APPENDIX B

FISCAL & FINANCIAL FEASIBILITY STUDY

Phone • (503) 222-6060
FAX • (503) 222-1504
info@econw.com

Suite 1600
222 SW Columbia
Portland, Oregon 97201-6616

Other Offices
Eugene • (541) 687-0051
Seattle • (206) 622-2403

October 15, 2012 Project #: 20870

TO: **Seth Otto, Maul Foster Alongi**
FROM: **Anne Fifield, Lorelei Juntunen**
SUBJECT: **ECONOMIC, SOCIAL, AND ENVIRONMENTAL INDICATORS: METHODS, ASSUMPTIONS, AND RESULTS SUMMARY**

ECONorthwest (ECO) is teamed with Maul, Foster, Alongi (MFA) and Redevelopment Economics on a project that: (1) estimates the total number of brownfields (contaminated redevelopment sites) in the Portland Metro area, and (2) evaluates various policy approaches to addressing the brownfields challenge. This memorandum documents a portion of the analysis conducted by ECO and Redevelopment Economics, together with MFA. It provides details on the methods, assumptions, and results of analyses of the potential fiscal, social, and environmental outcomes that might result from the redevelopment of remediated brownfields in the Portland Metro area.

This memorandum is organized into the following sections:

- Purpose
- Methods and assumptions
- Results: Fiscal outcomes and financial feasibility
- Results: Social and economic indicators
- Key findings

1 PURPOSE

The Metro government is charged with long-term planning for urban growth, including considerations of regional land supply and demand. Brownfields are a part of that regional land supply, and it is clearly more difficult to develop on a brownfield site than an otherwise comparable greenfield site. However, little is known about the number of brownfields that might exist in the region, what the redevelopment potential on those sites might be, and how their redevelopment might contribute to the fiscal, environmental, and social equity situation faced by Metro and its jurisdictional partners. The overall analysis addresses all of these questions.

The analysis described in this memorandum contributes to these larger questions by providing data and findings regarding: the financial (market) feasibility of redevelopment occurring on known and suspect brownfield sites, and the fiscal and other implications of redevelopment. Its purpose is not to precisely quantify the market for brownfield and economic impact of redevelopment, but rather to take a high level look at the potential contributions of these sites to the regional economic situation, and to provide input into a larger policy conversation regarding solutions to these challenges.

The analysis in this memorandum is based on analysis conducted by MFA to estimate the number of brownfield sites in the Portland region. MFA conducted a data gap analysis (described in Appendix A of the final report submitted to Metro) to estimate the number of suspect brownfield sites and used DEQ data to determine the number of DEQ sites in the region. Table 1 shows the number of sites associated with each typology, as determined by MFA.

Table 1. Estimated number of suspect and DEQ brownfield sites, Portland region, 2012

Typology	Extrapolated Number of Suspect Sites	Number of Known DEQ Sites
1 - Small Commercial	1,431	367
2 - Industrial Conversion	10	67
3 - Ongoing Industrial	160	140
4 - Rural Industry	129	6
Total	**1,730**	**580**

Source: Calculated by Maul Foster Alongi, 2012.

Definitions of the typologies:

- **Type 1—Small Commercial Sites**. Common historical uses were gas stations, repair shops, and dry cleaners, characterized by small parcel size and located along highways, arterials, and in commercial centers, including main streets and small downtowns. These properties are commonly redeveloped for commercial, office, multi-family, and mixed uses. The small size of these sites can be a challenge to redevelopment, because they often cannot generate enough value to balance remediation costs. These types of sites are typically located in centers, corridors, and scattered in employment areas.
- **Type 2—Industrial Conversion Sites**. These properties range in size and are historically found in areas that have transitioned from industrial to office, retail, and mixed-use centers. Change of zoning and location often drives redevelopment of these properties. Sites in highly attractive, high-density areas, may be redeveloped by the private sector. This type of brownfield faces greater financial challenges in areas with weaker real estate markets.

- **Type 3—Ongoing Industrial**. These properties are located in areas with an industrial past that continues today, particularly through regulatory controls such as Metro's Title 4 requirements and local employment sanctuary overlays. The types of historical uses vary, but they share constraints on land value and future use that can be a challenge to redevelopment opportunities. These properties are typically large.
- **Type 4—Rural Industry Sites**. These properties are associated with rural natural resource extraction industries and agriculture. They are typically large and located on the edge of urban growth boundary, especially within urban and rural reserves. Structural economic changes can make these properties difficult to redevelop. There are relatively few of these types of brownfields in the Metro region and its urban reserves, but they individually can occupy large areas and can have significant regional impacts.

The analysis estimated the potential amount of development that might be contained on these sites and some key outcomes associated with that redevelopment. The analysis estimates these key indicators:

- Potential square feet of structures that could be developed on brownfield sites
- The value of the built structure
- The impact of clean up on financial feasibility
- The net new assessed value and property tax
- The new jobs that could be accommodated in the redeveloped space, wages, and income tax
- The number of housing units
- Vehicle Miles Traveled and CO_2 reduction
- Savings of open space
- Savings of infrastructure costs
- Improvements in water quality and reductions in run off

The analysis is also intended to understand how the cost of remediation affects the ability of the brownfield sites to redevelop. We estimated the potential cost of redevelopment and compared it to the potential value of development, to understand if there is a financial gap. That is, we determined if the cost of development exceeds the value of development, for each typology.

The analysis is intended to establish an upper bound of redevelopment potential. It identifies the development that *could* occur on the brownfield sites—it does not include any assumptions about demand for the sites. It aims to provide insight into the extent that brownfield sites can contribute to the supply of land in the region.

2 METHODS, ASSUMPTIONS, AND LIMITATIONS

2.1 FISCAL AND FINANCIAL FEASIBILITY

The fiscal and financial feasibility analysis (results described in Section 3 of this memorandum) has six steps:

1. Estimate the total square footage of development for each parcel in the sample.

2. Estimate the cost and value of the development of each parcel.

3. Estimate the net new property tax revenue for each parcel.

4. Estimate the net new income tax revenue for each parcel.

5. Estimate financial feasibility of each parcel.

6. Extrapolate the results from the sample for each typology.

The remainder of this section provides details on each of these steps and documents the assumptions made.

2.1.1 Estimate the total square footage of development

ECO's first step was to identify appropriate buildings that could be built on the brownfield properties. To do so, we identified building types and assigned a building type to each parcel based on its zoning. This section describes how we identified building types and applied them to zones.

MFA provided ECO with the dataset that made up the sample for the data gap analysis. Of the 208 records in the sample, MFA identified 58 records as potential brownfield sites. ECO's analysis focused on those 58 records. Each record included the following data points:

- Site address
- Site City
- County
- Size of parcel, in acres
- Land value, as identified by the County Assessor
- Building value, as identified by the County Assessor,
- Square feet for existing structures
- The year the existing structure was built
- Land use

- Zone class, a region-wide zoning category
- Suspected brownfield site status (suspect, unknown, not suspect)
- Typology

ECO relied on the zone class category to determine the appropriate building type for each parcel. The zone class is a metro-wide zoning classification system that broadly identifies the allowed uses for a parcel. The potential sites included 12 zone classes, shown and defined in Table 2.

Table 2. Zone classes and their definitions, Portland Metro area, 2012

Zone Class	Definition
CC	Central Commercial - allows a full range of commercial typically associated with CBD's and downtowns. More restrictive than general commercial in the case of large lot and highway-oriented uses. Encourages higher FAR uses including multi-story development.
CG	General Commercial - larger scale commercial districts, often with a more regional orientation for providing goods and services. Businesses offering a wider variety of goods and services (including large format retailers) are permitted in this district and include mid-rise office buildings, and highway and strip commercial zones.
CO	Office Commercial - districts accommodating a range of low-rise offices; supports various community business establishments, professional and medical offices; typically as a buffer between residential areas and more intensive commercial districts.
IC	Industrial Campus - Campus/Industrial/Business Park - permits light industrial & limited commercial uses on large/irregular parcels
IH	Heavy Industrial - districts permit light industrial and intensive industrial activity such as bottling, chemical processing, heavy manufacturing and similar uses with noxious externalities.
IL	Light Industrial - districts permit warehousing and distribution facilities, light manufacturing, processing, fabrication or assembly. May allow limited commercial activities such as retail and service functions that support the businesses and workers in the district.
MUR1	Mixed Use Commercial & Residential with FAR maximum of about 0.3
MUR8	Mixed Use Commercial & Residential with FAR maximum of about 3
MUR9	Mixed Use Commercial & Residential with FAR maximum of about 4
MUR10	Mixed Use Commercial & Residential with FAR maximum of about 12.5
RI	Rural Industrial
RRFU	Rural Residential or Future Urban - residential uses permitted on rural lands (1 dwelling unit per lot) or areas designated for future urban development, typically lots are 10 or more acres

Source: http://rlismetadata.oregonmetro.gov/.

