

DEVENS SUSTAINABILITY INDICATORS REPORT

2012

An update of the year 2000 Devens sustainability indicators report evaluating the progress made in each of the seven sustainability areas towards Devens' vision for sustainable development

**Progress
Report
2000-2012**

DEVENS SUSTAINABILITY INDICATORS REPORT 2000-2012 Progress Report¹

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Executive Summary

This report summarizes the results from an update of Devens sustainability indicators and evaluates the progress made since 2000 in each of the seven sustainability areas - economy, social sustainability, governance, public health, transportation, natural resources, and environmental quality. Devens' vision for sustainable development is defined as "thoughtful and careful redevelopment of the base for the purpose of promoting economic development, social welfare, environmental protection, and natural resources" (Vanasse Brustlin 1994).

The initial Sustainable Indicators Report in 2000 identified two major issues that the Commission has focused on addressing over the past twelve years.

1. Lack of public transportation and alternatives to single occupancy passenger vehicles to commute to and from Devens. Addressing this issue led to the development of the Fitchburg Line Working Group, chaired by DEC Director Peter Lowitt, and subsequent \$200 million investment in commuter rail to enable a viable reverse commute.
2. Lack of "green" buildings was also identified as an issue and lead to the Commission adopting a Green Building Incentive Program and various regulatory changes to encourage the deployment of "green" buildings within the Devens Regional Enterprise Zone (DREZ).

Updating of the sustainability indicators from 2000 included a review of various Devens reports, goals, initiatives, and data, and the collection of additional information with the assistance of the Devens Enterprise Commission, MassDevelopment, and the Devens Eco-Efficiency Center (DEEC). Each of the original indicators was evaluated using ten criteria for effective sustainability indicators and considering the unique local circumstances. While no indicator was expected to meet all ten criteria, the goal was to identify indicators that are less effective today in evaluating Devens' progress toward sustainability and replace these with new indicators that better align with the aforementioned seven sustainability issue areas.

As result of this process, the following **six indicators were dropped** from the original list of 20 sustainability indicators:

1. "productivity/company revenue per employee";
2. "percent of mothers with adequate prenatal care";
3. "total chronic diseases related deaths per 100,000 population";
4. "road conditions-level of service";
5. "open space and recreation plan in place"; and
6. "total solid waste per capita."

Thirty new indicators are proposed to get a better means of measuring progress in each of the seven sustainability issue areas. The **updated list of 43 indicators** with data for 2000 and 2010² is included in Table 1 and discussed in detail in Section 4. Data for each of the 43 indicators were collected and analyzed during the period May-October 2012.

² The most recent data available were used to update the indicators, which varies from 2008 to 2012.

The report is organized as follows: **Section 1** briefly introduces the concept of a sustainable community and the role of indicators as a key tool for measuring progress. **Section 2** discusses the vision for sustainable redevelopment of Devens, the process since the establishment of the Devens Regional Enterprise Zone in 1993, and the efforts to redevelop it with sustainability principles. **Section 3** outlines the process of evaluating and updating the set of sustainability indicators in May-October 2012. **Section 4** provides detailed information and data for each indicator included in the revised list of 43 indicators, as well as the reasons for inclusion; the related goal or threshold; whether progress has been made since 2000; and recommendations for future use. **Section 5** includes overall recommendations for improving the process for measuring sustainability in Devens as well as specific suggestions about considering new indicators and dropping existing ones based on this evaluation and the results of a survey conducted in early 2013. **Section 6** provides a conclusion and some recommendations for the next sustainability indicator review.

Results from this process of updating the indicators demonstrate that overall Devens has made significant progress in most areas since 2000. Of the 43 indicators used in 2012, twenty-nine demonstrate progress (“Yes”), seven show lack of progress (“No”), six point to a potential progress (“Min.”), and for one no information is available to evaluate progress (TBD). **Most progress** has been made in the following areas:

- The number of organizations based in Devens increased from 60 to 95;
- Since its launch in 2008, the Devens Eco-Efficiency Center has attracted 37% of local organizations to its events promoting business sustainability;
- The number of people participating in community events increased from 120,000 to 300,000;
- All 324 CERCLA sites have been cleaned up and all known USTs removed;
- The total linear feet of sidewalks has increased significantly doubled from 40,673 to 65,482, representing 57% of the Devens roads in 2012;
- The total linear miles of trails has also more than doubled from 5.44 miles to 12.46 miles;
- The percentage of commuters using alternatives to driving has increased from 4% to 10%;
- Freight rail available to local businesses increased from 8,000 linear feet to 14,300 linear feet;
- Water consumption as percent of available supply dropped to 16.7% as result of developing new water sources;
- Percent of sustainable/high performance (“green”) buildings increased significantly and in 2012 represented 14% of the total square footage of all occupied space (no “green” buildings existed in 2000).

