

# Barriers to Affordable Housing on Brownfield Sites

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## Abstract

Brownfield development incorporates both private and public costs due to the contamination of land. Furthermore, brownfield sites generate negative externalities on real estate viability, and are perceived to be risky and costly for development. Viability risk makes affordable housing development on brownfield sites even more financially and economically challenging. To understand this issue, this paper introduces a conceptual model to analyse and overcome the economic and financial barriers to meet both community and environmental concerns, as well as verifying how it holds in practice via case studies that cover the development of three large scale brownfield sites that integrate affordable housing in the City of San Francisco. Significant barriers to overcome include (1) engaging with economic geography rationale; (2) integrating with economic viability and sustainability concerns; (3) increasing affordable housing quality; and (4) transcending scale to improve policy tool efficacy. Conclusions argue that viability needs to consider cost-quality both internally and externally for high-quality affordable housing units in large-scale brownfield environments.

## Introduction

Brownfield sites generate negative externality on real estate value, profit, and productivity (De Sousa, 2002). The use and development of brownfield sites are perceived to be risky and costly, in part due to the problems of large scale environmental remediation (Jackson 2001). To deal with this issue, we explore the economic and financial barriers which require to be overcome when providing affordable housing development in large-scale brownfield sites. To set this in context, we firstly theme economic geography perspectives that have captured and evolved brownfield and affordable housing ideas. Brownfield viability and sustainability concepts are included, as well as the theme of brownfield development that incorporates affordable housing. Finally, we outline the efficacy of policy tool responses in the United States, while including literature that introduces the City of San Francisco.

The case studies involve three large-scale 'brownfield with affordable housing' sites situated in San Francisco. This illustrative city case is particularly useful as the City adds a relatively small new base of affordable housing each year. For instance, given the total stock of 392,000 (approximate) units for the City of Francisco in 2017, only 1,460 (0.4%) newly built affordable houses were provided (SF Planning, 2020). The argument raised by some stakeholders is that these large-scale sites could unlock a considerable amount of affordable housing units for the City.

More specifically the paper focuses on 2 core questions; (1) Based on the existing literature on brownfield development what are the most important barriers to include in a conceptual model, and (2) What elements of the case study developments confirm or contradict this model and the theories that it is based on. The article has the following structure. The next section presents the literature relating to barriers to brownfield development under four sub headings (a) the economic geography rationale, (b) the balancing of economic viability and

sustainability, (c) specific considerations for affordable housing and (d) the efficacy of policy tools. The methodology follows with an overview of the data and methods. Findings look at characteristics and institutional partners in the three core case study sites located in San Francisco. Analysis and discussion is set against the four themes as understood by interviewee and literature knowledge, and focuses on the 2 core questions regarding important practical barriers and confirmation of theory as applied by the case studies. We then draw conclusions and recommendations.

## Literature

We now build out a conceptual model of barriers to enable the case study to inform what barriers were important, plus identify what elements in the case study provide confirmatory or contradictory aspects to the literature. At the outset, the conceptual approach to this study broadly uses evidence from McCarthy (2002), when she demonstrates that brownfield redevelopment has a dual policy challenge. The challenge is to reduce barriers to private development while meeting community and environmental concerns. Resource allocation from the market and public policy is of particular interest if we follow the conceptual definition of brownfield as one that:

“will permit the creation of brownfield inventories for resource allocation and federal funding purposes and will inform individuals of potential health hazards in their communities” Yount (2003, p.25).

### *The Economic Geography Rationale*

A core theme in conceptualising the barriers, is to give some economic geography historical context. Importantly and still relevant, is where Park (1915) argues that early 20<sup>th</sup> Century city growth gave rise to central urban decay as wealthier residents moved out to suburbs, and thus providing central spaces where future brownfield development could emerge. For Alonso (1960), bid-rent theory suggests that rents beyond the urban core (in a monocentric city) become lower, with competing land use classes in relation to the core, superseding each other over time. For instance, if industry moves outwards to benefit from lower rents, new brownfield land use emerges in the core for commercial office development. From a residential land use perspective, Boal (1976) suggests that spatial concentrations and categories can form along socio-economic differences such as ethnicity and age. More critical political economy thinking of a structural nature, see Harvey (1989), argue that low-income residents have fewer financial options to choose a move to the suburbs. Thus spatially, we see low-income households living near decaying industrial sites or ones that have become new brownfield developments.

Storper and Scott (1992) view that late 20<sup>th</sup>-century industrialization has relocated tech industrial spaces to the periphery of cities near good transport, as well as clustering around high paid service spaces in the core that would encourage brownfield (re)development. Development at the periphery is well documented by Garreau (1992), in that land on the periphery is simultaneously influencing the emergence of brownfield land in the centre of cities. For urbanisation in the centre, Smith (1996) argues that this new contested frontier is only viable for development in wealthier pockets, and developments that can price out still functioning low-income neighbourhoods. Bourne (1981) makes an essential point that there may only be a shift from decay towards infill and renewal, if the initial stock being 'thinned out' is of sufficient quality. If not, large-scale demolition will be the approach to brownfield

development, as part of a broader renewal and regeneration project. Greenberg (1999) sees that neighbourhood quality is also vital with social factors such as proportional concentrations of crime and access to good schools. Greenberg and Lewis (2000) argue that higher-income residents will be reluctant to live on brownfield sites because of poor environmental quality. In the broader context, especially for the United States, the barriers of brownfield development and affordable housing at scale have derived from the reversal effects from 1970s deindustrialization and globalization in some core cities. Voith and Wachter (2009) termed those cities with a return to urban growth in the 1980s and 1990s as 'comeback cities' and explored their associated affordable housing woes – namely Atlanta, Boston, Chicago, Denver, Indianapolis, Kansas City, New York, Seattle, St. Louis, Washington, D.C, and San Francisco. The argument for a turnaround or comeback being that these cities reinvented themselves and emerged as some of the most desirable places to live in the United States.