For each zone class, ECO identified an appropriate building type, based on building prototypes described in the Envision Tomorrow ™ planning tool developed by Fregonese Associates.[1] Metro has used this tool in several of its other planning projects, including the Community Investment Initiative and the Climate Smart Communities project; using it here provided some economy and consistency in assumptions among the various projects Metro is undertaking. For each prototypical building type, the Envision Tomorrow tool describes its estimated square feet and parking needs, given a specified parcel size. The planning tool provides the portions of office, retail, industrial,

[1] For a description of the planning tool, see http://www.frego.com/services/envision-tomorrow/.

and residential uses in each building prototype. Table 3 shows the crosswalk between Metro's zone class and ECO's assigned building prototype.

Table 3. Zone classes and applied building prototype

Zone Class	Building Prototype
CC	Low Density Commercial
CG	Low Density Commercial
CO	Low Density Commercial
IC	Business Park Campus Industrial
IH	Heavy Industrial
IL	Light Industrial
MUR1	SFR Houses (Suburban Medium Lot)
MUR8	Suburban MUR, Low
MUR9	Neighborhood MU
MUR10	Mid-Rise MU Small Units
RI	Heavy Industrial
RRFU	SFR Houses (Suburban Medium Lot)

Source: ECONorthwest, with data from Metro and Fregonese Associates.

Table 4 shows the results of the assignment of building prototype to zone class. The table shows the number of suspect brownfield sites by building prototype and typology for a sample of 58 brownfield sites selected from the region. Type 1-Small Commercial and Type 2-Industrial Conversion are expected to accommodate building prototypes that include housing, offices, and retail space. Type 3-Ongoing Industrial and Type 4-Rural Industrial are expected to accommodate employment-based structures. Type 4, however, does include a small portion that will accommodate residential development.

Table 4. Building prototype by Typology, sample of suspect brownfield sites

	Typology					
Building Prototype	**1**	**2**	**3**	**4**	**Total**	**% of Total**
Business Park Campus Industrial			1		1	2%
Heavy Industrial			1	10	11	19%
Light Industrial			4		4	7%
Low Density Commercial	17				17	29%
Mid-Rise MU Small Units	2				2	3%
Neighborhood MU	15	2			17	29%
SFR Houses (Suburban Medium Lot)	1			1	2	3%
Suburban MUR, Low	4				4	7%
Total by Typology	39	2	6	11	58	100%
% of Total	67%	3%	10%	19%	100%	

Source: ECONorthwest, 2012.

The Envision Tomorrow tool calculates the building size based on the lot size. For this analysis, ECO normalized the tool for a single acre, so that the building requirements could be applied to any parcel included in the sample.[2] ECO used build-out assumptions from the Envision Tomorrow tool to estimate the physical aspects of potential development.

ECO based its calculations of the physical elements of the potential developments on key factors in the Envision Tomorrow tool, shown below in Table 5. We multiplied the square feet per acre by the number of acres in each parcel. We applied the portions of each use type to estimate the square feet of office, retail, industrial, and residential uses.

Table 5. Assumptions for building prototypes, physical elements

	Protoype							
Variable	Business Park Campus Industrial	Heavy Industrial	Light Industrial	Low Density Commercial	Mid-Rise MU Small Units	Neighborhood MU	SFR Houses (Suburban Medium Lot)	Suburban MUR, Low
Square Feet per Acre	13,860	13,003	14,249	14,241	352,048	152,460	18,368	47,258
Use Type Portions								
Office	20%	0%	20%	30%	10%	0%	0%	0%
Retail	5%	5%	5%	70%	10%	20%	0%	25%
Industrial	75%	95%	75%	0%	0%	0%	0%	0%
Residential	0%	0%	0%	0%	80%	80%	100%	75%
Residential								
Square feet per unit	0	0	0	0	600	1,100	2,500	950
Parking Spaces								
Square feet per space	400	400	400	400	255	255	400	255
Surface Parking-Number/Acre	42	33	41	57	20	0	8	49
Structured Above-Number/Acre	0	0	0	0	0	0	0	0
Structured Below-Number/Acre	0	0	0	0	142	0	0	0
Tucked-Number/Acre	0	0	0	0	73	85	7	0

Source: Envision Tomorrow™, Fregonese Associates.

The calculations yielded estimates of the total potential developed square feet in the sample, by use type, for each of the four typologies.

2.1.2 Estimate the cost and value of development

In order to estimate the potential value associated with the region's brownfields, ECO estimated the value of the prototypical developments based on construction costs and likely market rents.

To estimate the costs, ECO estimated construction costs for each prototype. We identified hard costs for building types and parking. We multiplied the per-foot construction costs by the calculated square feet for each use type in each parcel and the cost for parking spaces by the number of spaces to estimate a total construction costs for each parcel. We then increased the costs by an estimate of soft construction costs (architectural fees, permitting fees, and others), a developer fee, and contingency. Table 6 shows the assumptions for each prototype.

[2] Some of the potential brownfield parcels are very small and unlikely to develop. It is reasonable, however, to assume that development on the smaller sites could occur if assembled with adjacent parcels.

Table 6. Assumptions for building prototypes, construction cost elements

Variable	Business Park Campus Industrial	Heavy Industrial	Light Industrial	Low Density Commercial	Mid-Rise MU Small Units	Neighborhood MU	SFR Houses (Suburban Medium Lot)	Suburban MUR, Low
	Protoype							
Cost per SF-Office	$85		$85	$95	$155			
Cost per SF-Retail	$85	$75	$85	$95	$155	$110		$120
Cost per SF-Industrial	$80	$75	$85					
Cost per SF-Residential					$155	$110	$120	$120
Cost per Space-Surface Parking	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000
Cost per Space-Above Parking	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000
Cost per Space-Underground Parking	$55,000	$55,000	$55,000	$55,000	$55,000	$55,000	$55,000	$55,000
Cost per Space-Tuck-in Parking	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000
Soft Costs	30%	30%	30%	30%	30%	30%	30%	30%
Contingency	10%	10%	10%	10%	10%	10%	10%	10%
Developer Fee	4%	4%	4%	4%	4%	4%	4%	4%

Source: Envision Tomorrow™, Fregonese Associates.

To estimate the value of each redeveloped parcel, ECO identified a range of market rents for each use type. We multiplied the rent by the leasable square feet for each building type and subtracted out allowances for vacancies and management costs, yielding a stabilized net operating income.

We divided the net operating income by a 7% capitalization rate—a rough estimate of a market-normal, regional average rate—to determine an estimated value for each parcel. For structures designed to be occupied by the owner (such as single family housing) we estimated a per-foot value for the property type. Table 7 shows the assumed rents and other factors that affect value. We calculated a 'low' and 'high' value for each parcel. Table 7 shows the factors used to estimate the values of the parcels.

Table 7. Assumptions for building prototypes, market value elements

Variable	Business Park Campus Industrial	Heavy Industrial	Light Industrial	Low Density Commercial	Mid-Rise MU Small Units	Neighborhood MU	SFR Houses (Suburban Medium Lot)	Suburban MUR, Low
	Protoype							
Leasable SF-Non-Residential	85%	85%	85%	85%	85%	85%	85%	85%
Leasable SF-Residential					85%	80%	100%	85%
Occupancy Rate	95%	95%	95%	95%	95%	95%	95%	95%
Annual Rents (triple net)								
Office-High	$26.50		$25.00	$25.00	$24.00			
Retail-High	$26.50	$20.00	$25.00	$25.00	$24.00	$25.00		$20.00
Industrial-High	$12.50	$13.50	$14.00					
Residential-High					$22			
Office-Low	$21.50		$20.00	$20.00	$19.00	-$5.00		-$5.00
Retail-Low	$21.50	$15.00	$20.00	$20.00	$19.00	$20.00	-$5.00	$15.00
Industrial-Low	$7.50	$8.50	$9.00					
Residential-Low					$16.84			
Management Fee	8%	8%	8%	8%	8%	8%	8%	8%
Capitalization Rate	7%	7%	7%	7%	7%	7%	7%	7%
Residential Owner Value Per Foot-High						$155	$182	$181
Residential Owner Value Per Foot-Low						$130	$157	$156

Source: ECONorthwest.

2.1.3 Estimate the property tax revenue

ECO used the estimated market value of the properties to calculate the expected property tax revenue. In Oregon, property taxes are determined by multiplying the property tax rate by the property's assessed value. For newly developed properties, the assessed value is the market value by the 'changed property ratio' or CPR. The CPR is specific to land type (residential, commercial, industrial) and varies by county.

