2019

Benefits of Brownfield Redevelopment in Minnesota

Minnesota Brownfields

Minnesota Brownfields is a 501(c)(3) non-profit organization.
Our mission is to promote the efficient cleanup and reuse of contaminated land as a means of generating economic growth, strengthening communities, and enabling sustainable land use and development. For more information visit www.mnbrownfields.org.

This report was made possible with funding from the Minnesota Pollution Control Agency and the McKnight Foundation.

MINNESOTA POLLUTION CONTROL AGENCY

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Minnesota's growing population and economy drive development decisions throughout the state. Historically, industrial and economic advancement have pushed outward to undeveloped and suburban land, leaving thousands of idle and contaminated properties, known as brownfields, vacant across the state.

Unattended brownfields threaten the environment, public health, and local communities and economies. Brownfields can drive out local businesses and burden neighbors with health risks related to air and water pollution and lack of recreation. Brownfields can solidify economic disparities and act as physical barriers between neighborhoods. Brownfield cleanup can provide an opportunity to improve neighborhood connectivity and public health, decrease energy consumption and carbon emissions, preserve carbon-sequestering green spaces, and grow local economies to support local residents and small businesses. This report presents the economic, environmental, and social benefits of reintegrating brownfield sites into Minnesota's economy and communities.

Introduction

The United States Environmental Protection Agency (EPA) defines a brownfield as

"real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant." [1]

Brownfields exist in a number of forms: as abandoned industrial sites, gas stations, dry cleaners, landfills, and any other industrial or commercial sites where prior uses introduced contaminants into the environment. Financial costs, time constraints, and the legal burden of preparing a brownfield for development can deter investment in these sites. Meanwhile, developers are often attracted to greenfields, which are undeveloped sites outside the urban core. Greenfields – free of hazardous waste, inexpensive, and unconstrained by urban infrastructure can be developed more quickly, at lower upfront cost, and without the legal constraints of a brownfield or previously developed site.[2]

To address some of the concerns associated with brownfield redevelopment, Minnesota passed the Land Recycling Act in 1992, becoming the first state to establish statutory authority for qualifying voluntary parties to obtain legal protections from state Superfund cleanup liability.[3] In 1992, Minnesota also passed an amendment to the Petroleum Tank Release Cleanup Act, which included establishing liability assurances for petroleum compounds. Since then, many of Minnesota's most visible brownfield sites have been remediated and repurposed.

A History of Superfund and Brownfield Legislation

In 1980, Congress passed the federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). This legislation allowed the Environmental Protection Agency (EPA) to utilize federal funds to clean up contaminated land and to hold property owners liable for the release of hazardous waste. The Minnesota Legislature passed a related act in 1983, the Minnesota Environmental Response and Liability Act (MERLA), which amended the original federal act with liability protections. Though this provision began to address liability concerns, developers' fears of pre-existing contamination paralyzed the real estate market in the developed, metropolitan core and initiated a market shift outward away from the core. Contaminated urban properties became idle and persistent sources of contamination and blight nationwide.

MERLA and its amendments in the late 1980s and early 1990s advanced brownfield legislation by establishing technical assistance, resources, and guidance for brownfield redevelopment. Statutory amendments to MERLA during this time period designated degrees of contamination; encouraged voluntary investigation, cleanup, and redevelopment of brownfields; and clarified legal protection options for non-responsible parties.[7] In 2002, Congress passed a third amendment to CERCLA, the Small Business Liability Relief and Revitalization Act, more commonly known as the Brownfields Act. The act limited the liability of neighboring property owners and prospective purchasers of brownfields, clarified the defense of innocent landowners, and authenticated relationships between the EPA and MPCA for coordinating contamination assessment and cleanup on local and federal levels.

In 2018, the Brownfields Utilization, Investment, and Local Development (BUILD) Act passed with the fiscal year 2018 Omnibus Package. This act amended the Brownfields provisions of CERCLA, re-authorizing the U.S. EPA Brownfields Program for the first time since its authorization expired in 2006.[8]

Brownfield Indicators and Challenges

By definition, brownfields present both opportunity and challenge. Brownfields are identified for their potential for reuse or redevelopment, but this potential is complicated by a variety of factors related to each site's past.

Because of their former uses, brownfields tend to be located in areas that are already developed, meaning brownfield properties are often surrounded by multiple properties and landowners. This presents one of the first challenges to a developer interested in a brownfield property: fragmented ownership. In the case of fragmented ownership, communication and negotiation with multiple stakeholders can complicate the development process. Another challenge – and perhaps the most daunting – is the risk of environmental contamination and liability. Developers must obtain liability assurances to cover a list of regulated, known contaminants. This list is updated as greater scientific understanding reveals new potential threats to human and environmental health. Brownfield property owners must be willing to address contaminants that may be revealed in the future. Recent examples of such "emerging contaminants" include vapor intrusion, a pathway for chemical exposure discovered in the early 2000's and per- and polyfluoroalkyl substances (PFAS), a class of widely used compounds with unknown health impacts. Learn more about PFAS on the next page.

Developers who take on brownfield redevelopments must accommodate the longer timeline associated with pre-development investigation and cleanup; upfront capital costs of demolition and remediation; legal protocol and communication with state and federal agencies; and the negative perceptions that may be associated with a chosen site. To assist with these challenges, a number of local, state, and federal agencies exist to assist developers with brownfield site investigation, assessment, cleanup, and development.