### *Economic Viability and Sustainability*

The second key theme to consider is the tension that ensues when driving for economic viability whilst trying to meet sustainability goals. For brownfield development, Bryson (2012) puts forward the proposition that environmental justice goals need to embed awareness of the gentrification process. For Lee and Mohai (2012), environmental justice in brownfield development is essential, as poor health could ensue. Wernstedt and Hanson (2009) demonstrate that community land trusts have helped in the context of affordable housing, just as area-wide large scale initiatives have eased the economic burden given benefits from economies of scale. Meyer and Lyons (2000) put forward the case that many large and highly contaminated 'dirty' sites are often the hardest to make economically viable for transformation at the site level. While Dale and Newman (2009) reinforce the notion that when focussing on brownfields, the relationship between sustainable development and gentrification is complex, given that there will be both incumbent and new residents.

Dorsey (2003) emphasises that brownfield projects are encouraging work towards sustainable development ideals, including those promoted by the planning profession such as environmental stewardship and community-oriented redevelopment. Planning principles in brownfield development, such as smart growth, are discussed by Greenberg et al. (2001a), where they argue the need to understand the broader economic viability of integrating housing types in such projects. De Sousa (2002) hones in on smart growth as a clear economic benefit from sustainable brownfield rather than greenfield development. Furthermore, De Sousa (2006) recognises that green space within brownfield development sites is essential for sustainability, and quite possibly for broader economic viability given the quality of space that is encouraged. Jackson (2001) also concludes that the literature on contaminated sites for real estate is not conclusive when it comes to appraisals and formulations of price. The perception of risk in valuation is highlighted by Syms (1997), with the recommendation that stigma needs to be integrated into the valuation, both before and after development. In assessing the sustainability of brownfield development, a framework is put forward by Williams and Dair (2007), which considers economic, social, and environmental factors. Adair et al (2007) examine the phases of urban regeneration and map out the risk/return criteria demanded by investors at each stage.

It is debated by Dixon (2006) that the development industry struggles to deal with the drawing together of sustainable development and brownfield regeneration goals. Further research by Dixon (2007) on sustainable brownfield development highlights the need for developers to partner up with multiple institutions for viability and success. With success on heavily contaminated 'hardcore' sites being dependent on strong potential markets and infrastructure, as well as a plethora of institutional imperatives such as branding, vision and integration (Dixon, 2011). Hutchison and Disberry (2015) put forward the case that institutional market forces can restrict development on brownfield sites, and that for example development taxes, such as developer contributions, can disincentivise development on brownfields. Davison and Legacy (2014) argue that 'positive planning' is encouraging brownfield rather than greenfield land to become a profitable choice for sustainable regeneration. For Schulze-Bäing and Wong (2012), brownfield residential development is one that seeks to meet multiple sustainability and regeneration (and renewal) objectives. Dealing with disadvantaged neighbourhoods in proximity to brownfield developments are seen by Gallagher and Jackson (2008) to be successful in certain circumstances, for instance, when there is a community and stakeholder participation. With findings demonstrating that any gains for deprived areas, are simultaneously lost to the provision of new unaffordable stock in the area. Given the sustainability and economic viability challenges, Page and Rabinowitz (1994) argue that policy should incentivise remediation funds that cover both returns on investment and risks of contamination. Adams et al. (2000) find that economic subsidies are increasingly becoming the main driver for brownfield regeneration, even if affordable housing is not the main focus of the development.

### *Affordable Housing and Brownfield Development*

A third theme when conceptualising barriers revolves around adequacy and quality of affordable housing when developing on brownfield land. This paper focuses attention on the supply of affordable housing for those households that have demand at various levels of affordability. Squires and Webber (2019) demonstrate that 'affordable housing' units may still be far from reaching affordability levels for many residents, particularly in a highly unaffordable city. Sirmans and Macpherson (2003) demonstrate that much of the literature on affordable housing identifies the main problem as being the provision of adequate housing for extremely low-income households. It is important to point out that affordable housing supply is different to subsidised housing. Several authors have discussed subsidised housing, with Rosen (1985) demonstrating those characteristics of owner-occupied implicit subsidies such as mortgage interest tax relief, or subsidised rents for low-income households. Crook and Whitehead (2002), argue that subsidy in the form of a planning gain contribution by developers will become more intertwined in the provision of land for affordable housing. Adams and Watkins (2008) also bring in consideration of planning gain subsidies for affordable housing, while noting that subsidies would be lower and more viable in greenfield rather than brownfield developments.

Mukhija (2004) demonstrates that business models involve several institutions working together for affordable housing to meet both commercial, regulatory, and mission-based objectives. For Dixon and Adams (2008), there is a view that the social goal (in addition to economic and environmental goals) of providing affordable housing will not be met by increasing supply on brownfield sites alone, and thus putting pressure on greenfield development. Greenburg et al. (2001b) argue in a study that many low-income households would rather leave the socio-economic disadvantages of their current neighbourhood, in

favour of affordable housing developments on brownfield land that may contain some environmental contamination risks.

Howland (2003) argues that brownfield sites for conversion to residential uses often have more public input, especially if the residential site has been heavily contaminated, and in a location of strong market demand. With regards to implementation, Rubinstein (2004) outlines that brownfield-to-affordable housing leaves private developers having to retain liability as well as mitigating risk over the long term when there is a long legacy of contamination. Simultaneously, Rubinstein (2004) finds that the financial model is more complex, given that sites can attract public money to make them viable.