For each parcel, we identified the primary use of the development to determine the land use category. We applied the appropriate CPR to each parcel based on its County and its primary use. Table 8 shows the assigned primary use and the CPRs for each building prototype.

Table 8. Assumptions for building prototypes, property tax elements

	Protoype							
Variable	Business Park Campus Industrial	Heavy Industrial	Light Industrial	Low Density Commercial	Mid-Rise MU Small Units	Neighborhood MU	SFR Houses (Suburban Medium Lot)	Suburban MUR, Low
Primary Use	Industrial	Industrial	Industrial	Commercial	Residential	Residential	Residential	Residential
CPRs								
Clackamas	0.961	0.961	0.961	0.886	0.821	0.821	0.821	0.821
Washington	1	1	1	0.655	0.787	0.787	0.787	0.787
Multnomah	0.8376	0.8376	0.8376	0.4883	0.6931	0.6931	0.6931	0.6931

Source: Envision Tomorrow™, Fregonese Associates and the Oregon Employment Department.

The parcels in the brownfield sample include properties that have actively used structures on them. These structures generate property tax revenue. To calculate the *net new* property tax, ECO excluded the existing property tax revenue. ECO collected data for each parcel in the sample from Assessor's Offices in the three counties.[3] We then subtracted existing assessed value from the calculated potential assessed value, to determine the net new value.

Property tax rates vary across a County. A single parcel may be included in a City, a school district, a parks district, a fire district, and other special districts. The boundaries of all the taxing districts are different so parcels within a single County can experience very different taxing rates. For this analysis, ECO applied a single property tax rate of $15 per $1,000 of assessed value, which is the Measure 5 limit for property tax rates. Subsequent changes to property tax law have made it possible for rates to exceed that (and General Obligation bonds for capital improvement are excluded from the Measure 5 limit). This analysis uses the $15 limit to provide a general estimate of property tax revenue across three Counties and a variety of taxing districts.

2.1.4 Estimate the income tax revenue

To estimate income tax revenue, ECO first estimated the number and type of job associated with redevelopment in the four typologies. Here, we relied on the job estimates provided in the Envision Tomorrow planning tool. The planning tool provides estimates of the number of jobs per building use type based on assumptions about typical space needs per worker. ECO divided the square feet in each parcel by the

[3] Multnomah County: http://portlandmaps.com/maps/raptor/;
Washington County: http://washims.co.washington.or.us/InterMap/index.cfm:
and Clackamas County: http://web5.co.clackamas.or.us/taxmap/

square feet per employee to estimate the number of employees, by type, in each development.

To estimate wages associated with the jobs in the redeveloped sites, we relied on 2011 income data reported by the Oregon Employment Department. The Employment Department reports total employment and payroll by industrial sector for regions across Oregon. To estimate the average wage per job, we used wage data specific to the Portland metropolitan region.

- For retail jobs, we took the mean wage for the "Food services and drinking places" sector.
- For Office jobs, we took the mean wage for the "Financial Activities", "Real Estate Rental & Leasing", "Professional & Business Services", "Administrative and support services", "Waste management and remediation services", and "Education & Health Services" sectors.
- For industrial jobs, we took the mean wage for the "Manufacturing" and "Wholesale" sectors.

For each parcel, we multiplied the jobs by the average annual wage to estimate the total potential wages for that parcel. Table 9 shows the assumptions regarding square feet per employee and the calculated average wage for each building type.

Table 9. Assumptions for building prototypes, employment elements

	Protoype							
Variable	Business Park Campus Industrial	Heavy Industrial	Light Industrial	Low Density Commercial	Mid-Rise MU Small Units	Neighborhood MU	SFR Houses (Suburban Medium Lot)	Suburban MUR, Low
SF per Employee								
Office	1,210	2,212	1,000	734	434	434	434	0
Retail	1,210	2,212	1,000	734	1,246	1,246	1,246	1,246
Industrial	1,210	2,212	1,000	734				
Residential	0	0	0	0	0	0	0	0
Average Annual Wage								
Office	$49,048	$49,048	$49,048	$49,048	$49,048	$49,048	$49,048	$49,048
Retail	$23,301	$23,301	$23,301	$23,301	$23,301	$23,301	$23,301	$23,301
Industrial	$73,117	$73,117	$73,117	$73,117	$73,117	$73,117	$73,117	$73,117

Source: ECONorthwest and Assessor's Offices in Clackamas, Washington, and Multnomah counties.

The parcels in the brownfield sample include properties that have actively used structures on them. These structures have employees and associated wages. To calculate the *net new* jobs, wages, and income tax, ECO subtracted the existing jobs and their wages from our estimate of potential jobs and wages on the parcels.

ECO obtained parcel-specific data regarding the number of employees and their wages for the parcels in the sample from the Oregon Employment Department. The Employment Department allowed ECO to review confidential Quarterly Census of Employment and Wages (QCEW) employment data for 2010. We matched the employment data to our existing land use dataset and then subtracted the existing jobs and wages from our estimated potential jobs and wages, to determine the net new jobs and wages.

To estimate potential net new income tax, we multiplied the effective income tax rate in Oregon for personal income tax by the net new income associated with jobs at the parcels. The effective tax rate differs from the state's personal tax rate. The effective rate is the mean rate paid by all Oregonians after all deductions and credits have been factored into all individuals' total tax burden. The effective tax rate for tax year 2010 was 5.6%.[4]

2.1.5 Estimate financial feasibility

To understand the financial feasibility of developing brownfield sites, ECO measured the difference between the fair market value for each site (as described in Section 2.2) and the cost of developing each site. If the market value exceeds the cost, the site is considered to be financially feasible. ECO calculated a low and high fair market value for each site.

The development costs, however, do not include the cost of remediating the brownfield site. The fact that these sites are potentially contaminated adds remediation costs to the total development costs. ECO used remediation costs provided by MFA.

Remediation costs are challenging to model because they vary greatly between each site and cannot be estimated accurately without field investigation on specific parcels. To account for the costs of remediation, real-world cleanup costs were collected from brownfield case studies in the Metro region and published data from cleanup projects in Oregon and across the country. Based on this dataset of approximately 100 cleanup projects, low, mid, and high remediation costs per acre estimates were calculated.

- Low – $58,920 per acre
- Middle - $255,871
- High - $695,639 per acre

These costs include the total costs associated with assessment and remediation, including engineering and remedy implementation. ECO used the low and the high costs to estimate the best and worst cases. We added the remediation costs to the total development costs and then compared the new, larger costs to the fair market value to determine if individual sites were financially feasible.

2.1.6 Extrapolation

The final step in ECO's fiscal analysis was to extrapolate the findings across the Metro region.

ECO determined the mean acres per parcel for each typology in the sample of 208 suspect brownfield sites. MFA conducted an analysis to extrapolate the sample into the

[4] Oregon Department of Revenue. *Personal Income Tax Statistics, 2012 Edition. Tax Year 2010*, page 17.

expected number of sites across the Portland region. ECO multiplied the extrapolated number of sites by the mean site size in the sample to extrapolate the expected number of acres of brownfield sites across the Portland region. Table 10 shows the data for the sample and the extrapolated number of sites and acres. The data show that the majority of the potential brownfield *acres* are in the Type 3 - Ongoing Industrial areas. Type 1 - Small Commercial areas, however, account for the majority of the *number of sites*. Type 1 – Small Commercial and Type 4 - Rural Industry areas each account for about 20% of the total. Type 2 - Industrial conversion accounts for less than 1% of potential brownfield acres. The table also shows the acres and number of sites for known DEQ sites.

Table 10. Number of sites and acres in known DEQ, sample, and extrapolated brownfield sites in the Portland Metro Area

	DEQ Sites			Sample			Extrapolated		
Typology	Acres	Number of Sites	Mean Acres/Parcel	Acres	Number of Sites	Mean Acres/Parcel	Acres	Number of Sites	% of Total
1 - Small Commercial	341	367	0.9	15	39	0.4	544	1,431	20%
2 - Industrial Conversion	690	67	10.3	0	2	0.2	2	10	<1%
3 - Ongoing Industrial	2,389	140	17.1	63	6	10.6	1,689	160	61%
4 - Rural Industry	91	6	15.2	46	11	4.2	542	129	20%
Total	**3,511**	**580**		**125**	**58**		**2,777**	**1,730**	100%

Source: ECONorthwest with data from MFA.