State and Regional Assistance for Brownfields

Today, technical assistance and funding are available from state agencies to facilitate the various phases of brownfield redevelopment. The Minnesota Pollution Control Agency (MPCA) Brownfield Program includes the the Voluntary Investigation and Cleanup (VIC) Program and Petroleum Brownfields Program (PB). The VIC and PB Programs provide technical assistance and liability assurance to facilitate the investigation, cleanup, transfer, and redevelopment of brownfield sites.

The Minnesota Department of Agriculture (MDA) is the lead state agency for the investigation and cleanup of contamination from agricultural chemicals. Staff in the Agricultural Voluntary Investigation and Cleanup (AgVIC) Program provide technical assistance and liability assurance letters for agricultural chemical contamination sites. Some financial assistance for investigation and cleanup activities at agricultural contamination sites is available through the Agricultural Chemical Response and Reimbursement Account (ACRRA).

The Minnesota Department of Employment and Economic Development (DEED) administers funds for the investigation and cleanup of sites with contaminated soil or groundwater. In awarding grants for brownfield cleanup, DEED prioritizes projects that address public health threats, increase local tax base, create jobs, and foster the social health of their surrounding communities.[4]

Minnesota has additional state and regional resources for brownfield cleanup and redevelopment. These include the Metropolitan Council's Tax Base Revitalization Account (TBRA) grants, the MPCA's

Emerging Contaminants: Spotlight on PFAS

Among the complicating factors of brownfield redevelopment is the emergence and identification of new contaminants. Though some chemicals have been used for decades, their effects on human and environmental health may not be known. PFAS are a relevant example of this challenge.

PFAS, or per- and ploy fluoroalkyl substances, are a class of approximately 5,000 compounds manufactured for their heat and oil resistance and insulating properties. Widely in use since the 1940's, PFAS are ubiquitous in stain- and water-repellent materials, firefighting foam, food wrappers, nonstick cookware, and electric insulation. The compounds are bioaccumulative and break down very slowly. PFAS persist in soil, water, and the bloodstreams of humans (among other animals).

In February, 2019, the EPA announced its PFAS Action Plan, which includes a plan to regulate two prominent substances – PFOS and PFOA – as hazardous substances under the Superfund Law by the end of 2019. At the time of writing this report, no action has been taken on this measure.

PFOS and PFOA, the two most widely studied of the PFAS class of compounds, have been linked to increased cholesterol levels, lower infant birth weights, immune system effects, cancer, and thyroid hormone disruption. PFOS and PFOA are no longer manufactured in the United States, but they are manufactured internationally, and consumer products containing the two compounds continue to be imported. Without federally-designated hazardous substance classification or drinking water maximum contaminant levels (MCL), the compounds cannot be regulated as a known toxin. However, some states have taken action and begun to research and/or regulate PFAS emissions and exposure.[9] [10]

Targeted Brownfield Assessment Program, and county-specific grants, including Hennepin County and Ramsey County Environmental Response Fund (ERF) programs and Dakota County's Redevelopment Incentive Grant Program.[5]

Demand is strong for the MPCA's Brownfield Programs. 2018 was a record-breaking year for the MPCA's VIC and PB programs. The MPCA enrolled 615 new sites totaling 4,563 acres in the VIC and PB Programs combined. This represents a 15 percent increase in the number of applications since 2017.

Federal Assistance for Brownfields

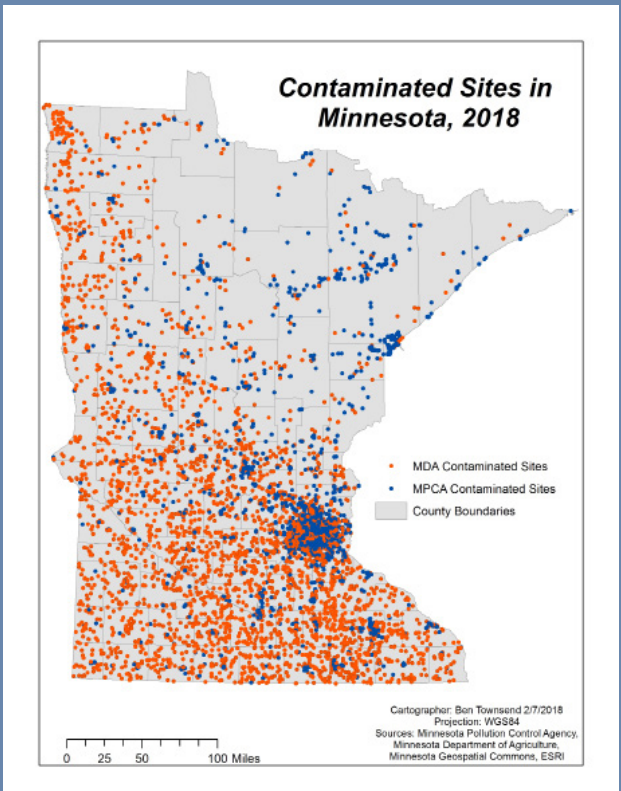
The EPA provides federal brownfield assessment, cleanup, and revolving loan funds to local project stakeholders interested in redevelopment. The EPA also provides technical information on brownfields financing. The EPA Brownfields Program collaborates with other EPA programs and partners at the federal and state levels to provide a variety of important resources that can be used for brownfields activities.[6]