### *Intervention and Policy Tools (In the United States and San Francisco)*

As a fourth and final conceptual barrier theme, the barriers from intervention and non-intervention via policy are important. To consider interventions via large-scale brownfield sites that have affordable housing, we need to acknowledge policy approaches at the national (United States) and city (San Francisco) level that have encouraged affordable housing situated in wider area brownfield development. Some of the main US housing intervention tools that affect the supply of affordable housing in large scale brownfield sites are listed in Table 1. For narrative, it is essential to note that Schwartz (2014, p. 7) states that the federal government is paying more in housing subsidy (on the demand side) for the affluent in the form of interest relief and tax benefits for home-ownership (\$220 USD Billion), compared to direct housing assistance (\$47.9 USD Billion). Further, Ross and Tootell (2004) explain that The Community Reinvestment Act (CRA) is a more national regulatory intervention that enables finance to flow into the affordable housing sector. Squires (2017) outlines several policy instruments on offer, such as Priority Development Areas (PDAs) and Transit-Oriented Affordable Housing (TOAH) set within spatial plans.

Lerman (2006) demonstrates that Inclusionary Zoning (IZ) regulation enables affordable housing, mostly by enforcing per unit or percentage development fees. Musil (2012) and DePass (2006) use the policy instrument of Community Benefit Agreements (CBA) to underscore ways of providing more viable affordable housing at the site level. Low Income Housing Tax Credits (LIHTC) also provide intervention for affordable housing (Shamsuddin and Cross, 2019). For LIHTC, financial institutions enable affordable housing by buying credits as a CRA investment credit incentive, which in turn helps fund an affordable housing project. Schwartz (2014) sees LIHTC as one of the most important in the US for producing affordable housing, as well as being the largest program overall in terms of units produced.

Scally (2012) highlights that Multi-level Housing Trust Funds (HTF) can be used to finance affordable housing in large scale brownfield sites. Similarly, funds for affordable housing can be from direct public grants such as the Community Development Block Grant (CDBG) and federal grants from the Housing and Urban Development (HUD) department (Galster et al., 2004). Some developments may include Housing Choice Vouchers for assistance in specific qualified affordable houses. Garg et al. (2013) explain Section 8 financial assistance for those in need of top-up, and direct spending on public housing, that can, on occasion, be formed from private subcontracted agents. Popkin et al. (2004) demonstrate that HOPE VI funds directed to ameliorate the problems of concentrated poverty in mass public housing are a form of direct funding of affordable public housing. Hutchison et al. (2016) provide monetary examples of wider area brownfield development, including affordable housing via the creation of bonds. In using bonds, Squires and Lord (2012) use policy instrument

examples of Tax Increment Financing (TIF), where subsidies claw back to the present based on future uplift and tax base projections. TIF districts are similar to the more newly formed Infrastructure Financing Districts (IFD) and Enhanced Infrastructure Financing Districts (EIFD) that also enable affordable housing through the creation of bond finance (Squires and Hutchison, 2014).

Table 1: Key US Housing Interventions affecting Housing Affordability in Large Scale Brownfield Sites

Policy Interventions	Year Implemented / Year of Significance
Inclusionary Zones (IZ)	1974
Community Reinvestment Act (CRA)	1977
Priority Development Areas (PDAs)	2007 (San Francisco and Bay Area)
Transit-Oriented Affordable Housing (TOAH)	2007 (San Francisco and Bay Area)
Mortgage Interest Tax Deduction	1913
Public Housing; including HOPE VI	1949 Housing Act; HOPE VI 1992
Grants from Housing and Urban Development (HUD)	1965
Housing Trust Funds (HTF) – National, State, County, Local Government	1970
Community Development Block Grant (CDBG)	1974
Housing Choice Vouchers (Section 8) – assisted private rental	1974
Housing Choice Vouchers – assisted private rental and part purchase option	1974
Low Income Housing Tax Credits (LIHTC)	1986
Community Benefit Agreement (CBA)	1993
Tax Increment Financing (TIF)	1952
Infrastructure Financing Districts (IFD)	1990

Source: Authors

We now give a brief overview of the case study literature. By introduction, San Francisco has experienced high market demand for housing, and also has the opportunity to redevelop large-scale brownfield sites as part of the City's affordable housing portfolio. Quigley and Raphael (2005) demonstrate back in the early 2000s that over the last two decades, San Francisco had become one of many cities in California that has seen affordability become a problem, driving the need for more affordable housing. Academic literature solely directed at affordable housing and brownfield in San Francisco is thin, although, at the city scale, several studies consider affordable housing issues. Voith and Wachter (2009, pp. 117) show that San Francisco is also contextualised by demographic changes, with an increased population of 679,000 in 1980, climbing to 777,000 in 2000, a 15 percent increase. Between 2000 and 2016, the population had risen to 871,000. In more consultancy oriented research, Clark (2017) suggests that the supply of housing has not kept pace with demand as between 2012 and 2017, 400,000 new jobs were created in the metropolitan area and this was matched by only 60,000 new housing units. Metcalf (2014) reveals that for San Francisco in 2014 there was approximately 172,000 rent-controlled units; approximately 6,300 public housing units; and approximately 16,000 privately developed, permanently affordable units — primarily owned by non-profits. In terms of market price, Bellisario et al. (2016) show that the median

home sales price of \$1.29 million in April 2016 set an all-time high, while the median one-bedroom apartment rental cost was out of reach for many low-income households at \$3,590 per month.

Based on this literature we set up a conceptual model that guided the analysis while we investigated the information and viewpoints on the sites, particularly the unlocking of financial and economic barriers to site development while ensuring community and environmental concerns (McCarthy, 2002). Figure 1 demonstrates a summary of the conceptual model, which is based on the earlier work of McCarthy (2002) on private developer barriers but adapted for this study, which focuses on economic and financial barriers for developing affordable housing on large scale brownfield sites.