The analysis described in Sections 2.1 through 2.4 estimated the square footage and tax impacts for the 58 parcels in the sample. For each data point, ECO summed the values within each typology and divided the sum by the total acres in that typology to calculate a normalized per-acre figure. For example, ECO calculated the per-acre assessed value for each typology, a weighted mean of all the individual assessed values.

To extrapolate the analysis from the sample to the full expected number of brownfield acres in the region, ECO multiplied the per-acre values for each typology by the extrapolated number of acres and by the number of acres in known DEQ sites to determine the full expected value. ECO also estimated the values for each typology of known DEQ sites by multiplying the per-acre values for each typology by the number of acres in known DEQ sites.

2.1.7 Limitations

- This analysis required many assumptions about income from and costs of construction, type and density of redevelopment that might occur, kinds of jobs and associated wages, value of new construction, and others that are detailed in this section. In all cases, these assumptions are intended to provide order-of-magnitude results that are roughly accurate across the region in an average development market. They are not intended to be accurate for any individual site in the Portland region, but rather are intended to provide a high-level understanding of the opportunities and constraints associated with redevelopment market for brownfield sites on average across the region.

- The estimates of total redevelopment potential provide an upper bound on the amount of redevelopment that might occur on suspect sites, because they assume that all suspect sites redevelop. In the real world, 100% redevelopment is unlikely to occur. The financial feasibility section provides some analysis of how many sites are likely to develop without public or other intervention, based on an evaluation of the market.

- The findings include estimates of the amount of "space for new jobs" that could be accommodated in the redevelopment. This language is important. Jobs estimates are based on typical densities of jobs per square foot, relative to the amount of new square footage that is likely to redevelop. These estimates do not account for industrial trends and the likelihood that the private sector will expand sufficiently to fill that new space, and they do not account for a multiplier effect. In short, they should not be read as "net new jobs" to the region, but as "net new space that can accommodate jobs."

2.2 Environmental and Social Indicators

Brownfield remediation and redevelopment can create a wide range of benefits to the Metro area beyond the fiscal and other benefits discussed in earlier sections of this memorandum. The additional benefits are both environmental (reduced contamination in groundwater and storm water, reduced toxics in soils) and social (public health and social justice improvements). Since many of Metro's brownfields are located near rivers and wetlands, the improvements to habitat and water quality resulting from cleanup of legacy contamination is particularly significant. Brownfield redevelopment can also address environmental justice issues to the extent that contaminated lands may be located near low-income and minority populations.

To begin to evaluate some of the additional benefits that may also accrue to the region as a result of a targeted brownfield remediation strategy, analysis completed by Redevelopment Economics reviews national research that estimated these indirect environmental benefits, and applies them to the Portland Metro area:

- Lowered vehicle miles traveled (VMT) and lowered greenhouse gases due to locating economic activity in existing communities
- Conservation of rural lands and opens space accommodating growth within the envelope of developed areas
- Reduced infrastructure costs that may have been required to accommodate alternative development
- Reduced runoff and improved water quality because of greater density than alternative development patterns

The memorandum summarizes Redevelopment Economics' analysis and presents order of magnitude estimates for each of these measures; when possible, Redevelopment Economics adjusted these national figures to account for Oregon's unique growth management framework, but more specific and rigorous research that is specific to the Metro area would be required to fully understand the magnitude of environmental outcomes that might be associated with brownfield redevelopment in the Metro area. The report recommends this additional research as a next step if additional information is needed to support continued policy discussion. Nonetheless, the analysis here is a helpful starting place for a conversation around environmental and social justice effects.

3 RESULTS: FISCAL AND FINANCIAL FEASIBILITY

The aim of this analysis to understand the potential development and fiscal impacts associated with the underutilized status of brownfield properties throughout the region. It is important to note that this analysis has estimated an **upper bound** of potential lost development and revenues—the analysis simply calculates the potential value associated with all the sites. The financial feasibility analysis more carefully consider what portion of these properties might redevelop with and without public sector support or other subsidy.

3.1 FISCAL ANALYSIS

The methods used by Metro and MFA to estimate the total number of sites across the region focused on the four typologies. The extrapolation of the development and fiscal factors is limited to those four typologies.

The analysis determined that the region's brownfields could support approximately 234 million new square feet of built space, as shown in Table 11.[5] This is roughly equivalent to 390 new high-rise buildings similar to the KOIN Tower in downtown Portland. Across typologies, the largest portion of the brownfield acres is most likely to support residential uses, with industrial uses being the second largest portion. Only 6% of the brownfield acreage is expected to support office space.

[5] Large office buildings in downtown Portland range from roughly 500,000 to 750,000 square feet.

Table 11. Square feet of potential new development possible on suspect and DEQ brownfield sites in the Portland Metro Area

	SF of New Development		% by Typology			
Typology	Suspect sites	DEQ & Suspect sites	Office	Retail	Industrial	Residential
1 - Small Commercial	40,905,000	66,526,000	8%	21%	0%	71%
2 - Industrial Conversion	258,000	105,454,000	0%	20%	0%	80%
3 - Ongoing Industrial	22,288,000	53,806,000	3%	5%	92%	0%
4 - Rural Industry	7,358,000	8,594,000	0%	4%	81%	15%
Total	**70,809,000**	**234,380,000**	**6%**	**14%**	**37%**	**43%**

Source: ECONorthwest, 2012.

The new square feet of built space would add assessed value to the region, as summarized in Table 12. The table shows a 'low' and 'high' estimate. The low estimate is based on the low rents and market values and the high is based on the high values, shown in Table 7.

The data show that the majority of the assessed value is expected to be in Type 1 - Small Commercial areas. Type 1 accounts for about 60% of total assessed value, but only 20% of all the acres. Type 3 - Ongoing Industrial areas accounts for about 30% of total assessed value, yet accounts for 60% of the acres. As shown in Table 11, Type 1 - Small Commercial areas are dominated by residential uses and Type 3 - Ongoing Industrial areas are dominated by industrial uses. The estimated per-acre value of industrial land is much lower than the per-acre value of residential land.

The region's suspect brownfield have the potential to increase the region's assessed value by $6.7 billion to $9.2 billion. The region's suspect and known brownfields combined have the potential to increase the region's assessed value by $21.6 billion to $28.4 billion. Current assessed value for all property in the three counties is:

- Clackamas - $38 billion
- Multnomah - $58 billion
- Washington - $48 billion

The region's suspect brownfields have the capacity to increase the entire region's total assessed value by 5% to 6%. The known and suspect sites have the capacity to increase the regions total assessed value by 15% to 20%

Table 12. Potential net new assessed value if all suspect brownfield sites redevelop; Portland Metro Area

Typology	Low		High	
	$ Millions	% of Total	$ Millions	% of Total
1 - Small Commercial	4,274.4	63%	5,407.4	59%
2 - Industrial Conversion	23.2	<1%	28.5	<1%
3 - Ongoing Industrial	1,845.7	27%	2,873.7	31%
4 - Rural Industry	603.8	9%	906.1	10%
Total	**6,747.2**	**100%**	**9,215.7**	**100%**

Source: ECONorthwest, 2012.

Table 13. Potential net new assessed value if all known DEQ and suspect brownfield sites redevelop; Portland Metro Area

Typology	Low		High	
	$ Millions	% of Total	$ Millions	% of Total
1 - Small Commercial	6,951.8	32%	8,794.4	31%
2 - Industrial Conversion	9,504.9	44%	11,645.4	41%
3 - Ongoing Industrial	4,455.8	21%	6,937.4	24%
4 - Rural Industry	705.2	3%	1,058.4	4%
Total	**21,617.7**	100%	**28,435.6**	100%

Source: ECONorthwest, 2012.

The analysis estimated the potential property tax revenue that could be generated by the redevelopment of the region's brownfields (see Table 14 and Table 15). The region's redevelopment brownfields have the capacity to generate approximately $324 million to $427 million in new property tax revenue. This revenue would be distributed across all taxing districts in the region. If all the suspect and known DEQ brownfields redeveloped, this would represent a 13% to 17% increase in the three-county property tax revenue.

Table 14. Potential net new property tax revenue if all suspect brownfield sites redevelop; Portland Metro Area

Typology	Low	High
1 - Small Commercial	$64,117,000	$81,112,000
2 - Industrial Conversion	$349,000	$427,000
3 - Ongoing Industrial	$27,686,000	$43,105,000
4 - Rural Industry	$9,056,000	$13,592,000
Total	**$101,207,000**	**$138,235,000**

Source: ECONorthwest, 2012.

Table 15. Potential net new property tax revenue if all known DEQ and suspect brownfield sites redevelop; Portland Metro Area

Typology	Low	High
1 - Small Commercial	$104,277,000	$131,917,000
2 - Industrial Conversion	$142,574,000	$174,682,000
3 - Ongoing Industrial	$66,837,000	$104,061,000
4 - Rural Industry	$10,578,000	$15,875,000
Total	**$324,266,000**	**$426,535,000**

Source: ECONorthwest, 2012.