Neutral or negative progress was registered for the following new indicators added in 2012: “linear miles of bike lanes,” “OSHA reported days away from work,” “Toxics Release Inventory emissions,” and “Total Chemical Use per square footage of occupied space used.” Measuring Devens unemployment rate was found to be an ineffective indicator due to the town demographics. Instead, two alternative measures were used – the first one tracking the average unemployment rate in the four hosting communities (Ayer, Harvard, Lancaster and Shirley), and the second - the average unemployment rate

in the 24 Massachusetts communities impacted by the closure of Fort Devens (see Appendix H for detailed information). Results demonstrate that while both these measures were below the Massachusetts average of 4.7% in 2000, in 2010 they exceeded the state average unemployment rate of 7.4% (the average unemployment rate for the four hosting towns was 7.9% and for the 24 Massachusetts communities – 8.2%).

Some of the **main recommendations** for improving the process for measuring sustainability in Devens in the future include:

- Create a separate issue area for measuring business sustainability or include under the economy (e.g., economic and business sustainability);
- Increase the number of indicators from 20 to about 35-40 to evaluate progress in each of the seven core issue areas more finely;
- For each issue area and indicator used, include specific goals, targets, or thresholds to increase the process effectiveness and accountability;
- For each indicator used include the source of information to promote transparency, data verification, and easy updating;
- Consider tracking the following new indicators for which no data is currently available but can be gathered in the future: “total linear feet of bike lanes,” “landfill diversion,” and “public health status”;
- Consider measuring sustainability in Devens every five years.

As part of the process to solicit input into the draft report and finalize proposed goals and indicators, DEC staff met with Devens businesses at the September 12, 2012 Devens Business Breakfast, and with the public as part of the October 11, 2012 annual MassDevelopment Board of Directors meeting. In early 2013, the DEC conducted a survey to obtain additional feedback from Devens organizations. The survey was followed by face to face meetings and provided valuable insight and direction in evaluating the indicators against the current sustainability programs and services of MassDevelopment, the DEC and the Devens Eco-Efficiency Center.

With its development as an eco-industrial park, ability to attract a variety of organizations, and the adoption of integrated policies to promote sustainability, Devens is ideally positioned to address some emerging issues such as:

- Resource scarcity and increasing focus on reuse, remanufacturing, and extending products’ useful life;
- Decoupling consumption from growth (dematerialization or offering services versus selling products);
- Focus on worker health, public health, and disease prevention; and
- Focus on building a more resilient and self-sufficient community to withstand climate disruptions and global/national economic downturns.

Overall, significant progress has been made in the redevelopment of DREZ in accordance with the established sustainability vision and goals. The next indicator update (ideally in five years) should not only evaluate progress made in each of the issue areas and indicators but also consider including issues and questions that reflect changing sustainability constraints and priorities.

1. Introduction: Defining and measuring community sustainability

Since first introduced by The Brundtland Commission in 1987, the movement toward sustainable development has expanded dramatically. Defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED 1987), the concept has been embraced by governments, communities, and companies as environmental, social, and economic pressures have become even greater. Since 1990, hundreds of sustainable communities’ projects have been initiated in cities, counties, and regions across the United States.³ Collectively termed the sustainable communities movement, these efforts share much in common with a number of other “community movements” including green communities, healthy communities, and quality of life. According to the Institute for Sustainable Communities, *“a sustainable community is one that is economically, environmentally, and socially healthy and resilient. It meets challenges through integrated solutions rather than through fragmented approaches that meet one of those goals at the expense of the others. And it takes a long-term perspective—one that’s focused on both the present and future, well beyond the next budget or election cycle”* (ISC 2012).