## Figure 1: Overcoming Financial and Economic Barriers to Affordable Housing on Large-Scale Brownfield Sites

Source: Authors

### **Methodology**

This study is framed around an investigation into the financial and economic barriers surrounding the development of brownfield sites which seek to integrate affordable housing development. The research methodology focussed on projects, key institutions, and informed practitioners in 'the business' of developing affordable housing on large scale brownfield sites. Through multi-stakeholder open interviews, the research probed the perceptions, attitudes, and practices of the development concerning affordable housing on large-scale brownfield sites.

Primary data collection is in the form of senior stakeholder interviews with knowledge of large-scale affordable housing development in San Francisco. Interviewee institutions (Table 2) were selected initially from the Property Advisory Group (PAG) run by the University of California (Berkeley). Recommendations generated further essential interviewees via a snowball method (Denzin and Lincoln, 2011). While acknowledging bias, the snowball method enhanced the number of potential good quality interviewees. It provided suggestions for further contacts for interviews that were highly informed on the project sites and on the broader challenges that were being faced by many varied institutional stakeholders.

A full range of experienced professional stakeholders in the 'business of' affordable housing of large scale sites overcame sample bias. The sample comprised senior-level directors and officers who not only had some practical input into the case-study sites, but also provided a higher-level overview of the broader economic and financial challenges. The range of professions and roles are listed in Table 3. Professions ranged from consultants, developers, academics, policymakers, financiers, think tanks, bankers, housing partnerships, and agencies. Residents considerations are from secondary findings from public and not-for-profit institutional sources, given that undeveloped brownfield sites often have no incumbent residents. Residents may be those affected by proximity or structural changes in the housing market. These resident concerns were most prominently from the affordable housing developers and the Mayor's office that at the time controlled 100% of affordable housing provision in the City.

The desk-based element of the study mainly included academic papers on concepts and theory, with the addition of case study documents in practice such as online newspapers, consultancy reports, think-tank reports, and policy briefings. Extraction of findings also involved the context of The Bay Area, plus, the City's further relationship with the State of California and the US at the National Federal level. A further desk-based study involved exploring literature available online during the period 2015-2020. Furthermore, during late 2019 to early 2020, the original interviewees (housing providers/financiers – see acknowledgements) engaged with the final draft of the paper to give updates and further comment. This was a valuable element of the research as it enabled reflection on progress over a five year period. Documents and interview transcriptions were loaded into NVivo software to aid in analysis.



Table 2: Key Institutions Interviewed

<b>Institution</b>
Bay Area Economics
Eden Housing
Urban Land Institute (ULI)
University of California – Berkeley
Mayor’s Office – City Hall –San Francisco
Association of Bay Area Governments (ABAG)
Prudential
Wells Fargo Bank
Amcal Housing
SPUR (San Francisco Planning and Urban Research Association)
Bay Area Council Economics
Port of San Francisco
The US Housing Partnership Network
TMG Partners

Source: Authors

Table 3: Key Senior Stakeholder Interview Professions and Roles

<b>Profession</b>	<b>Role</b>	<b>Reference Number</b>
Consultant	Director	1
Affordable Housing Developer	Director	2
Consultant	Director	3
Academic	Real Estate Academic	4
Policy Maker	Department Head	5
Policy Maker	Director	6
Financier	Department Head	7
Policy Maker	Department Head	8
Financier	Commercial Real Estate Head	9
Academic	Researcher	10
Affordable Housing Developer	Director	11
Think Tank and Consultancy	Deputy Director	12
Policy Maker	Department Head	13
Bank / Financier (Housing)	Director	14
Commercial Developer - Finance	Deputy Director	15
Developer Partnership (Housing)	Directors	16
Academic and Chair of Property Advisory Group	Academic	17
Real Estate Agents	Agents	18
Consultant	Director	19
Commercial Developer	Director	20

Source: Authors

Analytical techniques brought out typical responses that were in tune with the literature as well as critical points that ran counter to the conventional understanding of the central research topic. Analysis of data was further enhanced using NVivo by categorizing key issues and themes that emerged, with relevant quotes to evidence and illustrate the narrative. Interviewee names were anonymized as ethical convention dictates. This field-work was synthesized and triangulated along with the initial and subsequent review of literature. Plus, to bootstrap further, a re-engagement was conducted with original interviewees to give updates and comment on the full paper presented here. The method of investigation was mainly a 'retroductive' process whereby interview results fed into the analysis and further questioning of other participants in the study (Mason, 2017).

A case study method cross-cut the primary and secondary data (Yin, 2017). Case study methods are rigorously embedded in methodology literature and provide practical boundaries as to the core topic, in this case, a geography provided case focus. Case study theory expresses how the cases can be very useful for galvanising mixed methods, in addition to having a strong relationship with real world qualitative research (Yin, 2017). For this research, the San Francisco case study selection was chosen due to the intense affordability problems in the City, as well as the interesting array of interventions for affordable housing development, and the significant number of large-scale brownfield sites. The quality and qualitative reasoning for such real world problems are thus improved through this case study method. All research material was subsequently synthesised for this paper, which retrospectively focussed on the case study findings.

The three significant sites selected for this study involve projects referred to as: (1) Trans Bay; (2) Mission Bay; and (3) Hunters Point Shipyard. Each of these projects is examined further in the findings, although it is worth introducing here the key facets and visualization of each case site. Figure 2 maps the geographic location of each of the sites, where you can see the Transbay site as located in the built-up downtown core, the Mission Bay site South-East of Trans Bay, and the Hunters Point Shipyard much further South-East of Mission Bay – all considered here as 'large scale,' with each site having a larger respective size and lower density of the built environment. In short, the further the location from the CBD, the greater the plot/section/parcel size, and the lower the density. Further useful site updates on all site developments can be found at the Office for Community Investment and Infrastructure (OCII, 2020).