Table 16 shows the potential number of jobs that could be supported in the newly built structures on brownfield sites, and the estimated wages and the potential personal income tax paid to the state of Oregon from those jobs.[6]

Based on the building types assumed to be built on the parcels, Type 1 - Small Commercial and Type 3 - Ongoing Industrial areas are expected to generate the most additional space for new jobs. Type 1 - Small Commercial areas accounts for 22% of net new jobs; Type 3 – Ongoing Industrial areas accounts for about 59% of net new jobs. The Portland region currently has about 850,000 jobs. The 69,000 new jobs associated with known and suspect brownfield redevelopment would increase the total number of jobs in the Portland metropolitan region by about 8%.

We estimate that if all of the new employment space were filled with new jobs, roughly $3.3 billion in additional wages would be generated, which would in turn generate about $183 million in personal income tax to the state of Oregon. Type 3 - Ongoing Industrial sites are expected to generate the majority (59%) of wages and income tax. Type 3 - Ongoing Industrial areas accounts for a larger portion of income tax because the typology has a high portion of industrial land and the average wage for the industrial sector is higher than the average wage in both the retail and office sectors.

Table 16. Potential new jobs and associated wages if all suspect brownfield sites redevelop; Portland Metro Area

Typology	Jobs	% of Total Jobs	Wages ($millions)	Personal Income Tax ($millions)	% of Total Income Tax
1 - Small Commercial	13,142	48%	$440.9	$24.7	31%
2 - Industrial Conversion	41	<1%	$1.0	$0.1	<1%
3 - Ongoing Industrial	11,410	42%	$798.4	$44.7	55%
4 - Rural Industry	2,839	10%	$200.5	$11.2	14%
Total	**27,433**	**100%**	**$1,440.8**	**$80.7**	**100%**

Source: ECONorthwest, 2012.

[6] This analysis did not calculate corporate income tax that would be generated by the businesses on the redeveloped brownfield sites.

Table 17. Potential new jobs and associated wages if all known DEQ and suspect brownfield sites redevelop; Portland Metro Area

Typology	Jobs	% of Total Jobs	Wages ($millions)	Personal Income Tax ($millions)	% of Total Income Tax
1 - Small Commercial	21,370	31%	$717.1	$40.2	22%
2 - Industrial Conversion	16,930	24%	$394.4	$22.1	12%
3 - Ongoing Industrial	27,550	40%	$1,927.5	$107.9	59%
4 - Rural Industry	3,320	5%	$234.2	$13.1	7%
Total	**69,170**	**100%**	**$3,273.2**	**$183.3**	**100%**

Source: ECONorthwest, 2012.

Table 18 shows the potential number of dwelling units that could be built on the suspect and known DEQ sites. Based on the density assumptions, the full set of brownfield sites could accommodate about 138,000 new dwelling units. It is important to remember that this figure does not reflect *demand* for housing. Instead, this analysis identifies the total capacity for the new dwelling units on the existing brownfields.

Table 18. Potential new dwelling units if all known DEQ and suspect brownfield sites redevelop; Portland Metro Area

	Number of New Dwelling Units	
Typology	Sample sites	Known & Sample sites
1 - Small Commercial	37,656	61,243
2 - Industrial Conversion	188	76,694
3 - Ongoing Industrial	0	0
4 - Rural Industry	431	504
Total	**38,275**	**138,441**

Source: ECONorthwest, 2012.

3.2 Financial Feasibility Analysis

To understand the impact that remediation costs have on the financial feasibility of a site's redevelopment, ECO subtracted the development costs with and without remediation costs from the estimated market value of each parcel. This evaluation provides some context for thinking about what properties are likely to redevelop, and which are likely to need additional support.

We evaluate a "worst case" scenario, which combined the high end of the remediation costs with the low end of the achievable rent costs, and a "best case" scenario, which combined low-end clean up costs with high achievable rents, to bracket the results in a range. This measure is one indicator of redevelopment feasibility and potential interest from the private sector in reinvesting in the site.

Overall, the analysis showed that the majority of sites cost more to develop *even if remediation costs are not included* than the estimated market value, an indicator that the sites are not likely to redevelop without market intervention.

Figure 1 shows the per-acre difference between market value and costs. The figure shows four data points for each typology:

- **Development Costs Only-Worst Case -** The per-acre difference between market value and development costs, with the 'low' rent assumption.
- **Development Costs Only-Best Case -** The per-acre difference between market value and development costs, with the 'high' rent assumption.
- **Plus Remediation Costs-Worst Case -** The per-acre difference between market value and development costs, including the 'high' cost of remediation, with the 'low' rent assumption.
- **Plus Remediation Costs-Best Case -** The per-acre difference between market value and development costs, including the 'low' cost of remediation, with the 'high' rent assumption.

The data show that, on average across all typologies, rents affect the financial feasibility more than the cost of remediation. In Type 1 - Small Commercial sites[7] - both 'worst' case scenarios are not financially feasible. But both 'best' case scenarios are feasible. Thus, if the market rents for this typology are low, subsidizing remediation will not push development into feasibility without additional support to overcome a gap that is based on an overall weak market.

Type 2 - Industrial Conversion sites[8] - parcels have the most difficulty achieving financial feasibility, on a per-acre basis. The financial gap is large even if rents are high and there are no remediation costs. In strong, close-in markets near the City center, conversion of an industrial property to a higher value, higher density commercial or residential use could be the best path to feasibility. However, in outlying town centers and corridors that make up the majority of these parcels across the entire region, market challenges are hindering development of higher value product such as mixed use or office even when brownfields are not an issue. Very little new development of this type is taking place in the region outside of close-in locations in the current market.

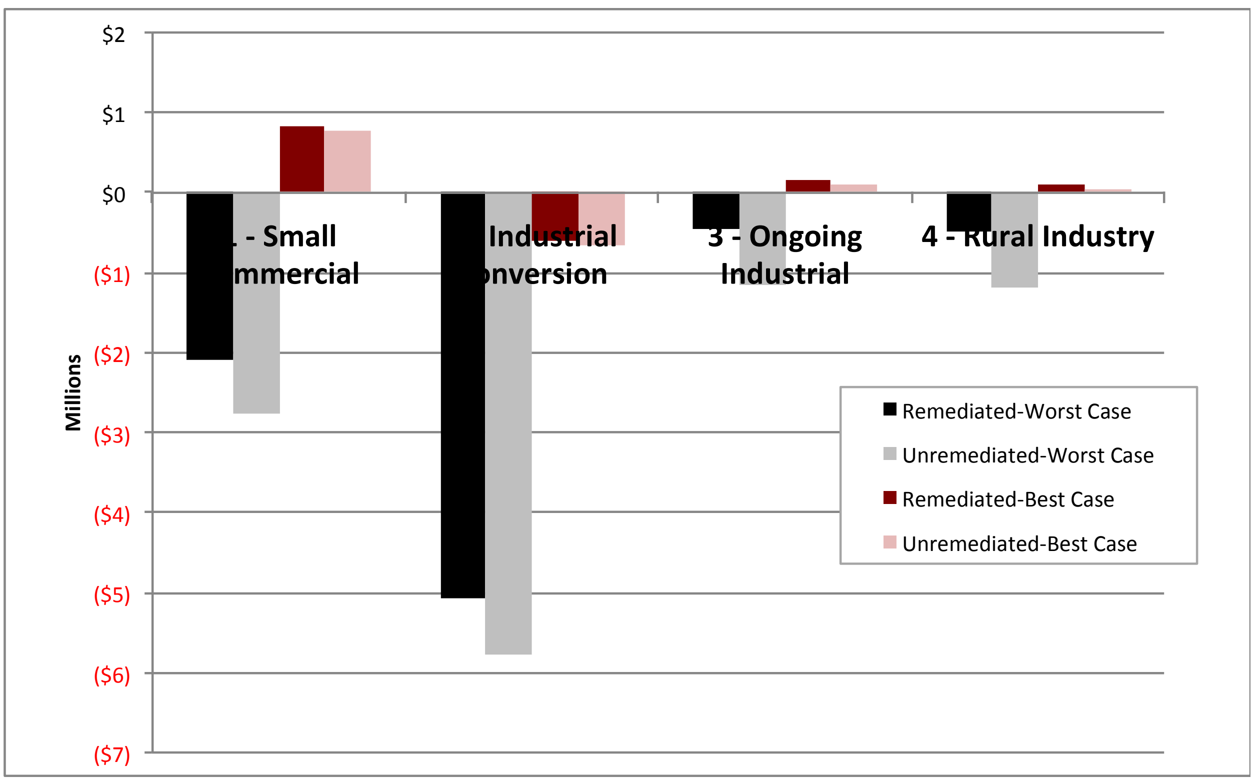
[7] Type 1 - Small Commercial definition reminder: Common historical uses were gas stations, repair shops, and dry cleaners, characterized by small parcel size and located along highways, arterials, and commercial centers. These properties are commonly redeveloped for commercial, mixed use, offices, and multi-family residences. The small size of these sites is often a challenge to redevelopment, because they often cannot generate enough value to balance remediation costs. This typology is the most numerous in the Metro region, with sites located in centers, corridors, and employment areas.