Brownfields in Minnesota

More than 450,000 brownfields exist throughout the United States.[1] Minnesota has made significant progress in brownfield cleanup and redevelopment since the late 1980s, but more work remains to be done. As of January 2019, brownfield investigation and/or cleanup has been completed on 5,333 MPCA Voluntary Investigation and Cleanup (VIC) sites and 2,746 MPCA Petroleum Brownfield (PB) sites. Over the lifetime of both Brownfield programs, MPCA estimates that the combined programs have helped return approximately 93,245 acres of land back to productive use.[11]

Despite Minnesota's brownfield cleanup and redevelopment successes, the MPCA estimates that approximately 10,000 brownfields or potential brownfields sites in Minnesota remain.[12] Minnesota's brownfields are concentrated in the

state's urban and industrial centers but also exist in smaller communities and rural areas. Identified sites range from small corner gas stations with leaking underground storage tanks to large abandoned industrial complexes with plumes of contaminated groundwater migrating off-site. Map 1 on the left shows the distribution of such brownfield sites throughout Minnesota.



Map 1: Contaminated Sites in Minnesota, 2018

Cartographer: Ben Townsend

Sources: Minnesota Pollution Control Agency, Minnesota Department of Agriculture, Minnesota Geospatial Commons, ESRI

When brownfields are successfully redeveloped...

- ***the economy benefits:*** local businesses thrive and new businesses open, providing new jobs for locals and housing to match; larger tax bases provide funding for essential public amenities; and market demand for compact development is met.
- ***the community benefits:*** neighborhoods become more connected; the health risks associated with air and water pollution and inactivity decrease; and transporation options for non-drivers become more widely available.
- ***the environment benefits:*** energy is distributed and used more efficiently; car trips become shorter and less frequent; and undeveloped greenspace – critical to habitat connectivity, biodiversity, climate resilience, and carbon-sequestration – is preserved.

Economic Benefits

Economic development is a central policy goal in most brownfield programs and is one of the most visible and measurable benefits of remediation and redevelopment. Brownfield redevelopment enables job creation and retention, increases private investment, revitalizes the tax base, and encourages the use of existing infrastructure. Additionally, redeveloped brownfields often attract new businesses and lead to further economic development and tax base expansion. Collectively, these benefits contribute to economic competitiveness at the local and regional level, providing a substantial return on public investment.

Job Retention and Creation

Brownfield redevelopment offers opportunities for new business activity, bringing new jobs and instilling life in neighborhoods and economies. In state fiscal year 201` alone (July 1, 2016 through June 30, 2017), DEED awarded $10.2 million in Contamination Cleanup and Investigation grant funding, yielding the creation of 1,141 jobs and retention of another 1,597 jobs.[13] DEED reports that projects funded over the lifetime of this grant program, 1995-2018, have created or retained over 48,000 jobs in Minnesota. [14] The same projects spurred the development of over 19,000 housing units, 4,000 of which are considered affordable, allowing residents to live where they work. In fiscal year 2018 alone, EPA's Brownfield Program leveraged 11,197 jobs nationwide, an average 8.9 jobs for every $100,000 EPA funds expended on brownfield assessment, cleanup, and revolving loans. [15]

$38

average private investment leveraged for each $1 in public grant funding from DEED [58]

Leveraging Private Investment

By offsetting the costs and liabilities associated with redeveloping contaminated property, public investment makes brownfield sites financially viable for private developers. In fact, private investment provides the majority of investment in brownfield redevelopment. Minnesota DEED reports that since 1995, awards from its Contamination Cleanup and Investigation Grant Programs have leveraged a total of $6.89 billion in private funding in Minnesota alone.[16] On average, every dollar in grant funding provided by DEED leverages $38 in private investment, demonstrating the power of public investment.[17]

Tax Base Expansion and Revitalization

By placing previously abandoned and undeveloped lots on the tax roll, brownfield redevelopment often increases the local tax base. Residents benefit from job opportunities, new businesses and services, and increased utilization of existing infrastructure and mass transit. As a result, local economies flourish, and consumer spending, state income tax, and sales tax revenue increase. In 2015, the University of Wisconsin-Whitewater's Fiscal and Economic Research Center determined that the assessable tax base of an average remediated brownfield site in Wisconsin increased by $3.4 million as a direct result of redevelopment, with an additional $3.5 million increase from resounding effects on nearby properties.[18]

Tax base revitalization provides economic stimulus beyond what a state or federal subsidy alone can produce. In Minnesota, projects supported through DEED's Contamination Cleanup and Investigation Program have contributed an estimated $123 million to the collective local tax base from 1995-2018.[19] In Hennepin County, Environmental Response Fund (ERF)-aided projects between 2003-2012 generated at least $64 million more in incremental property taxes than they did prior to ERF involvement.[20]

Increasing Property Values

When brownfield sites are remediated and returned to productive use, benefits extend to the surrounding community. In their study of residential property values in the Twin Cities, Taylor, Phaneuf, and Liu (2016) found that residential property values neighboring an untreated brownfield site were about eight percent lower than other nearby residential properties.[21] A national study of EPA-funded cleanups found that the cleanup and redevelopment of brownfield sites led to residential property value increases ranging from 5-11.5 percent within a 1.29 mile buffer.[22]

Locally, Hennepin County reports that property values of completed ERF-aided projects increased in value by over $437 million, compared to their pre-assessment values. This represents an 11 to 1 return on investment.[23]

NordHaus *Minneapolis*

Formerly the home of Superior Plating, this 3.15 acre site was declared a State Superfund site. The developers of NordHaus, a mixed use commercial and residential space, cleared the site of lingering heavy metals, cyanide, and trichloroethene (TCE) to build a 280-unit, 20-story residential building and a 5-story mixed use building, which houses retail space, an amenity deck, and a 14,000 square foot green roof.

