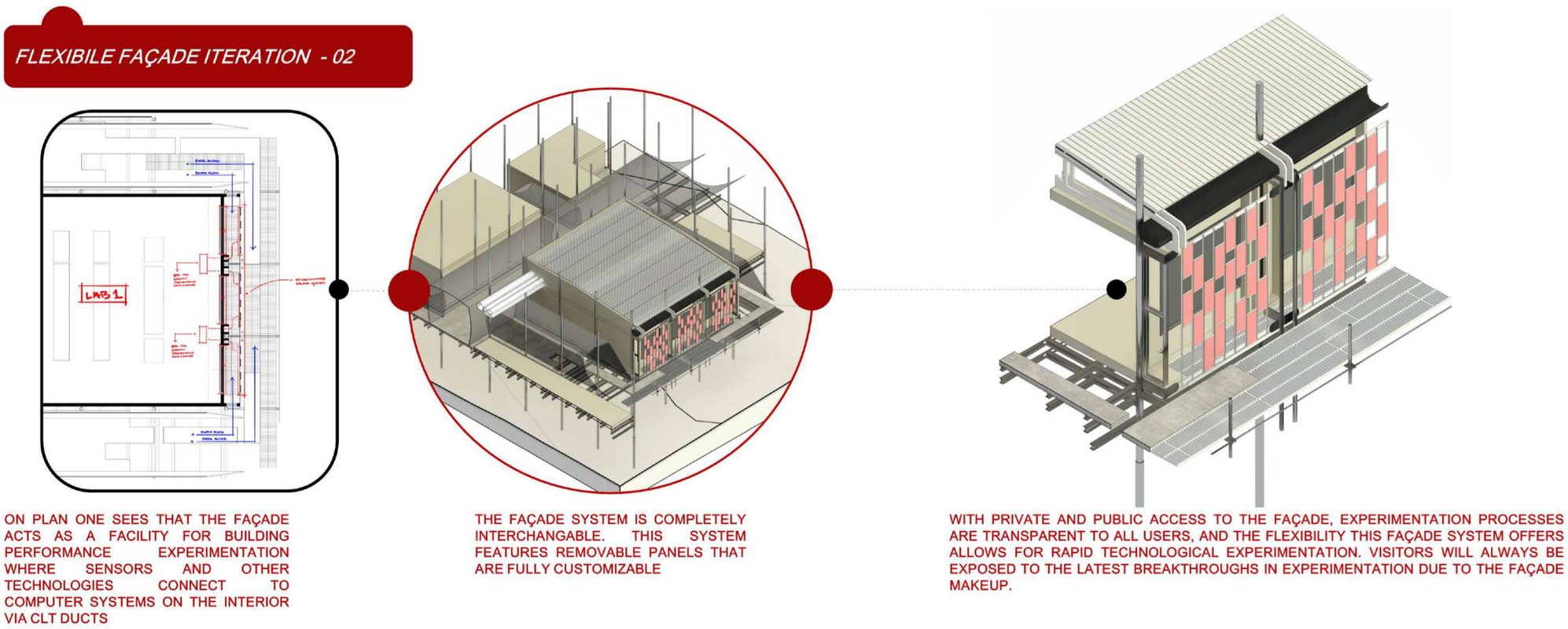


Figure 43: Flexible façade iteration 02 (Adapted by Author, 2023)

REFLECTION

As previously stated, the main goal of BERH-SA's function is to have new information on construction and emerging building technologies penetrate the South African market as quickly as possible. It was decided that the building façade would become the main tool for the actualization of this concept, which meant that there was a demand for adaptable and flexible infrastructure.

The requirements for the needed flexible façade system are as follows:

- Rapid technological experimentation
- Multi-scale technological display
- Real time building performance data capturing
- Designated professional access
- Designated Social access
- Deliberate movement patterns
- Research process display and transparency
- Integrated social and professional fabric
- Multi- dimensional ecological integration

After running a testing protocol across a base case, a pool of 3 precedents featuring successful flexible facades, and the first design iteration, in order to improve on the second iteration, it was found that the following flexible façade principles were mandatory for implementation:

- The façade needs to become a spatial element that people can interact with
- The façades flexibility is increased if people can experience it from behind and in front
- The façade should be perceived as a deliberate element from interior and exterior spaces
- The façade should be designed as an element that serves the building further than just being a solar control device
- The façade should be designed in such a way that it can be dismantled easily, this increases programmatic longevity and interchangeability as required
- The façade should be designed using modules – this helps with the dismantling process
- The façade should be articulated separately from other structural and special elements – this allows for adjacent architectural elements to change over time without affecting façade elements (this theory can be applied inversely Aswell)

06 CRITICAL REFLECTION 1 – MINI PROJECT

During the early stages of this dissertation, creative processes around informing a route for architectural exploration were informed by an individualistic internal focus. These creative processes of looking within were set out to critically understand my self as an architect, designer, and author. This process brought out an array of personal normative approaches, influenced by the way in which I experience the world around me.