[8] Type 2 - Industrial Conversion definition reminder: These properties range in size and historically housed various uses in areas that have transitioned from industrial to office, retail, and mixed use centers. Change of zoning and use often drives redevelopment of these properties. The potential for redevelopment of these properties is driven largely by location and density. Sites in highly attractive, high density areas, such as the Pearl District often are redeveloped by the private sector. This type of brownfield faces greater financial challenges in areas with weaker real estate markets.

For typologies 1 and 2, when evaluating on average across the entire region, this analysis finds that it is unlikely that an investment in brownfields will overcome market variables. For certain parcels however, where market fundamentals are strong but the cost of remediation is high, an investment in reducing or eliminating the cost of remediation could be the variable that affects feasibility and generates redevelopment. The policy challenge will be to identify those parcels where the investment in brownfield remediation will make the difference and create the fiscal and redevelopment outcome that is desired.

Type 3 - Ongoing Industrial - and Type 4 - Rural Industrial - both show a small positive difference between market value and costs. The data show that the range of market rents affects the feasibility to a greater degree than the cost of remediation. However, more of the parcels are closer to the feasibility indicator mark where development costs are equal to market value than in the other typologies. In particular, even in the best-case scenarios, most redevelopment is barely feasible. This suggests that any changes in development factors--whether it is land costs, entitlement issues, achievable rents, or long-term financing terms—is more likely to have an overall effect on feasibility.

Figure 1. Market value minus development costs (with and without remediation) average per acre of suspect brownfield sites, by brownfield typology, Portland Metro Area

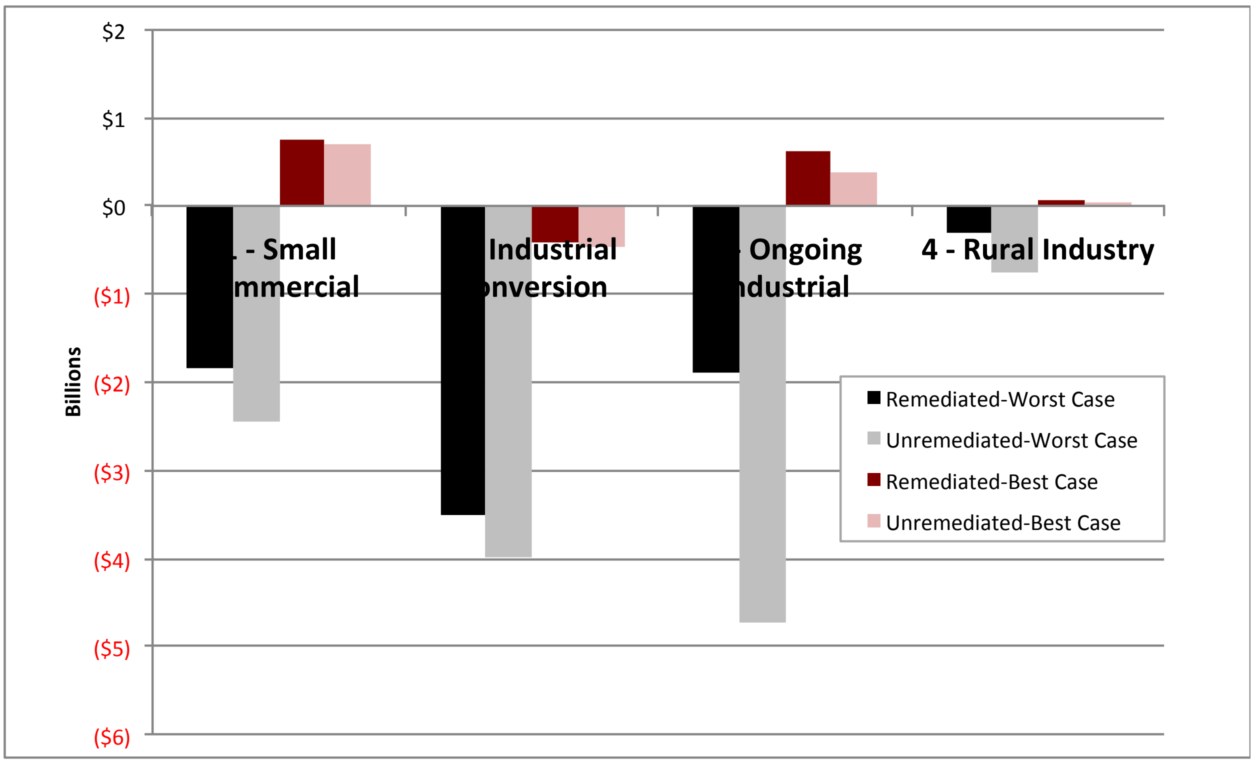


Source: ECONorthwest, 2012.

Figure 2 shows the same analysis, but with the per-acre costs multiplied across all acres of suspect and known DEQ brownfields in the region. It is a slightly different way of considering the data that highlights which typology has the biggest dollar gap. In essence, Figure 2 shows the total funding gap by typology. The figure shows that Type 3 - Ongoing Industrial has a relatively small per-acre financial gap, but there are many acres of the typology across the region.

Overall, only Type 2-Industrial Conversion has a financial gap under best-case scenario even if remediation costs are eliminated. The other typologies show no financial gap, with or without remediation, under best-case assumptions. This indicates that market rents for buildings is a key determinant of whether or not redevelopment is financially feasible.

Figure 2. Total market value minus development costs for known DEQ and suspect sites (with and without remediation), by brownfield typology, Portland Metro Area



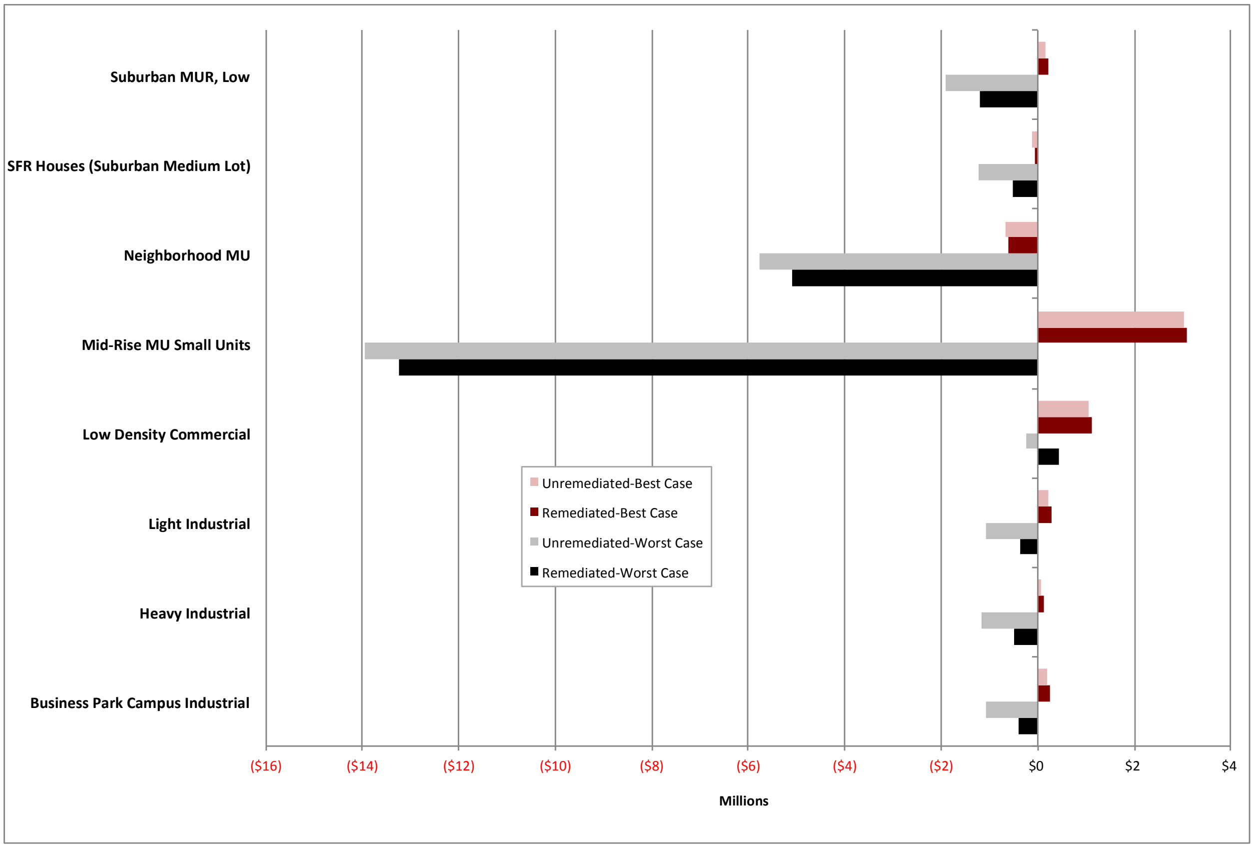
Source: ECONorthwest, 2012.