NordHaus supports ten new full-time equivalent jobs, and developers predict the site will support an additional 50 jobs once the retail space is fully leased. The project is credited with a tax base increase of $717,005 and an $8.3 million increase in property value, which tripled the site's original property value. By providing new, dense housing options along 1st Avenue Northeast, NordHaus is expeted to restore vibrancy along the corridor. Developers hope the residents of the site's 280 units will support and attract neighborhood businesses.

The NordHaus project aligns with the Minneapolis Plan for Sustainable Growth and the Nicollet Island East Bank Neighborhood Association's Small Area Plan by supporting a diversity of uses, adding dense housing to a main Minneapolis "Activity Center," preserving the stability of housing and small-business ownership, and encouraging pedestrian traffic and transit use.

Meeting Market Demand for Compact Development

As the population of new homeowners, aging baby boomers, and single homeowners grows, so does demand for walkable and connected neighborhoods and centrally located housing. Infill development on brownfield properties presents an ideal opportunity to provide housing in close proximity to a city center and opportunities to walk, roll, and bike to nearby goods and services. In addition, the economic efficiency of infill projects can be attractive to developers, who collect more per square foot than they would outside the central city and do not need to accommodate as many automobiles.[24] Recent shifts in city planning reflect the growing demand for housing density and reduced car use, a theme at the forefront of Minneapolis's 2040 Plan. As cities move to rewrite zoning codes and parking requirements for new development, infill proves a promising method for matching demand for new, affordable, and accessible housing.[25] [26]

Economic Benefits of Density and Connectivity

Brownfield redevelopment can minimize sprawl and its associated public infrastructure costs.[27] On average, greenfield development uses two to four times more land than infill redevelopment on brownfields.[28] Infill redevelopment often utilizes existing infrastructure, while development on greenfield sites requires the expansion of public sewage and water systems, utilities, streets, transportation facilities, schools, and parks. Suburban infrastructure is typically more expensive – with increased costs per homeowner – than urban infrastructure.[29]

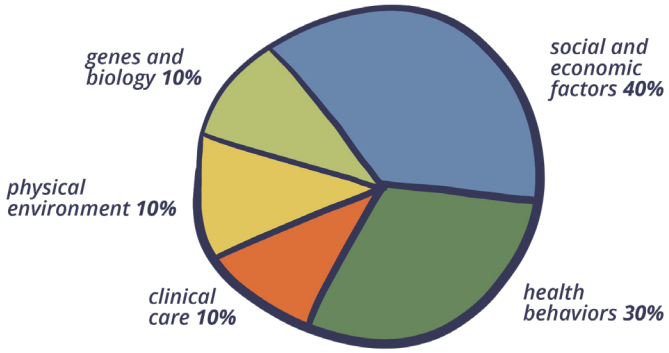
Community Benefits

Brownfield cleanup and redevelopment improves public health and livability in Minnesota's communities. Brownfields pose human health risks, influence investment and development decisions, and physically divide neighborhoods. The he air, water, and noise pollution associated with untreated brownfields can include health outcomes such as increased blood lead levels, asthma, cardiovascular and heart disease, emphysema, and cancer. [30]

Brownfields and Public Health

Taken together, the physical environment and socio-economic factors such as education, income, housing, and access to services comprise up to 50 percent of the factors that determine a person's health (Fig. 1).[31] Brownfield cleanup can eliminate the potential health hazards associated with contaminated soil and groundwater, and redevelopment can create new opportunities for recreation by connecting neighborhoods and establishing green space. Furthermore, brownfield redevelopment can create opportunities for new businesses and new jobs, affordable housing, and transporation options.

Figure 1. Determinants of Health[31]



A 2019 air quality report from the Minnesota Pollution Control Agency (MPCA) estimates that the annual economic impact of air pollution-related health effects in the state of Minnesota is $30 billion dollars.[32] While many factors contribute to Minnesota's air quality, brownfield remediation presents an opportunity to reduce emissions from the most potent sources of air pollution. The MPCA reports that on-road passenger vehicles contribute to 24 percent of air pollution emissions in Minnesota, and neighborhood sources like dry cleaners, gas stations, and auto shops contribute another 35 percent. Infill development can decrease the number of vehicle miles traveled (VMT) by shortening commutes, introducing new transportation options, and eliminating the need to expand road infrastructure. Brownfield remediation also addresses the lingering volatile organic compounds (VOCs) remaining on properties that previously housed dry cleaners or auto shops, where solvents, degreasers, paint thinners, and fuels remain in untreated soils.[33]

Environmental Justice

Brownfields and their associated public health risks are frequently concentrated in low income communities and communities of color. While 32 percent of Minnesota's communities experience "above risk exposure guideline" levels of air pollution, this number is 46 percent for low income communities and 91 percent for communities of color and indigenous communities. Air pollution poses real risks to affected communities. In 2015 alone, air pollution contributed to 2,000 deaths and hundreds of emergency room visits.[34]

This long-standing pattern is an issue of environmental justice, a term defined by the MPCA as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies."[35] Historically, environmental justice communities have faced discrimination, lack of investment, and inadequate opportunities for meaningful involvement in the political, planning, and environmental decisions that directly affect health, access to jobs, and daily lives. Communities who are overburdened with environmental pollution face additional barriers to brownfield redevelopment. It is imperative that such redevelopment prioritizes the needs of existing residents.