Figure 2: Map of 3 Case Studies in San Francisco: (1) Trans Bay; (2) Mission Bay; and (3) Hunters Point Shipyard

Source: OCII, 2020

## 5. Case Study Development Findings – Varied-multiple economic and financial barriers

The three case study sites in San Francisco are now unpacked to provide clear and concise practical workings that link back to the core focussed questions.. The case study explanations and descriptions here can set forward what has been important. To note, the identified themes containing specific barriers are; barriers of economic-geography, barriers of tension in meeting viability and sustainability, barriers of the adequacy of affordable housing on brownfield land, and barriers of policy mechanisms available to encourage positive development outcomes.

### 5.1. *Trans Bay – A Downtown, high-density tower and mixed-use transit hub*

The Trans Bay site, also known as the ‘East Cut’ neighbourhood, involves a multi-modal center built on an existing terminal that serves local and regional bus and rail lines. Above-ground there is a bus facility and below-ground a train station. The development at Trans Bay includes an extension of the rail line. The new terminal (re)opened in 2019. For housing, the former freeway and terminal parcels will be a new neighbourhood. There will be three million square feet of commercial space, plus streetscape and open space improvements. A view of the downtown core overlaid with the above-ground Trans Bay building developments can be seen in Figure 3, noting that the tallest structure is marked ‘T’, being the Trans Bay Tower, now called the Salesforce Tower. Partners on the project development include the Transbay Joint Powers Authority (TJPA), Caltrans (transport), California High-Speed Rail Authority (transport), the Mayor's Office of Housing, private developers, and the Office of Community Investment and Infrastructure (OCII)- the Successor Agency to the former state-wide redevelopment agencies.

Affordable housing characteristics to overcome some of the economic and financial barriers are particularly intricate. 3,000 new residential units are for development, of which 35% are affordable, at a total of 1050 affordable units. Funding is by a variety of federal, state, and local sources. Sources include the Transportation Infrastructure Finance and Innovation Act (TIFIA) loan from the U.S. Department of Transportation, which is secured by land sale and tax increment revenue from the Redevelopment Project. All land sale proceeds and net tax increment revenue from the former freeway and terminal parcels will help fund the construction of the new transit hub and rail extension. The Redevelopment Plan requires the remaining net tax increment to be allocated 50% to affordable housing (through the Mayor’s Office of Housing) and 50% to non-housing (including streetscapes and open space). State law requires 35% of all housing units developed as part of the redevelopment project to be affordable. The residential development parcels are market-rate or affordable, with the market-rate parcels required to provide 15% on-site inclusionary affordable housing and the affordable parcels making up the balance of the 35% requirement.

### Figure 3: Transbay Redevelopment Project

Source: OCII, 2020

#### *5.2. Mission Bay – A Mid-Town, Mixed Use Area Development*

Mission Bay is a mid-town development on a former industrial site that covers 303 acres of land between the San Francisco Bay and Interstate-280. It is a mixed-use, transit-oriented development that intends to have a significant development of affordable housing. Other sectors include high-tech/office/life science/biotechnology commercial space, a new UCSF (University of California San Francisco) research campus including a medical center, an entertainment arena, retail space, hotel, public open space, public school, new public library, and new fire and police stations. Development began in 2000 and will take place over 20 to 30 years. The total development cost for Mission Bay will reach almost \$9 billion. Figure 4 demonstrates the large scale of the Mission Bay site relative to the CBD in the distance, intending to show status in 2011 with a vast amount of development.

In terms of stakeholders, a board of supervisors established the Mission Bay North and South Redevelopment Project Areas in November 1998. Development control is through the Redevelopment Plans and Designs for Development, as well as Owner Participation Agreements. Agreements are between the Office of Community Investment and Infrastructure (OCII), Catellus Development Corporation (now held by FOCIL-MB, LLC), and Interagency Cooperation Agreements, which commit all City departments to the Mission Bay Infrastructure Plans. City departments include the Mayor's Office of Housing, the Federal Transit Administration, SFMTA – San Francisco Metropolitan Transit Authority, FOCIL-MB, LLC Development Corporation. The affordable housing development is by a mix of commercial and non-profit affordable housing developers.

Affordable housing characteristics for Mission Bay include owner participation agreements, bonding for tax increment pledged to the project, and community facilities districts. There will be 6,350 housing units, with 1,850 (29%) affordable to moderate, low, and very low-income households. Sponsored non-profit (but not all non-profit) developers to build 1,445 (78%) of the affordable units on 16 acres of land contributed by the master developer. The remaining 255 (12%) affordable units are privately developed projects designated as inclusionary housing.

Figure 4: Mission Bay Site

Source: OCII, 2020

*5.3 Hunters Point Shipyard (and Candlestick Point) – An Uptown ‘dirty’ contaminated site, at extremely large-scale with social challenges*

The case of Hunters Point Shipyard is even larger in scale, with approximately 500 acres located along the southeastern waterfront of San Francisco. The site is a former naval base, and was part of a Redevelopment Plan in 1997 that was modified to include the Candlestick Point portion (approximately 280 acres) of the Bayview Hunters Point Redevelopment Project Area. The site is complicated in that there is a need for the Navy to fulfill its obligations to remediate the site before handover, under a Conveyance Agreement that would convey the Shipyard parcels to the City that is consistent with the City's reuse plans. Remediation was further heightened, given a recent 'scandal' involving alleged fraudulent soil test samples (Waxmann, 2018).

The site includes a cleantech business incubator and the headquarters for the United Nations Global Compact Sustainability Center, in addition to over 300 acres of parks and open space between the two sites. Figure 5, shows a 2019 ariel view which reveals how the developments are progressing on site and their proximity to incumbent neighbourhoods such as Bayview. Of particular note for Hunters Point Shipyard is that there has historically been a significant amount of affordable, subsidized housing (public housing and other) located in the project area. In terms of stakeholders, the project is a joint venture among three developers; Lennar Corporation (Five Point Holdings) and Scala Real Estate Partners, Hillwood (a Perot Company), and Estein and Associates, USA. Government agencies include the US Navy, California State Parks, the Mayor's Office of Housing, Caltrans (Transport), as well as non-profit affordable housing developers linking with public housing projects.