Figure 3 provides the same information by *development type*, per acre of redevelopment. Again, those development types that have the shortest bars – where all cases hover closest to the feasibility marker of $0 (development costs equal to market value)—are those development types that are most likely to have feasibility positively affected by an investment in brownfield remediation. Key findings:

- Those development types with the highest development costs (mid-rise mixed use, neighborhood mixed use) are the most strongly affected by overall market conditions. In these development types, remediation costs are a lower proportion of total development costs, and investment in remediation, on average, does not affect feasibility. Again, at the site level, this pattern may not hold. An individual site that has high remediation costs but has strong market fundamentals may become feasible if the remediation costs are removed. On average, however, these investments don't swing the needle.

- All other development types are more sensitive, and are more likely to be affected by investment in remediation.

Figure 3. Market value minus development costs (with and without remediation) average per acre of suspect brownfield sites, by development type, Portland Metro Area



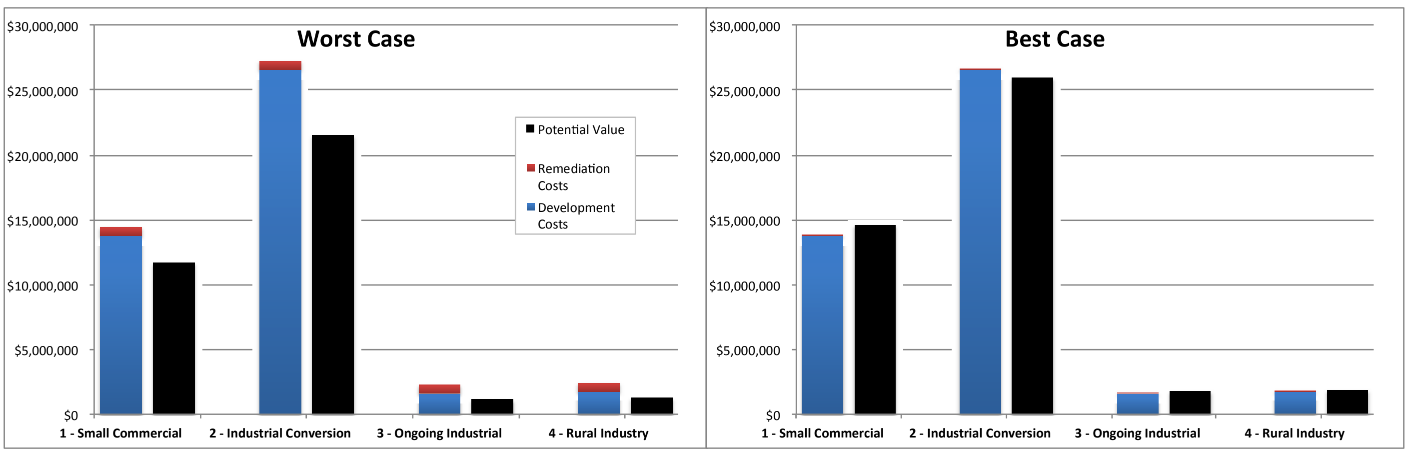
Source: ECONorthwest, 2012.

Figure 4 shows the per-acre development costs, remediation costs, and the potential market value. The left chart shows the worst-case scenario and the right chart shows the best-case scenario.

The blue bar shows the development costs, with the red portion representing remediation costs. The black bar shows the potential market value. The two charts highlight some factors that affect how important remediation costs are to development and how those costs can vary.

- In Types 1 and 2, remediation costs make up a small portion of total development costs, even if the remediation costs are at the high end of the cost spectrum (worst case). Dense building prototypes dominate Types 1 and 2, leading to high per-acre development costs. If remediation costs are at the low end of the cost spectrum, the account for a very small portion of overall costs.
- In Types 3 and 4, remediation costs can make up a large portion of overall costs. If the remediation costs are high and market rents are low, the cost of remediation equals about one-third of all development costs. If, however, remediation costs fall at the low end of the cost spectrum and market rents are high, remediation costs are a small portion of total development costs.

Figure 4. Per-acre costs and potential development value, suspect brownfield sites, by brownfield typology, Portland Metro Area



Source: ECONorthwest, 2012.

4 RESULTS: SOCIAL AND ECONOMIC INDICATORS

Note: All research in this section of the report was completed by Redevelopment Economics, in collaboration with Maul Foster Alongi and ECONorthwest.

Brownfield remediation and redevelopment can create a wide range of environmental and social benefits to the Metro area beyond the fiscal and other benefits discussed in earlier sections of this memorandum. To begin to consider some of the additional benefits that may also accrue to the region as a result of a targeted brownfield remediation strategy, this analysis reviews national research that estimated these indirect environmental benefits, and applies them to the Portland Metro area:

- Lowered vehicle miles traveled (VMT) and lowered greenhouse gases due to locating economic activity in existing communities

- Conservation of rural lands and opens space accommodating growth within the envelope of developed areas
- Reduced infrastructure costs that may have been required to accommodate alternative development
- Reduced runoff and improved water quality because of greater density than alternative development patterns
- Proximity of brownfields to disadvantaged populations

The report presents order of magnitude estimates for each of these measures; national statistics have been adjusted when possible to account for Oregon's unique growth management framework, but more specific and rigorous research that is specific to Portland would be required to fully understand the magnitude of environmental outcomes that might be associated with brownfield redevelopment in the Metro area. Nonetheless, the analysis here is a helpful starting place for a conversation around environmental and social justice effects.

4.1 Automobile Greenhouse Gas Emissions

A recent US EPA study found that, on average, VMT and carbon dioxide (CO_2) emissions associated with brownfield redevelopment projects are 32% – 57% lower than typical greenfield, suburban development patterns.[9] The finding is reflective of national research that correlates VMT and CO_2 reduction with urban densities, mixed uses, access to job centers, street connectivity, and access to transit.

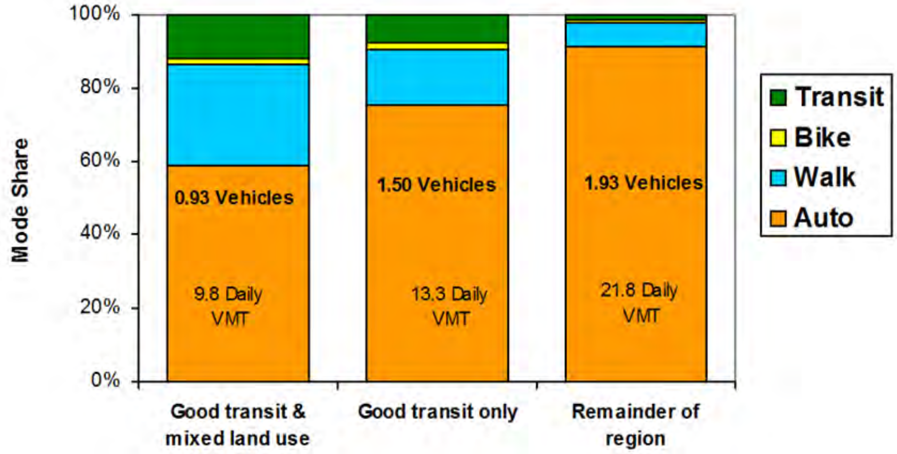
Research focused on the Portland metropolitan area (not specific to brownfields) supports this, finding that development sites with good access to mass transit and a mix of use types result in approximately 50% lower VMT and CO_2 than areas that rank low for those same two factors (See Figure 5).[10]

---

[9] US Environmental Protection Agency, Air and Water Quality Impacts of Brownfields Redevelopment, September, 2011.