Brownfields and Developmental Health

Children are at particular risk of the pollution leached by brownfields sites. 11 million Americans live within a mile of a Federal Superfund Site,

Brownfield Health Indicator Tool

To enable brownfield project planners to investigate and identify potential health risks, engage with project stakeholders, and prioritize the long-term health benefits of redevelopment, Minnesota Brownfields partnered with the Minnesota Department of Health (MDH) to create a Brownfield Health Indicator Tool, available on Minnesota Brownfields' website. The tool incorporates six categories that address health considerations in community planning, enabling residents to identify and prioritize their goals for improving health outcomes during the brownfield redevelopment process.

The Brownfield Health Indicator Tool helps communities leverage brownfields as catalysts for healthy change. For example, one of the six health indicator categories is "Context and Connectivity," addresses access to goods and services, incompatible uses, mixed use and density, parks and open space, and transportation. This category highlights how built environment and land use can shape the flow of people, money, and resources to help or hinder opportunities for health. The tool features a series of questions to help communities understand how redevelopment decisions can meet their long-term goals and promote health.

Find the tool here: https://mnbrownfields.org/home/available-resources/brownfield-health-indicator-tool/

including 3-4 million children. Water and air pollution are especially dangerous to children because of their physical size, developing organs, and early-age cell development. Furthermore, many environmental toxins are fat soluble and accumulate in placenta, bloodstreams, and breastmilk.[36]

Longitudinal research projects are beginning to expose lifetime effects of pollution and toxic waste on physical and cognitive development. Recent research suggests that lead poisoning may be one of the causes of continuing disparities in test scores among school children.[37] Furthermore, the developmental impacts of Superfund site exposure are increasingly the topic of public health research. A 2016 study compared academic outcomes of children born before or during Superfund cleanup with their siblings, born after completed site cleanup. Children who were conceived prior to Superfund cleanup were 7.4 percentage points more likely to repeat a grade, received 0.06 of a standard deviation lower test scores, and were 6.6 percentage points more likely to be suspended from school than their siblings who were conceived after site cleanup.[38]

Castle Danger Brewery, ***Two Harbors***

This one acre site was originally developed in 1888 as a sawmill and railroad warehouse, later becoming the site of a YMCA until 1960 when the building was demolished, and many of the waste materials were buried on site. Unique site challenges complicated redevelopment and required flexibility and clear communication between city staff and Castle Danger Brewery's owners.

At the forefront of Castle Danger's mission is community. The brewery collects regular donations for the local food shelf and uses their sales as a platform to fundraise for North Shore habitat restoration. Castle Danger is now one of the largest private sector employers in the area, and their tap room business continues to grow by 30 percent annually since the business's establishment. Castle Danger draws an estimated 1,500 additional visitors to the city weekly, which in turn increases foot traffic to neighboring local businesses.

The emerging understanding of the risks associated with early childhood exposure to industrial toxicants provides further evidence of extreme disparities in public health and decisionmaking in U.S. planning. Brownfield cleanup and redevelopment can provide essential opportunities for increased physical, economic, and social health. It is critical that such redevelopment prioritizes the needs of existing residents.

Connectivity and Accessibility

Smart Growth America found that 40 percent of average household spending is comprised of housing and transportation costs.[39] They therefore urge affordable housing and short commutes as a primary solution to poverty. Because brownfields are often situated in already-developed areas, many are ideally suited for affordable housing and access to local ammenities. Infill – associated with increased housing density, mixed land uses, and shorter blocks – increases access to active, human-powered transportation methods and public transit.

Dense infill development on brownfield properties can encourage physical activity, daily face-to-face interactions, and community participation. These are essential resources for aging adults – and all people – to combat social isolation, depression, and the cognitive challenges associated with age.[40] Physical activity is correlated with greater longevity and positive health benefits, such as reduced risk of obesity and heart disease.[41]

Furthermore, emerging research demonstrates the negative effects of long commutes on students' sleep schedules, daily activity levels, and obesity.[42] Market trends demonstrate a rising preference for these amenities among new homeowners and renters, too. By increasing the accessibility of Minnesota's neighborhoods, brownfield redevelopment can encourage a more diverse and connected public realm.

Environmental Benefits

Brownfield remediation improves local environmental quality through the remediation of air and ground contaminants. These changes translate to large-scale environmental improvements like improved air quality, climate resilience, biodiversity, connectivity, and ecosystem health.

4.5

the average number of greenfield acres preserved for every acre of brownfield redeveloped

Reducing Energy Consumption and Emissions

The density and urban location of most brownfield sites can reduce the length of individual commutes and trips, resulting in energy savings and reduced emissions. Brownfield redevelopment reduces per capita vehicle miles travelled (VMT) by 43-67 percent, relative to conventional greenfield development.[43]

Infill development often encourages greater housing density and a mix of land uses, including small-scale local retailers. Infill development, in turn, incentives public transit and active transportation options while reducing vehicle miles traveled.[44] Increased development density corresponds with further reductions in greenhouse gas emissions because denser development frequently requires less energy use per capita, builders can utilize existing structures and infrastructure rather than building anew, energy is transmitted more efficiently within denser service areas, and greenfields are maintained as critical carbon sinks.[45] The reduction in VMT translates directly to reduced greenhouse gas and carbon dioxide emissions. A 2011 US EPA study of the Twin Cities area found a 32 percent reduction in carbon dioxide emission per capita for brownfield redevelopment sites compared to conventional development.[46]

Further, compact development can bring energy savings of approximately 25 percent, compared to greenfield development because electricity distribution in dense urban areas is far more efficient than in sprawling suburban areas.[47] "Line loss," or energy lost in transportation, accounts for approximately nine percent of electricity production.[48] This percentage is reduced in areas where electricity need only be transported short distances.