Affordable housing characteristics include phasing to overcome economic and financial barriers. Phase 1 of the Shipyard's redevelopment comprises up to 1,600 homes, 27% to 40% of which are designated affordable, and 26 acres of open space (OCII, 2020). Phase 2 of the redevelopment program provides for an additional 10,500 new housing units to be located on the Shipyard and Candlestick Point, 32% of which are to be affordable, including the rebuilding of the Alice Griffith public housing development (one of three developments) consistent with the City's HOPE SF (San Francisco) program. On average, there will be 12,000 residential units, of which 30% will be affordable. The Mayor's Office of Housing implements the affordable housing program. In the broader area, bonding for tax increment pledged to the project aids economic viability for affordable housing provision as does the inclusion of community facilities districts. The site development is more challenging for wider development, given the adjacent existing disadvantaged neighbourhood is part of the brownfield revitalisation. In this instance, tax credits enable the renewal. They are incorporating annual federal tax credits to finance the acquisition and rehabilitation of 209 units of housing. These units serve tenants with rents affordable to households earning 50% of area median income (AMI).

Figure 5: Hunters Point Shipyard (and Candlestick Point) Development

Source: Google Maps (2020)

To summarise, we find in the case study characteristics a plethora of barriers, with useful identification of important barriers as set against the conceptual model (Figure 1). For Transbay in the CBD, barriers of economic-geography are around ensuring site and neighbourhood quality given that infill apartments based around a transport hub make up the majority of what is designated as a new neighbourhood. Viability and sustainability barrier tensions are reduced given the high market value and transport connectivity. Plus for Transbay the barriers from affordable housing quality adequacy are tempered by low contamination and this low remediation costs. Further out from the CBD, important barriers for the Mission Bay site involve the economic-geography barrier of being neither core city development nor edge city development (e.g. an airport-industrial hub) that could dilute the offer ability to maximise the number and quality of affordable housing units. Transport corridors and hubs are thus essential to overcome this barrier. What could be described as edge city is the Hunters Point development, and here the main barrier to affordable housing provision would be the viability and sustainability tension given the need to integrate adjacent low-income residents whilst dealing with highly contaminated land. For all sites there is high importance of policy mechanisms to reduce barriers, particularly given the transit-orientation and multi-stakeholder agreements that incentivise an engagement with affordable housing providers.

### **Affordable housing on Large-Scale Brownfields – Theory, Practice and Policy**

This section draws out some confirmation and contradiction of the three case study sites when looping back to the initial literature that helped form the conceptual model. To recall, these are set against the four theoretical themes in the literature seen as being critical for overcoming economic and financial barriers to providing affordable housing on large-scale brownfield sites. Discussion uses collectively synthesized understanding and occasional quotes as evidence to illustrate the points.

#### *1. The barriers in engaging with economic geography rationale*

Perspectives from economic geography help to understand how and why the brownfield sites emerged for redevelopment, as well as the underlying economic and financial barriers for affordable housing provision. City development patterns (Park, 1915) see the downtown CBD project of Trans Bay transformed for a higher and best use, mainly as a high-density commercial tower and surrounding space that makes some affordable units viable. The mid-town brownfield project at Mission Bay is restructuring from industrial use to more new housing. While the more peripheral uptown project at Hunters Point, is a very large-scale transformation that runs as an outlier to the Park (1915) model, in that it is a navy port conversion with radioactive contamination. Bid rent market forces (Alonso, 1960) have influenced the land use designations. As the downtown and midtown sites supersede land use value from being sole purpose transit and industrial spaces to higher land use as new redeveloped mixed-use spaces. The more peripheral uptown site demonstrates the potential to

reap higher rents and taxes from area-wide development but dependent on additional cleanup costs.

Within and adjacent to brownfield sites, we can see structural (Harvey, 1989) socio-economic clustering that have formed around ethnicity (Boal, 1976). Gentrification concerns of pricing out residents on the sites (Smith, 1996) cannot happen given the vacancy of the sites. However, we see issues affecting surrounding markets from the redevelopment. Development in Transbay and Mission Bay has put housing market pressure on adjacent neighbourhoods and the city as a whole. However, the Hunters Point development has added issues of synthesis with extremely low-income households. Households could be priced out of their existing poor quality neighbourhoods (Greenberg, 1999), with the potential to be rehoused in more environmentally hazardous ones (Greenberg and Lewis, 2000).

“Unfortunately or fortunately, because the demand now is stronger than it's ever been, people will develop, under those circumstances, so you see all the cranes in the air. So probably the City at the end of the day was right. At some point, all those fees will cause the development to stop and then the City will have to look back and say, "Oh, what do we do now?" because cities live off of that income, transport tax, property tax fees are all the lifeblood of the city" (Commercial Developer, partnering with Affordable Housing Developers).

More contemporary spatial-structural processes of globalization and industrialization are observed (Storper and Scott, 1992). The ‘comeback’ swing of San Francisco from urban decline to extreme growth demonstrates how all sites have increased in value to make them viable (Voith and Wachter, 2009). Market forces have worked in the developer’s favour (Hutchison & Disberry, 2015). The poor quality of the sites also shows why they needed wide-area renewal rather than infill but acknowledge that each site had different quality challenges (Bourne, 1981), such as converting a transit depot, a redundant industrial use, and a heavily contaminated site. Further, perspectives engage with edge city (Garreau, 1992) ideas, in that we find simultaneous contemporary needs of transport access in the uptown-periphery site and high skill supply toward the downtown-core.