One of the first and most widely used tools to guide and evaluate progress in sustainable community development was sustainable community indicators. Indicators have been used for centuries to evaluate physical, biological, or economic systems, but sustainability indicators grew out of the ecological indicators applied to evaluate stress on the ecosystems and overall ecosystem health. According to EPA, an ecological indicator is defined as “a measure, an index of measures, or a model that characterizes an ecosystem or one of its critical components.” An indicator may reflect biological, chemical, or physical attributes of ecological condition. Examples of ecological indicators include chemical emissions, biological oxygen demand (BOD), acidification, and eutrophication, among others. The primary purpose of such indicators is to characterize ecosystem status and track or predict significant changes (EPA 2000).

Similarly, sustainable community indicators enable policy makers and other stakeholders to understand the health of a community and thus make better decisions, adopt relevant policies, and launch initiatives. These indicators also enable communities to measure progress toward their sustainability visions and goals and thus promote greater transparency, accountability, and shared responsibility. By measuring specific phenomena in the community, such as waste recycling rates, water quality, vehicle miles traveled, acres of parkland, and voter turnout, indicators provide critical information about current trends and conditions and help track progress toward community goals. Indicators are also valuable because the process of developing them generates community consensus about what is important and engages community members in working toward shared goals. Three of the best resources on community sustainability indicators are Sustainable Measures, the Partnership for Sustainable Communities (PSC) and the EPA.

³ For a list of some of the best known U.S. community sustainability indicator projects, see www.sustainablemeasures.com

The PSC, a collaboration among Housing and Urban Development (HUD), the Department of Transportation, and the Environmental Protection Agency (EPA), undertook a study in 2010 to review and evaluate existing indicators to develop a core set of indicators for widespread use by U.S. cities and regions (HUD, 2011). The EPA's Green Communities Assistance Kit provides valuable information about the different indicator frameworks; specific examples of indicators and guidance on how to select the best ones; and use and report sustainability indicators (EPA 2012).

Each community needs to create its own vision and goals and then select specific indicators to measure progress and guide decision-making. While there are some common indicators such as water consumption, waste generated, and unemployment rate, many indicators will be community-specific. To be meaningful and actionable, indicator systems should include a manageable number of indicators that are clear and simple; scientifically sound and verifiable; relevant; doable; and time-related (Penn Institute for Urban Research 2011). Every community needs to decide what the right number of indicators is to evaluate progress toward sustainability vision and goals. The greater the number of indicators, the more comprehensive the evaluation will be; too many indicators can be, however, time-consuming and costly to track. While having 20-25 indicators is considered ideal for annual reporting (Penn Institute for Urban Research 2011), many communities have used a larger number of indicators (e.g., Hamilton, Oregon Benchmarks). The latter is even more relevant when indicators are updated less frequently.

2. Sustainability: Vision and process for implementing sustainability indicators

Devens is a regional enterprise zone created by the Massachusetts legislature in 1993 to aid the redevelopment of the former Fort Devens. First created in 1917 by the U.S. Congress and the Department of the Army as a military base, Fort Devens consisted of predominantly rural lands from the adjacent Towns of Ayer, Shirley, Harvard, and Lancaster. When the closure of Fort Devens was announced in 1991, a local and regional movement toward base reuse planning was initiated. A Joint Boards of Selectmen from the four surrounding towns was formed to identify reuse opportunities and priorities. The Massachusetts legislature adopted Chapter 498 of the Acts of 1993, which created the Devens Enterprise Commission (DEC) to take regulatory and permit-granting responsibilities for Devens, which today comprises lands that originally came from Ayer, Shirley, and Harvard. MassDevelopment, a quasi-state agency, retains the infrastructure, police, fire, and public works responsibilities of Devens (Devens Sustainability Indicator Report 2000).

The 1993 Fort Devens Charrette and the Devens Reuse Plan began the process of establishing the vision and goals for Devens redevelopment. Among the fundamental principles of Devens' redevelopment was sustainability. Through an open and inclusive process, key stakeholders identified the following goals:

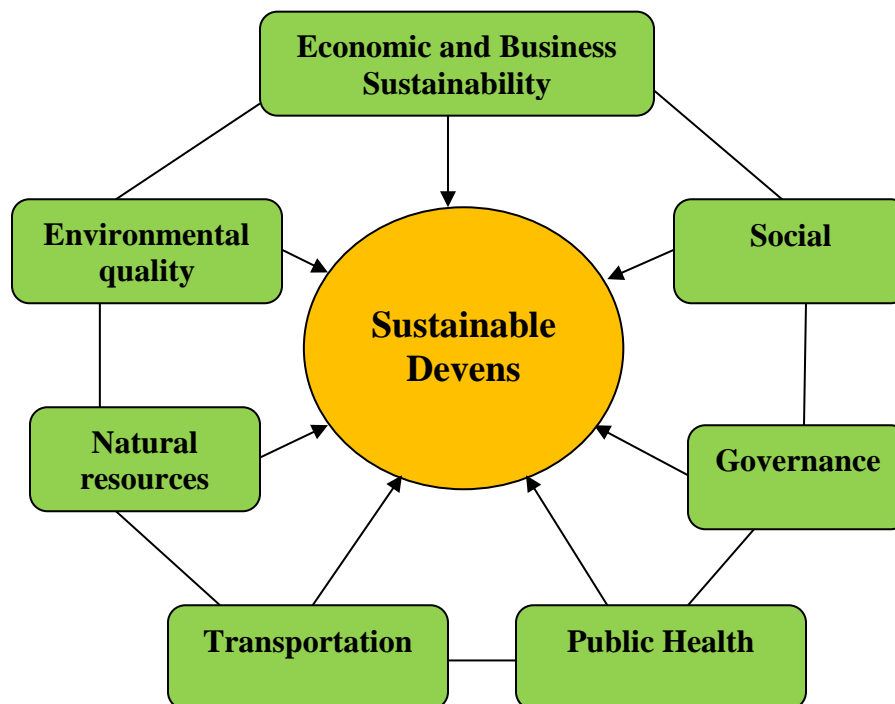
- Preserve and protect the region's natural resources and systems

- Maintain the integrity of the land as a single planning unit
- Increase the regional economic base by employing the principles of industrial ecology
- Use the existing built environment
- Encourage mixed use and diversity
- Think holistically.

The Devens Reuse Plan defined sustainability at Devens as “development which achieves a balance of economic, social and environmental needs, while maintaining and enhancing the natural resource base” (Vanasse Brustlin 1994). The Devens By-Laws, written in 1994, built upon sustainability goals and objectives established in the Reuse Plan through zoning, density, and groundwater resources, historic district, watercourse, and wetland protection. The result of this early planning was a **vision** for what sustainability means to Devens, its residents, users and the involved public bodies: *“the thoughtful and careful redevelopment of the base for the purpose of promoting economic development, social welfare, environmental protection, and natural resources”* (Devens Sustainability Indicator Report, 2000).

In 2000 after reviewing existing indicator sets and criteria, and incorporating public input and suggestions, a set of sustainability issues and indicators for Devens was developed. Seven core sustainability issues were identified, and specific questions and indicators were formulated to guide their evaluation. The seven issues are economic, social, governance, public health, transportation, natural resources, and environmental quality (see Figure 1). (More detailed information about the process of visioning and indicator development can be found in “Devens Sustainability Indicator Report, Progress Report, March 2000” available online at: <http://www.devensec.com/sustainreport.html>).

Figure 1. Sustainable Devens: Framework and Seven Key Issues



3. Sustainable Indicators Review Process 2012

This report evaluates the progress made at Devens since 2000 in each of the seven sustainability issue areas and related indicators, and provides specific recommendations for what to measure in the future. This analysis is summarized in Table 1 and presented in a greater detail in the next section. After a review of Devens reports, goals, initiatives, data, and conversations with representatives from Devens Enterprise Commission, MassDevelopment, and the Devens Eco-Efficiency Center, each of the 20 sustainability indicators from 2000 was evaluated using the following ten criteria for an effective indicator (Swisher et. al. 2009; Sustainable Measures 2010):

- The indicator *reveals links between the economy, society and the environment*.
- The indicator *addresses the carrying capacity* of the community's natural resources and acknowledges ecological limits.
- The indicator *provides a long-term view of the community*, looking forward 25 or 50 years rather than 5 or 10.
- The indicator is *sensitive and adaptable* to changing circumstances and conditions such as the changing mix of businesses and other organizations in Devens.
- The indicator is *clear, simple and unambiguous*.
- The indicator is *reliable*, providing accurate data and measuring what the community wants to measure.
- The indicator *demonstrates how individuals and organizations contribute* to the overall picture of sustainability.
- The indicator allows Devens to recognize *how local sustainability is tied to and dependent on regional and global sustainability*, and vice versa.
- The indicator is *measurable*, or based on accessible data which is either available or can be gathered.
- The indicator is *cost effective* – obtaining the data is relatively easy and inexpensive.