Curbing Sprawl and Conserving Land

Among the most critical ecological benefits of brownfield redevelopment is the preservation of undeveloped, vegetated land. Brownfield redevelopment replaces the need for greenfield development and, consequently, can preserve habitat connectivity and biodiversity on undeveloped land.

In their paper "Growing Cooler: The Evidence on Urban Development and Climate Change," Ewing et al. site a "dual-effect" of infill development. Infill improves transportation efficiency while also preserving carbon- sequestering green space.[49] Furthermore, the higher real estate costs associated with infill development often encourage developers to use land more efficiently. Brownfield development typically requires a quarter to a half of the land for a given project compared to conventional greenfield development because of the building practices and parking requirements associated with each type of development.[50]

Greenfield development is associated with an overall loss of habitat, locally dominant ecosystems, biomass, and carbon storage.[51] Forest cover is particularly critical for carbon sequestration. The expansion of impervious land cover – such as paved roads and developed infrastructure – can reduce soil carbon pools by approximately 66 percent.[52] Furthermore, EPA estimates that stormwater runoff is 43-60 percent lower in brownfield developments than their greenfield alternatives because infill does not require the same extent of road and utility infrastructure as conventional development.[53]

Providing Urban Green Space

Brownfields can be repurposed as recreational spaces, including community gardens, pocket parks, and green infrastructure. Greening brownfields improves quality of life for residents and incentivizes private investment in the surrounding area. Park and recreation space currently comprises nearly 11 percent of the Twin Cities, the highest ratio of green space in the region's history.[54]

Infill development provides

DUAL BENEFIT

to the environment, minimizing energy consumption and transportation-related emissions while preserving carbon-sequestering greenspace.

Reclaimed landfills and industrial sites also provide stopover habitat for migrating birds in highly urbanized and industrialized regions (see case study: Hall's Island, Minneapolis). Studies are beginning to evaluate the effectiveness of these reclaimed sites to provide rest and energy maintenance along migration routes and the potential for improved stopover areas to improve migrations routes and habitat conservation.[55]

Biodiversity and Climate Resilience

Increasingly, brownfields are recognized for their capacity to build resilience in climate vulnerable regions. Because industry tends to cluster along shipping corridors like rivers and large bodies of water, brownfields are often concentrated along these same buffer regions. Thus, these previously industrial brownfields can provide important space to establish local resilience to erosion, flooding, and storm surge.[56]

Brownfield redevelopment also provides an opportunity to preserve ecosystem services. As an alternative to greenfield development, brownfield redevelopment encourages the reuse of previously developed land that is already integrated into urban systems. Thus, brownfield redevelopment can prevent the degradation of existing habitat and migration corridors in undeveloped green space. Large, undisturbed, and connected habitat is essential to preserving the ecosystem services associated with biodiversity – pollination, pest control, drought tolerance, and flood and erosion protection – which we rely upon for sustainable food production and storm protection.

Brownfields can also be utilized to revive green space and facilitate habitat and migratory connectivity. Brownfields – particularly those with a long history of disuse – might even become home of flourishing ecosystems. Sensitivity to existing habitat and ecosystems is an essential component of brownfield redvelopment, whether on abandoned brownfields, developed park space, or undeveloped green spaces.[57]

Hall's Island, *Minneapolis*

In 2017, the Minneapolis Park and Recreation Board (MPRB) began reconstruction of historic Hall's Island. The site, originally an island, was dredged and deposited along the mainland in the 1960's. The project filled the channel to extend the owner's shoreline access, placing contaminated fill and debris in immediate proximity to flowing water.

The Hall's Island Reconstruction is a component of MPRB's RiverFirst Campaign, with an overarching goal of reconnecting local communities with the Upper Mississippi Riverfront and establishing cultural and recreational destinations, particularly in North and Northeast Minneapolis, which have been historically underserved by parks and recreation.

The project required the collaboration and cooperation of multiple agencies, with the particular challenge of constructing a natural landscape in a flowing river. The project team took advantage of the wintertime period of low flow but consequently dealt with extreme cold and frozen ground. The project enhances habitat, facilitates biodiversity of terrestrial and aquatic species, prevents erosion from the island and channel, protects water quality, and provides a migratory flyway stopover for birds amid Minneapolis' urban infrastructure.

Redevelopment Opportunities

Redevelopment opportunities are scattered throughout the state. These brownfields present opportunity to stimulate economic growth, reconnect communities, and begin to reduce environmental threats. Assembling these small, disconnected, and available parcels can yield attractive, developable sites or corridors for future infill development.