## *2. The barriers of integrating economic viability and sustainability*

Overcoming the barrier of tensions between economic viability and sustainable development is often found via integration over wider regeneration and renewal goals (Dixon, 2006), particularly those that frame concerns that are multiple - economic, social, and environmental (Williams and Dair, 2007). Ideas around environmental justice (Lee and Mohai, 2012) are intrinsic to brownfield site environmental cleanup, but are put in perspective when the sites could be potentially gentrifying residents (Bryson, 2012) into unhealthy developments (Meyer and Lyons, 2000) such as the 'dirty' site at Hunters Point. The economic viability part of the integration is aided by the economies of scale generated by large-scale sites (Wernstedt and Hanson, 2009). For Transbay, the ability to build higher is similar to the vast scale of the Hunters Point site that needed significant cleanup. Moreover, we discover that for the Hunters Point site the participation and integration (Gallaher and Jackson, 2008) with neighbouring low-income communities is a problem for existing disadvantaged residents (Schulze-Baing and Wong, 2012) in proximity, not just those relocated or new to the site (Dale and Newman, 2009).

The research finds that greenfield alternatives (Dorsey, 2012) are at a significant distance to the three brownfield sites and therefore increase their economic viability, given that the metropolitan Bay Area region has large scale sites which will be significantly further out from the City. Greenspace quality (De Sousa, 2006) options are more pronounced for each site further outwards from the City, and we find that for the peripheral site of Hunters Point, that the parks authority is involved to ensure large-scale quality. All sites also have smart growth (De Sousa, 2002; Greenberg et al., 2001a) and positive planning benefits (Davison and Legacy, 2014), in that they retain density and reduce urban sprawl, but also involve competitive financial models to maximize economic viability. This is particularly so given that all sites have multiple stakeholder arrangements (Dixon, 2007) and incorporate long-standing developer institutions that will have an abundance of branding and vision (Dixon, 2011), as well as financial backing to endure a long timescale.

"It bears consideration regarding America's history of "affordable housing" and low-income communities and communities of color located on or around brownfields or other environmental contamination or hazards...Affordable developers need to figure out how to subsidize the financial gap created by lower rent (or sales) revenue. So if there's remediation costs, that's true for all types of development. We should be sensitive to inference that we should prioritize affordable housing on brownfields because they may carry marketing/value challenges for market-rate housing, which in a way would be a repeat of our historical inequities in this regard" (Affordable Housing Developer)

Valuation risks (Jackson, 2001) of the site were not seen directly as an issue, although stigma and perception of risk is of concern with respect to the contamination at Hunters Point (Syms, 1997). It is interesting to note the amount of legal risk taken to allow the site to receive environmental go-ahead. For financial and economic risk, the viability concerns are less risky given the strength of the market (Hutchison and Disberry, 2015), the provision of subsidy (Adams et al., 2000), and the highly lucrative returns once there is permission to develop. Direct remediation funds were not considered critical as part of the financial model (Page and Rabinowitz, 1994). Further, there are market incentives in all of the sites given the buoyant market, although the need to partner up with not-for-profit affordable housing providers as part of the agreements would dampen commercial viability slightly.

### *3. The barriers of increasing affordable housing quality*

At the city scale, we are setting the supply of affordable housing as one that deals with various levels of affordability, whether middle income or low-income residents. Addressing low-income residents more directly is found in the Hunters Point site. Housing adequacy (Sirmans and Macpherson, 2003) is of critical concern here as some residents will be trading risks when moving from one location to another location on a brownfield site. For instance, if the remediation is substandard, those moving out of a poor-quality house in a disadvantaged neighbourhood could be moving into a high-quality home in an unhealthy environment. All sites have some form of subsidy to enable affordable housing development (Rosen, 1985; Crook and Whitehead, 2002). The proportion of affordable housing relative to market-rate range from 27%-40% with some intricate differences in the affordable housing modelling. Trans Bay has market-rate housing as well as 15% inclusionary affordable housing via a cross-subsidy. The mid-town Mission Bay project has 29% affordable to moderate, low, and very low-income households with 12% of this as affordable inclusionary housing as part of the market rate cross-subsidy. Hunters Point long term plan to have 12,000 residential units

are 30% affordable. Of most significance in the model is the direct public grant subsidy in phase one with the wider renewal as part of the City's HOPE SF (San Francisco) program.

"In a large scale development, you're always going to have some phasing certainly. Some of the challenges, especially for mixed-income, is that they're different animals financially. When the market rate is ready to go, it needs to go. You can't sit around, the market is volatile. Whereas on the affordable side, a lot of times we have to wait for tax credit allocations. There's got to be a reasonable amount of separate elements, so that they can work independently. Otherwise, it will collapse under its weight because it's too complicated" (Affordable Housing Developer).

"There's risk in it [Affordable Housing], but there's not nearly as much risk as market-rate development. Primarily because it's affordable it requires lots of subsidies. So not only does it require tax credit allocations as a subsidy but often local jurisdictions will put targeted dollars into it...Once you get that, you get your equity, then you can plug in your interim construction loan and your permanent debt" (Affordable Housing Financier)

Economic and financial barriers to overcome in the more peripheral site of Hunters Point integrate both community and environmental aspects (Murphy, 2002). There are economic barriers in the community dealing with public housing objectives, but they are aware of the commercial realities of profit margins. Economic barriers for environmental concerns include greenfield alternatives (Adams and Watkins, 2008), where there is an 'opportunity cost' to consider whether the projects are viable. Developers may seek better returns and put resources to less costly greenfield sites further on the periphery of the Bay Area region. As such, public contributions such as funds from Communities Facilities Districts at Hunters Point increase the wider area viability to provide more affordable housing. The mix of external public costs and private internal costs are especially important for the quality of affordable housing that can be developed (Mukhija, 2004). At Hunters Point there is a public external cost trade-off between social neighbourhood quality improvements and neighbourhood environmental costs as part of a significant high-level contamination cleanup (Greenburg et al. 2001b). The ability for residents to have public participation in land-use change (Howland, 2003) also appears to be a most pressing need for low-income groups adjacent to the Hunters Point site. This need is different from the downtown development at Trans Bay, which has more local input concerns for middle-income groups that, for instance, lose their view from tower development. The focus here is more on the complexities of financial modelling in these cases, particularly as the liability retained by developers (Rubinstein, 2004) on contamination, exposed high profile legal-financial problems for the developers given the environmental assessment scandal (Waxmann, 2018).