[10] Todd Litman, "Can Smart Growth Policies Conserve Energy and Reduce Emissions?" Victoria Transport Project, *Center for Real Estate Quarterly Journal*, May 2011. Available here: www.vtpi.org/REQJ.pdf.

Figure 5. Transit Oriented Development Impacts on Per Capita Vehicle Ownership and Vehicle Miles Traveled



Source: Litman 2011.

As with the other social and environmental indicators discussed in this memorandum, more specific research would be necessary to determine this research transfers to brownfield redevelopment in the Metro area; nonetheless, it does provide a starting point for quantifying the effect on CO_2.

Because the Portland metropolitan area has stronger growth controls than is typical across the country, Redevelopment Economics applied the lower end of the EPA estimates were used to estimate the potential VMT and CO_2 reductions related to redevelopment of brownfields (32% reduction). Though the factors affecting VMT are somewhat different than in other regions in the country, for the purposes of an order of magnitude estimate, this analysis assumes that redevelopment of the Portland brownfields inventory has the potential to produce an industrial development pattern that will reduce VMTs and CO_2 by the same percentage: 32% reduction relative to alternative development areas.

Applying these research findings to the inventory of potential brownfield sites in the Metro area suggests that redevelopment of 100% of the sites would reduce CO_2 to remove the equivalent of taking about 30,000 cars off the road.

4.2 Protection of Rural Land and Open Space

As with other types of infill development, redevelopment of brownfield properties reduces pressure to build on undeveloped "greenfield" land, including open spaces and productive farmland in the urban and rural reserves that surround the Portland Metro area. One national study estimated that one acre of redeveloped brownfield property absorbs growth that would otherwise consume 4.5 acres of undeveloped land.[11] This comparison is driven largely by the higher density that urban infill development projects can achieve. Generalizing this national finding to the Metro inventory of 6,288 acres of potential brownfields would result in "saving" a maximum of 28,000 acres of open space and rural land.

This estimate, based on national figures, probably overstates the potential benefit in the Portland metro area given the requirement to maintain industrial uses in the industrial/employment sanctuaries, and the fact that development on the urban fringe of the Portland metro area often occurs at a higher density than it does at the fringes of other regions across the country. Nonetheless, these estimates do underscore the very real potential for brownfield redevelopment to reduce the development pressure on the urban fringe.

4.3 Infrastructure Cost Savings

Redevelopment of brownfields typically allows development to connect to existing infrastructure rather than requiring construction of new or expansion of existing roads, water, and sewer lines. When existing infrastructure has excess capacity, infill and redevelopment can allow local governments to take advantage of this excess capacity and reduce the need to build new infrastructure.

Redevelopment Economics cites two national research findings have quantified this connection between infrastructure costs and infill development, and can serve to create a basis for estimating infrastructure savings attributable to brownfields redevelopment in the Portland area.[12] One study by the Center for Neighborhood Technology estimates the differential between greenfield and infill development at five to one or $49,000 per dwelling unity (in 2012 dollars).[13] Another estimates a more modest 45 to 50 percent savings, or $31,500 per dwelling unit (assuming 15-dwelling units per acre for infill development and 3 to 5 units per acre for greenfield development).[14]

[11] George Washington University, "Public Policies and Private Decisions Affecting the Redevelopment of Brownfields: An Analysis of Critical Factors, Relative Weights and Areal Differentials," 2001, http://www.gwu.edu/~eem/Brownfields/

[12] For a more comprehensive analysis of the research on infrastructure costs within the brownfields vs. greenfields construct see: Evans Paull, "Infrastructure Costs, Brownfields vs. Greenfields," Excerpt, "Analysis of the Economic, Fiscal, And Environmental Impacts of the Massachusetts Brownfields Tax Credit Program," Redevelopment Economics, June, 2012. See: http://redevelopmenteconomics.com/yahoo_site_admin/assets/docs/Infrastructure_Costs_-_brownfields-greenfields_final2.213114938.pdf

[13] Scott Bernstein, "Using the Hidden Assets of America's Communities and Regions to Ensure Sustainable Communities." Center for Neighborhood Technology, 2003, http://www.cnt.org/hidden-assets/pt1f.html

14 James Frank, "The Costs of Alternative Development Patterns: A Review of Literature." Washington, DC. Urban Land Institute. 1989.

National research on this topic cannot easily be applied to any particular specific site, or even to a specific region, without at least acknowledging some of the site-specific and local characteristics that could result in different outcomes:

- It is important to note that the location of the redevelopment and increased density and site characteristics can greatly affect these outcomes. Infill and redevelopment is only helpful as an infrastructure cost savings mechanism if it is located such that it doesn't trigger major new systems (a new sewage treatment plant, or a new arterial or highway to accommodate additional density, for example). In some locations, infill development may actually be more costly than greenfield redevelopment from an infrastructure perspective.

- Life cycle costs of infrastructure are rarely considered in analyses of this type. In some cases, building new infrastructure with newer and more sustainable technologies may be less expensive, when ongoing maintenance and operations costs are also accounted for, than the ongoing maintenance and upgrading of existing infrastructure over time.

- Growth management policies can also affect the outcome. In the Portland Metro area, there is very little development of any significant density outside of UGBs. This has resulted in a situation where urban "greenfield" development on the fringe and in UGB expansion areas (such as Damascus and North Bethany) is extremely expensive because all of the backbone infrastructure (water, sewer, and transportation arterials) has to be provided to support development. In metro areas with less strict growth management controls, some of this backbone infrastructure may be available to greenfield development, reducing the cost savings relative to infill development.

Collectively, it is difficult to determine which direction these caveats might push Metro area cost savings relative to national norms. However, to begin to consider what infrastructure cost savings might be realized, this research applies the more conservative estimate of 50% savings to the Metro area, and finds that redevelopment of the full inventory of potential brownfields in Metro could save a maximum of $480 million in public infrastructure investment that would have otherwise been required to accommodate growth on greenfields.

4.4 STORM WATER MANAGEMENT AND WATER QUALITY

Studies have also found that dense urban development can result in less storm water runoff than comparable scale of suburban development. EPA studies indicate that brownfields and similarly dense redevelopment projects have been found to reduce run-off by 47 to 62 percent relative to sprawl development patterns.[15] Given the allowed

[15] US EPA, ibid.

densities in the Metro area, it can be assumed that redevelopment of brownfields in the City can reduce stormwater impacts by a similar range.

4.5 Social indicators

The benefit associated with cleanup and redevelopment of Brownfields includes the protection of present and future public health, safety, and welfare. Oregon rules require consideration of existing and reasonably likely human health impact as a result of exposure to hazardous substances at these sites. Cleaning up properties to levels that are considered protective of human health results in remedies that ensure that individual's health are not adversely affected, or that populations are not exposed to hazardous substances that could result in an increased risk of serious degenerative illness.

Geospatial analysis of the existing DEQ sites database has shown that the location of brownfield sites appears to be strongly correlated with communities designated as underserved by Metro's Equity Composite, an analysis which highlights areas that simultaneously have a high underserved population (non-white, elderly, low-income, non-English speaking, youth), a low density of essential services (food, essential retail, health, civic, financial/legal), and low proximity to non-auto transportation (conducted originally for the Regional Flexible Funding Allocation). There is no documented nexus between brownfields and underserved populations; however, the risk to human health presented by environmental contamination can clearly be seen as an additional challenge faced by underserved communities in the region.

4.6 Ecological Health

Approximately 50 percent of the DEQ sites are in, or within 1,000 feet of, sensitive environmental areas, such as wetlands and streams, as designated by Title 3 and Title 13 of the region's Urban Growth Management Functional Plan. Brownfield redevelopment may be of particular benefit to the environment for properties that are situated near areas of high ecological value (e.g., estuaries, rivers, and wetlands). The remediation of environmental contamination on brownfield properties can help protect from adverse impacts to ecological receptors, including threatened or endangered species, as a result of exposure to hazardous substances.

5 Key findings

- Overall and on average, the analysis showed that the majority of sites cost more to develop *even if remediation costs are not included* than the estimated market value, an indicator that the sites are not likely to redevelop without market intervention. Those development types with the highest development costs (mid-rise mixed use, neighborhood mixed use) are the most strongly affected by overall market conditions.

- For certain parcels however, where market fundamentals are strong but the cost of remediation is high, an investment in reducing or eliminating the cost of remediation could be the variable that affects feasibility and generates redevelopment. The policy challenge will be to identify those parcels where the investment in remediation will make the difference and create the fiscal and redevelopment outcome that is desired.

- While more research would be needed to fully evaluate the magnitude of environmental and social effects associated with redevelopment of brownfields rather than developing on greenfields,