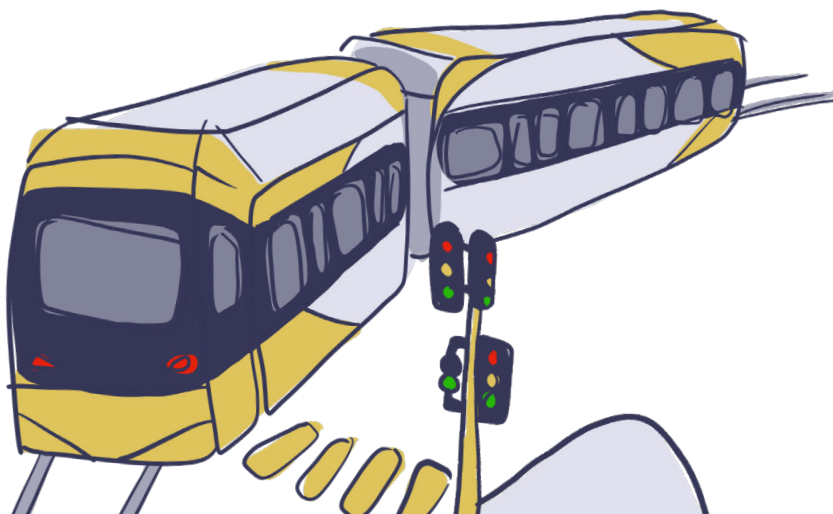
Specific opportunities for brownfield redevelopment in Minnesota include:

Opportunity Zones: The Opportunity Zone program – signed into action as part of the 2017 federal Tax Cuts and Jobs Act – incentivizes private investment in the 8,764 Opportunity Zones across the United States, Washington, DC, and five U.S. territories. The program allows private-sector investors to reinvest unused capital gain profits into new projects in distressed census tracts, in the hopes of spurring economic development and job creation in underserved and economically distressed communities. Investors can defer taxes on their capital gains profits until as late as 2026. The program incentivizes long-term investment in Opportunity Zone sites, with the greatest tax benefits for those who remain invested in a site for at least ten years.

Many view this as an opportunity to create new, affordable housing and increase access to essential amenities like grocery stores and clinics. However, critics view the new program as a potential facilitator of gentrification, especially in the context of the current housing market. Because the incentive is so new, participating projects are only in early stages. Without the perspective of time, the impacts of this new incentive cannot yet be known. Opportunity Zones have attracted bipartisan support, and many are optimistic that the program will draw healthy investment and new opportunities where economic revitalization is most needed. However, local governments will play a critical role in guiding incoming private investments to align with the needs of existing residents and local businesses.[59] [60] [61]

To view a map of the Minnesota census tracts designated as Qualified Opportunity Zones, visit the Department of Employment and Economic Development's website: https://mn.gov/deed/business/financing-business/tax-credits/opp-zones/census-opp-zone-tracts.jsp

Transit-Oriented Development: Defined as high-density, mixed-use residential and commercial development near transit stations, transit-oriented development (TOD) is often possible in areas with concentrations of brownfields, where neighborhood infrastructure and economy are already in place. A relevant example of TOD in Minnesota is new development along the Blue Line and Green Line Light Rail Transit (LRT) extensions. Since 2009, Metro Transit reports that 15,000 multifamily housing units have been built along LRT and bus rapid transit (BRT) lines, demonstrating the desirability of residential space near public transportation – both for residents and for developers. Metro Transit also reports that 8.6 percent of the Twin Cities Metropolitan Area lives in high-frequency LRT and BRT station areas, which comprise only 1.7 percent of the region's land area. New transit lines provide



important opportunities for new development while placing significant market pressure on affected neighborhoods. By extending LRT lines, Metro Transit aims to support the specific needs of affected communities and residents by supporting and expanding local businesses, housing options, and local investment; improving connections for walking, biking, and rolling; and engaging residents in planning activities.[62]

Former Ford Plant Site, St. Paul: Formerly the home of Ford Motor Company's Twin Cities Assembly Plant, this 135-acre site along the Mississippi River will soon be the City of Saint Paul's "21st Century Community." Years of environmental investigation, public input, and planning are now coming to life as the City Council and the site's selected developer, Ryan Companies, work to establish consensus in their Master Plan. The city's vision for this site prioritizes a range of affordable housing options, with plans to build 3,800 units on the 135-acre site; a mix of uses and transportation options; local job and tax base growth; sustainable new infrastructure and technologies; and access to parks and public spaces. The amendments put forth by Ryan Companies were approved by the Saint Paul City Council in April of 2019. The Ford Site has been rezoned for this redevelopment in order to actualize the City's vision for a mixed-use urban village. The site has been divided into six districts. The four to the east side, further from the Mississippi River, are to be residential districts, with buildings of increased height, density, and mixed uses. Two of the districts are zoned primarily for commercial use along Ford Parkway. Twenty percent of the Ford Site will be greenspace, including a stormwater system. [63]

Brownfields and Renewable Energy: The Brightfields Initiative

As Minnesota diversifies its energy production, brownfield sites offer advantageous locations for renewable energy generation. Nationwide, support for solar generation is growing, particularly as states begin to develop solar arrays on closed landfills and contaminated, abandoned properties. Brightfields – contaminated sites with potential for solar energy generation – have seen particular success on the East Coast, where states like Massachusetts, Connecticut, and Rhode Island have implemented solar photovoltaic installations on closed landfills.

While all closed landfill sites present geo-technical feasibility challenges related to site composition and landfill contents, Minnesota faces additional state-specific legal barriers. Many of the sites enrolled in the Minnesota Pollution Control Agency's (MPCA) Closed Landfill Program (CLP) are constrained by state general obligation bonds, which cover closure and continuing maintenance costs of the closed landfill sites but do not address post-closure development, such as solar installation. These bonds present a critical barrier that prevents involvement from third party developers and complicates the regulatory process for local municipalities interested in developing solar arrays on CLP sites.