#### *4. The barriers to the efficacy of policy tools*

The efficacy of the policy tools is interesting for the case studies as we need to consider a transcendence of scales for calculating viability. For example, there may be internal affordable housing viability modelling or external wider site viability modelling. Firstly, the deeper housing subsidy imputed benefits of tax relief for home-ownership are not in the internal viability of affordable housing on these brownfield sites (Schwartz, 2014). Moreover, we are not looking directly at the demand side housing assistance (Garg et al., 2013) provided for low-income residents. On the supply side, the Hunters Point development includes grants (Galster, 2004) and Trust Funds (Sally, 2012). It is these publicly affordable housing funds

that are allocated more by need rather than effective demand. We also find regulation at all governance levels ensuring the sites are viable (Ross and Tootell, 2004). For instance, at the federal level, there are tax credit (Shamsuddin and Cross, 2019) components as affordable housing developers make the project viable.

As well as regulatory considerations, there are significant spatial planning policy tool integrations that make sites both economically viable and sustainable. All sites are Priority Development Areas (Squires, 2017) that are infill development opportunity areas within existing communities that are served by transit. It is also these transport considerations that make the sites economically viable for transit-oriented affordable housing purposes (Squires and Hutchison, 2014), and build in inclusionary zoning (Lerman, 2006). Affordable housing is achieved by a cross-subsidy from the market-rate housing units. The financial viability models all include transport institutions, and the use of bonding and paid back (captured) by future value increments as the sites build-out value (Hutchison et al., 2016; Squires and Lord, 2012). The Trans Bay site, which incorporates the high-speed rail transport hub, has the remaining net tax increment to be allocated 50% to affordable housing.

“The first attempt never got off the ground because it didn’t have tax increment as an ingredient, because the upfront costs just to create a developable pad of real estate, they were too great.” (Affordable Housing Policy Director).

To reduce economic and financial barriers, the use of multi-stakeholder agreements (Musil, 2012; De Pass, 2006) is vital for the sites. Of most prominence in Mission Bay are the owner participation agreements that bind the public community-infrastructure department and the private developers. There are also interagency cooperation agreements, which commit all city departments to the infrastructure plans. It is this multi-institutional strength that makes the policy tools have efficacy. The sum being greater than the parts to overcome economic and financial viability problems while focussing on community and environmental concerns (McCarthy, 2002).

To summarise, we can refer back to the second question - whether the case study developments confirm or contradict the literature used to formulate the conceptual model. We find in this case study application many useful confirmations, but also find contradictions when dealing with scale of concept. To illustrate, the addition of literature on specific policies can demonstrate that barriers can be overcome, such as through the application of inclusionary zoning or transit-oriented development initiatives. Despite these confirmations, contradictions are found in that a conceptual model may miss the greater potency in the sum of the parts. For instance, the addition of individual barriers such as inclusionary zoning could dilute the broader holistic barriers that may have more efficacy, such as engaging with ‘community’ or ‘the environment’.

## **Conclusions and recommendations**

In conclusion, large-scale brownfield sites have significant economic and financial barriers to overcome if they are to meet community and environmental concerns. The supply of affordable housing is particularly tricky to overcome in this process. Engaging with the broader economic geography rationale helps to frame more practical issues, such as changing market land uses and the structural changes of industrialisation and globalisation. Conceptual issues of integrating economic viability and sustainability also help to overcome barriers

further, particularly as buoyant markets such as San Francisco can improve the number of quality affordable housing units while retaining environmental integrity.

In overcoming the quality condition of affordable housing, we see a need for greater scrutiny on internal and external costs for viability. External costs may not be included, such as the net public cost of trading poor housing in poor quality neighbourhoods for good quality housing in unhealthy neighbourhoods. When looking at the efficacy of policy tools on offer for encouraging affordable housing on large-scale brownfield sites, there is a need to reduce barriers by transcending scales when doing viability modelling. For instance, multi-institutional funds can provide economically and financially viable affordable housing at the scale of the unit and the city scale. Transport integration can reduce barriers of scale by porting funds and value across space for future value capture. Through a transcendence of scales when calculating internal-external viability, the projects can meet long-term sustainable, affordable housing for low-income groups while reusing land with environmental improvements.

As such, we find clear answers to our research questions. The economic-geography barriers of spatial location of sites were important for San Francisco. A classic case of the need to consider both site and situation., Applying the cases to the literature confirmed many aspects such as the engagement with community and environment concerns. This engagement could be under different guises in the literature such as sustainable development, or practically within literature that explores internal commercial viability models and external policy directives However, the research showed that while disaggregating the model down to its component parts it useful in the analysis, it may hide the potency of the various components interacting and initiating change.

As recommendations and further research, we see a benefit in exploring the future condition of the sites, as part of broader city policy. We recommend further research on other sites that are grappling with economic and financial barriers for affordable housing provision on large-scale brownfield sites. If we bypass concerns over the unique and specific development of cities as a kind of path-dependency, we can make some broad lessons learnt from the study. Refining of the conceptual model will also help frame more and different case study applications. Plus, we express the real need to deeper understand the barriers to affordable housing on brownfield sites. Especially, given that the barriers are often there to be overcome for reasons that are not in the interests of all stakeholders.

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