While no single indicator is expected to meet all above criteria, the goal was to identify indicators that are less effective today in evaluating Devens progress toward sustainability and replace them with new ones that better align the aforementioned seven sustainability issue areas. As result of the evaluation, **the following six indicators were dropped** from the list of sustainability indicators from the 2000 report - “productivity/company revenue per employee,” “percent of mothers with adequate prenatal care,” “total chronic diseases related deaths per 100,000 population,” “road conditions-level of service,” “open space and recreation plan in place,” and “total solid waste per capita.”

Upon analysis of data collected from the previous indicators and researching current sustainability indicators, 30 new indicators are proposed to better measure progress in each of the seven sustainability issue areas. The updated list of indicators with data for 2000 and 2010 is included in Table 1. The next section of this report provides detailed information on each of these indicators, such as the reason for including, the goal or

threshold related to it, actual data for 2000 and 2012, indication whether progress has been made since 2000, and recommendations for future use.

As part of the process to solicit input on this report, DEC staff met with Devens businesses at the September 12, 2012 Devens Business Breakfast, and with the public as part of the October 11, 2012 annual MassDevelopment Board of Directors meeting at Devens. In early 2013, the DEC conducted a survey to obtain additional feedback from Devens organizations. The survey was followed by face to face meetings and provided valuable insight and direction in evaluating the indicators against the current sustainability programs and services of MassDevelopment, the DEC and the Devens Eco-Efficiency Center. All obtained feedback has been incorporated in the present report.







4. Progress since 2000

When using indicators to evaluate progress, a community must establish a clear vision, goals, targets, and thresholds. While some thresholds were included in the 2000 Progress report, no explicit goals were listed, which makes evaluating progress more challenging. To address this issue, the present report and indicator table (see Table 1) include specific goals and thresholds under each of the seven issue areas. These goals and thresholds are derived from Devens ReUse Plan and other Devens policies and commitments.









Another change involves adding a column with the source of information in the indicator table (see Table 1), which promotes transparency, accountability, and easier updating of the indicators. While the total number of indicators has increased from 20 to 43, this change allows for more comprehensive evaluation of the progress made in each of the seven sustainability issue areas. Having a larger number of indicators is not a major concern if these will be updated once every 5 or 10 years and good system is put in place for cost-effective data collection.

To evaluate progress, data for each of the 43 indicators were collected for both 2000 and 2010 (or the most recent data available), and analyzed. Results demonstrate that overall Devens has made significant progress in most areas. Of the 43 indicators used in 2012, twenty-nine (67%) demonstrate progress (“Yes”), seven (16%) show neutral or no progress (“No”), six (14%) point to potential progress (“Min.”), and for one (3%) no information was available to evaluate progress (TBD), as presented in the indicator table (see Table 1). The rest of this section provides a detailed assessment of each sustainability issue area and the progress made based on the indicators measured.