The Brightfields Initiative is addressing this challenge. With a diverse set of professional backgrounds, including public and non-profit sector employees from across the country, the collective provides cost-free professional, technical, financial, and regulatory expertise and analysis for local governments across Minnesota. By assisting pilot projects, the initiative is forging a path for consistent policy, permitting, and redevelopment protocol regarding solar installation on closed landfills enrolled in the MPCA's CLP.

In June 2019, the Brightfields Initiative secured funding from the State of MN for a "Solar on Closed Landfill Study." This one-time $300,000 appropriation to the Environmental Quality Board will fund a comprehensive study of solar photovoltaic device installation on twenty-four of the 114 sites enrolled in the MPCA's CLP. The study will examine the legal status of CLP site constraints; assess financial barriers; evaluate potential complications posed by closed landfill site characteristics; assess the potential and logistics for solar energy generation for low-income communities, and areas where environmental justice concerns are present; establish regulatory procedure for local governments; and analyze the costs, benefits, and logistics of solar energy production on a variety of sites. In March 2019, a bipartisan group of legislators introduced the bill. It was referred to the Committee on Energy and Utilities Finance and Policy, recommended for passage, and re-referred to the Environment and Natural Resources Finance Committee for inclusion in the omnibus environmental finance bill.

Initiative partners include Metropolitan Council, Great Plains Institute, SolSmart, MN Solar Energy Industries Association (MnSEIA), MN Department of Commerce, Clean Energy Resource Teams (CERTs), Windustry, the U.S. Environmental Protection Agency, and National Renewable Energy Labs.

The Importance of State Brownfield Funding

Brownfield sites pose complex fiscal challenges to potential developers, municipalities, and broader communities alike. The need for up-front capital to clean contaminated sites – paired with a shortage of loan availability and private equity investment monies – requires developers to seek public assistance. Government grants, such as those from the EPA, DEED, Metropolitan Council, MPCA, and local counties, defray upfront cleanup costs and make brownfield projects financially viable. Loans for brownfield sites are often more difficult to obtain because lenders can be reluctant to take on the risk of contaminated properties or economically depressed regions. While public funding is available for brownfield revitalization in Minnesota, current programs are vastly over-subscribed, further complicating the redevelopment process and resulting in fewer financially viable projects.

Grant funding is available from the EPA and through state and regional grant programs: Minnesota DEED's Contamination Cleanup and Investigation and Redevelopment Grant Programs, the Metropolitan Council's Tax Base Revitalization Account, MPCA's Targeted Brownfield Assessment Grant Program, and Hennepin and Ramsey County's Environmental Response Funds. These grantors are all critical to the success of brownfield redevelopment projects.

Spurring Development and Economic Growth Through Public Funding

Most brownfield projects rely on a combination of funding sources. Many redevelopment projects – especially those that take place on properties with a history of commercial or industrial use – encounter contamination issues. The longer the history of commercial or industrial use, the greater the probability that a property will require remediation. Private developers work on tight budgets with limited capacity to absorb the unpredictable costs of environmental investigations and cleanups. Therefore, developers look for significant return on investment to justify redevelopment. Public-private partnerships have proven an effective strategy to spur development.

A comparison of competitive state, regional, and county brownfield financial resources can be found on the Minnesota Brownfields website underneath the "Available Resources" tab.

Barriers to Capitalizing on Minnesota's Brownfield Opportunities

Funding for Minnesota's main brownfields grant programs has fluctuated with the state's economic and political climate. The 2012 Minnesota Legislature ended the Hennepin and Ramsey County Environmental Response Funds for six months, only to reinstate the Funds in 2013 for the next fifteen years. Up to half of the Metropolitan Council's brownfield grant funds were earmarked to cover a transit operating deficit between 2009 to 2011. Despite the recent increase in funding and the reauthorization of the EPA's Brownfields Program, the funding of the EPA Brownfields Grant Program has been historically cyclical, peaking in 2009. There is intense national competition for EPA grants. Federal funding is now more uncertain than ever, making it critical that Minnesota's in-state brownfield grant programs are funded to meet demand.

Conclusions and Recommendations

Brownfield remeditation supports Minnesota's future economic competitiveness, environmental sustainability, and public health. In the context of budget constraints and social and environmental challenges, brownfield redevelopment provides an opportunity for Minnesota to ensure a strong economy, protect the environment, and provide a high standard of living for all Minnesotans – now and for generations to come.

We can ensure this future by:

- strengthening the commitment to brownfield redevelopment by Minnesota's state, regional, and local governments, as well as its real estate community, environmental professionals, corporate community, lenders, and nonprofit community.

- encouraging local governments to support redevelopment and brownfield cleanup by establishing redevelopment policies and best practices. The Urban Land Institute's (Re)development Ready Guide is a proactive framework that provides clarity, transparency, collaboration, and efficiency to support thriving, sustainable communities.[64]

- ensuring that Minnesota's brownfield funding programs receive adequate appropriations to support the cleanup and redevelopment of our state's brownfields. Grant programs should not be vulnerable to reallocation of their funds to competing programs. Income obtained by the state through the voluntary cleanup programs should be used exclusively for the operation, expansion, and innovation of the voluntary cleanup programs.

- incorporating community and regional objectives into the brownfield redevelopment decision-making process, to ensure that public funding of brownfield projects continues to benefit the communities surrounding the projects and appropriately leverages private investment.

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