The final iteration of these creative processes was made up of 5 curated A5 frames in combination with a designed audio file narrative. The combination of audio and visual intended on depicting a series of thought patterns as they would occur in my head – unfinished, fleeting, emotional, and overwhelming. The curation stood to display fragments of an iterative process around answering questions that dealt with tectonic experimentation, and the phenomenological experience. The audio file narrative guided the viewer through my personal thought patterns and being supplemented with the 5 curated A5 frames, my thought patterns became a tangible element that made the viewing experience that much more immersive.

From the beginning of this project, recuring themes of reconsidering the norm, questioning the existing, and overall reinvention played an important role in what the final project has become. To me the world can be broken up into sequences, patterns, singular elements that make up bigger objects, systems, and processes. In understanding that the world is made up of many small elements, I often ask myself – “but what if these singular parts were reconsidered and rearranged…would the final product become better?”

This way of thinking in collaboration with an interest for high-tech and low-tech emerging building technologies, tectonic theory, and the importance of architectural longevity played an important role on how I defined this dissertations route for architectural exploration.

Figure 44: Mini project installation(Adapted by Author, 2023)

07 CRITICAL REFLECTION 2 – MAJOR PROJECT OUTCOME

With respect to what was said in reflection 1, the final architectural product produced during the course of this dissertation coincides quite closely with my view of the world as sequences, patterns, singular elements that make up bigger objects, systems, and processes.

Each element of the final architectural intervention can be perceived and understood as a single entity. However, these single entities cannot exist without their adjacent counterparts. The collection of designed counterparts work together in order to create a system that allows for an array of programs to take place. The culmination of patterns and systems designed for are not entirely revolutionary and can sometimes be seen within the existing buildings surrounding the new intervention. The innovation comes through in the reconsideration for these single entities, and how reorganizing system patterns can result in a more pleasant environment for participants. Therefore, the final intervention becomes a collection of interchangeable processes and systems that work together to create a synergized architectural experience.