**TABLE 1
DEVENS: SUSTAINABILITY INDICATORS**

Issues	Goal or Threshold	Indicators	2000 Data	Current Data	Progress made?	Comments/Source of Information
Economic and Business Sustainability						
1. Is the economy healthy?	Attract and retain companies/organizations to Devens within the carrying capacity	1A. Number of companies & non-profit organizations	60	95		Source: Mark Sternman, 2012 Donahue Institute Study. Total of 95 includes 65 businesses, 19 nonprofits, and 11 government entities.
	Maintain unemployment rate below the MA average	1B. Unemployment rate compared to MA average 1B.1 – average for 4 neighboring towns (Ayer, Harvard, Lancaster, Shirley) 1B.2 –average for 24 MA communities designated as impact region	1B.1 - 2.3% vs. 4.6% in MA 1B.2 – 2.5% vs. 4.6% in MA	1B.1 – 7.9% vs. 7.4% in MA 1B.2 – 8.2% vs. 7.4% in MA		Source: Mark Sternman from MD; 2010 U.S. Census, MA average: 7.4%; http://factfinder2.census.gov/aces/tables/services/jsf/pages/productview.xhtml?pid=ACS_10_5YR_S2301&prodType=table
	Increase the number of jobs in Devens	1C. Number of jobs/employees	NA	3,208		Source: Edmund Starzec, MassDev, 2012 Donahue Institute study (data for 2010)
	Increase the number of high paying jobs	1D. Annual mean wage vs. MA average	NA	\$68,794 vs. MA average of \$57,799		Source: 2012 Donahue Study (2010 data); 2011 BLS http://www.bls.gov/oes/current/oes_ma.htm#00-0000
Are Devens organizations embracing sustainability?	Increase participation in the Devens Eco-Efficiency Center (DEEC) events	1E. Percent of Devens organizations participating in the Eco-Efficiency Center events	0	37%		Source: Dona Neely, DEEC; 35 organizations out of 95 (note: DEEC has had interaction with 80% of Devens businesses)
	Increase the % of firms that purchase together, share equipment, personnel	1F. Percent of firms that purchase together, share equipment or personnel	36%	86%		Percentage of respondents that currently partner with other organizations in Devens and surrounding region. Source: 2013 Business Sustainability Practices and Indicators Survey









DEVENS: SUSTAINABILITY INDICATORS continued...

Social						
2. Is the community healthy socially?	Increase number of arts, cultural events and performances at public sites	2A. Number of arts, cultural events or performances at public sites	3	89+		Source: Maura Peeler, 2011 salesdevens@truenorthhotels.com , and Social & Community Events Appendix.
	Increase the number of recreational events available to public	2B. Number of public recreational events	75	34		Source: 2011 data from MassDevelopment Public Works, Kate Walsh, KWalsh@Massdevelopment.com
	Increase participation in community events	2C. Number of people participating in community events	~120,000	~300,000		Source: 2011 Annual Report Devens (brochure), Peter Lowitt
	Achieve at least 25% affordable housing	2D. Percent of affordable housing (households earning 80% or less of median income per HUD)	100% (20 units)	40% (50 units)		Source: Peter Lowitt, in 2012 there were 50 affordable units out of 126 total housing units
Governance						
3. Is the government responsive?	Maintain high gov't responsiveness to citizens & business	3A. Public perception of gov't responsiveness via public survey	NA	66% rated very Responsive	TBD	Source: 2013 Business Sustainability Practices and Indicators Survey
	Offer expedited permitting process in less than 75 days	3B. Average time to obtain a permit	50 days	46 days		Source: 2011 Devens Annual Report (brochure); Neil Angus
	Promote high level of transparency and engagement	3C. Number of annual meetings with citizens and businesses	NA	25 meetings		Source: Neil Angus; 21 DEC public meetings, 4 meetings with residents' groups, 2011
	Improve communication with companies/citizens	3D. Number of website announcements per year and number of website visitors.	NA	88,701 website visitors		2011 data: J. Lee, N. Angus: DEC website: 38,441 visitors Devens website (MD): 30,997 EcoStar: 19,263
	Clean up all CERCLA sites, USTs and remove Devens from Superfund list	3E. Percent of CERCLA sites which have been cleaned up (\$ investment in cleanup); USTs removed; Devens on Superfund list	NA	100%; Still on Superfund list		Source: Ron Ostrowski Cleaned up all 324 CERCLA sites; pulled up all 200 known UST; Army spent \$170 million

DEVENS: SUSTAINABILITY INDICATORS continued...