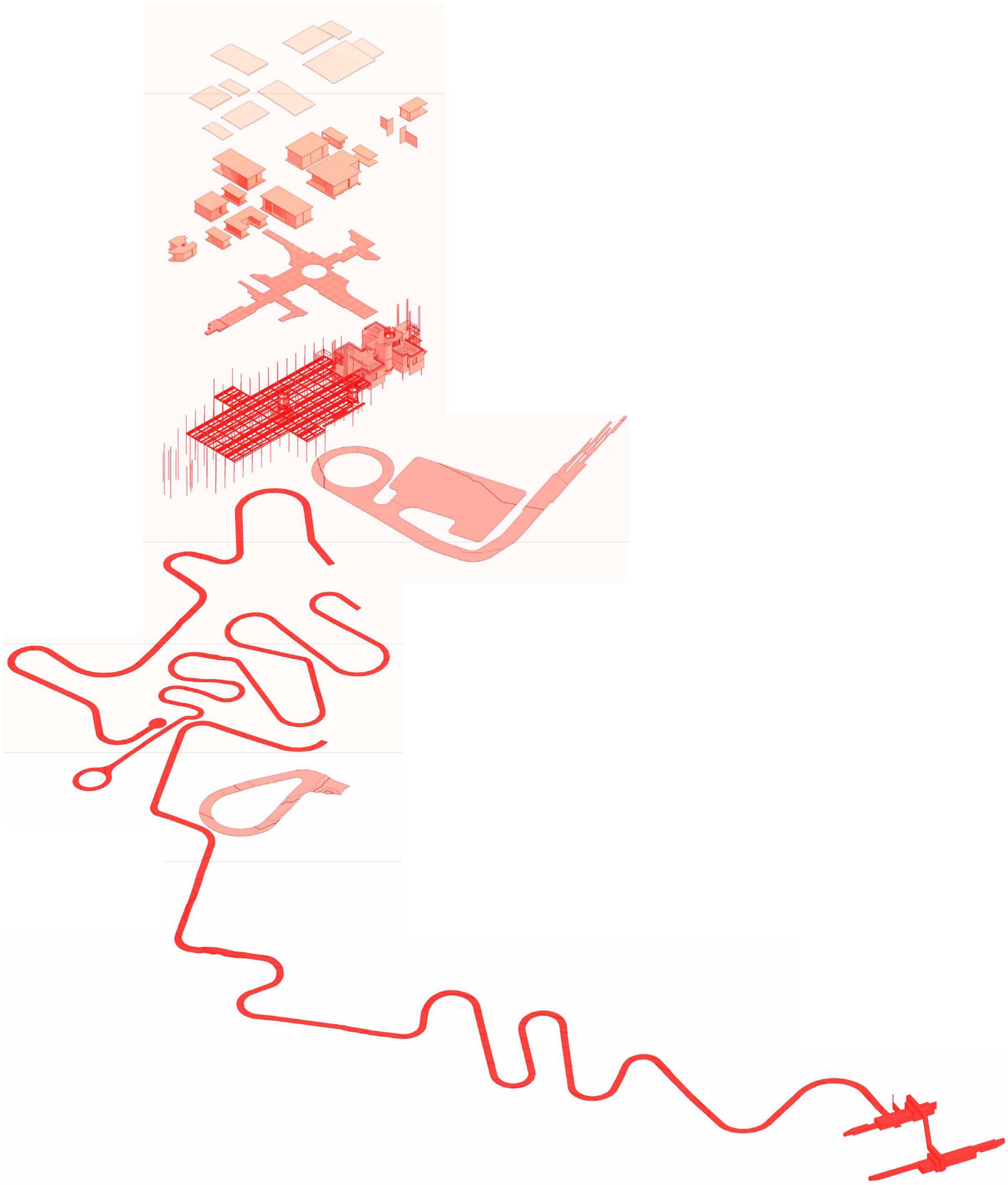


Figure 45: Exploded view depicting architectural elements as patterns (Adapted by Author, 2023)

08 CONCLUSION

As previously discussed, Tectonic theory is dynamic and integrational standing to express an “interwoven relationship between space, function, structure, context, symbolism, representation, and construction where no single definition exists to convey the full meaning of the term” (Schwartz, 2016: xxxii). Due to the theory’s “symbiotic relationship between architecture and structure” (Oxman, 2010: 3), and its strong consideration for structural expression “by encompassing the act of making” (Louw, 2021:xi), its theoretical adaptability becomes the consequence of considering value parameters associated with region, culture, tradition, and historical narratives (Schwartz, 2016: xv). Tectonic theory is all about critical technological implementation in relation to human beings and their most pressing needs.

There is a level of flexibility implied when considering the general basis of tectonic theory. Considering that the most important relationship highlighted through understanding tectonic theory exists between technology and human beings, one can deduce that the implied levels of flexibility at play coincide with both counterparts within the relationship. This therefore means that appropriate architecture in todays context should account for a level of flexibility within both technological, and social realms. Architecture cannot be static and should adapt over time in response to changes within its immediate context.

Community strength is complex due to its integrity being mostly based on semantic values such as culture and heritage, a sense of belonging and ownership, and an overall sense of safety. Although the built environment needs a strong economic system to sustain it, without a community that invests in the cyclical process of economic success that contributes to the built environment’s progression, the physical built fabric faces severe threats of dilapidation and disfunction (Smith, 2019,10:00 – 12:35).

The social fabrics associated with communities are ever changing which means that architecture needs to become resilient to a particular pace of change in order to achieve longevity.

Due to the way in which BERH-SA was designed, there is an evident level of success in its response to accommodating change. Its puzzle-piece-like architectural elements offers a generous level of flexibility through critically differentiating between architectural permanence and impermanence. Furthermore, its design strategy also accommodates the revitalization and re-integration of flanking greenspaces, which is then used as a tool to incorporate social integration.

Overall, BERH-SA becomes an adaptable space which stands to create a strong relationship between people and technology through innovative production and educational methods, which simultaneously showing that the industrial fabric can co-exist with thriving greenspaces.

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