Public Health						
4. Are members of the community healthy?	Promote Devens as a walkable community	4A. Total linear feet of sidewalks and % of roads with sidewalks	40,673 linear feet (35%)	65,482 linear feet (57%) in 2012		Source: Neil Angus
		4B. Total linear miles of trails	5.44 miles	12.46 miles		Source: Neil Angus, 16 trails in 2011
	Promote intermodal accessibility and TDM benefits	4C. Total linear miles of bike lanes	0 miles	0 miles		Source: Neil Angus
	Achieve a rate of workplace injuries below US average	4D. OSHA reported Total Case Rate (TCR) of injuries and illnesses for Devens	NA	TCR 2.6 (< national avg. of 3.8);		2009/2010 data from OSHA - http://www.osha.gov/pls/od/eestablishment_search.html
	Achieve total days away from work below US average	4E. OSHA reported Days Away From Work (DAFWII) case rate	NA	DAFWII: 1.97 (> national avg. of 1.9)		2009/2010 data from OSHA - http://www.osha.gov/pls/od/eestablishment_search.html
Transportation						
5. Are adequate transportation facilities available?	Increase % of commuters using alternatives to driving (e.g., transit, biking, walking, working from home or carpooling)	5A. Percentage of commuters using transit, carpool, biking, walking, or working from home	4%	10%		Source: 2010 Devens traffic monitoring report: 90% drive, 6% carpool, 2% bike, 1% transit, 1% walk; MA: 71.9% drive, 9.4% transit, 4.7% walk, 4.2% work from home, 8.2% carpool; Year 2000 survey: 475 drive, 17 carpool, 4-other.
	Increase rail available to citizens and businesses	5B. Total linear feet of rail available to local businesses and residents	8,000 ft	14,300 ft		Source: Neil Angus, 2012 data
	Maintain total vehicle miles (VMT) below threshold of 59,625	5C. Vehicle miles traveled (VMT) total and per 1000 ft ² occupied space	About 13,000 total; 13.9 VMT per 1000 ft ²	33,396 total or 9.1 VMT per 1000 ft ²		Source: 2010 Devens traffic monitoring report

DEVENS: SUSTAINABILITY INDICATORS *continued...*

Natural Resources						
6. Are local natural resources in adequate supply to meet future needs?	Maintain water consumption below the maximum threshold of 4.8 mgd authorized withdrawal by DEP	6A. Water consumption as percent of available supply	100%	16.7%		Source: Jim Moore, MassDevelopment
7. Is biodiversity intact?		7A. Size, shape, and composition of wildlife habitat areas	Large, varied, unbroken, connected	Large, varied, unbroken, connected		Source: Neil Angus, Green Infrastructure Map
	Maintain at least 30% of land as open space	7B. Percent of area permanently protected as open space	24% (1073 acres)	25% (1118 acres)		Source: Neil Angus, 2012 data; additional 460 acres is pending permanent protection
	Reduce percent of impervious surface	7C. Percent of impervious surface	10.3% (454 acres)	10.1% (444 acres)		Source: Neil Angus, see Appendix E
	Adaptive Reuse of Existing Buildings	7D. Total square feet of buildings reused and as % of all former buildings	271,237 ft ² or 18.2%	760,347 ft ² or 51%		2000 and 2012 data by Neil Angus; total available former buildings: 1,490,430 ft ²
8. Is energy consumption excessive?	Reduce energy use per 1000 ft ² occupied space	8A. kWh of electricity consumed per 1000 sq.ft. of occupied space	43,799 MWh total use; 46,672 kWh/1000 ft ²	91,320 MWh total use; 23,028 kWh/1000 ft ²		Source: Data for 2000 and 2008 provided by Jim Moore; Note: Poor indicator-industry specific
		8B. Therms of natural gas consumed per 1000 sq.ft. of developed space	695	7,347		Source: Jim Moore, Devens Utilities
		8C. Percentage use of renewable energy	0%	Less than 0.25%		Source: 2011 data by Jim Moore, Devens Utilities; two small residential solar panels; proposed 3MW solar farm to be built by EBZ Solar






DEVENS: SUSTAINABILITY INDICATORS continued...

Natural Resources continued...

	Reduce energy use in municipal buildings 20% by FY2012 and 35% by FY2020 (baseline FY2004)	8D. Municipal buildings electricity use (in kWh)	NA	1,373,877 kWh		Source: Spreadsheet sent by Peter for 2008; Goal from MA Executive Order 484 (2007) - http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=MA13R&re=1&ee=
		8E. Municipal buildings natural gas use (in therms)	NA	91,939 therms		Source: MDFA Usage Spreadsheet for 2008
	Increase total square footage and percent of certifiable green buildings	8F. Green buildings square footage as % of total occupied space; % of residential & commercial buildings certifiable green	0%	14% (24% of residential and 8% of commercial buildings)		Source: Neil Angus, in 2012 there was 513,672 ft² of green building; total occupied space in 2010: 3,662,758 ft²
Environmental Quality						
9. Is the local environment healthy?	Maintain 100% safe drinking water	9A. Drinking water quality	100% safe, zero violations	100% safe, zero violations		Source: 2010 Report to Consumers on Water Quality
10. Is the regional environment healthy?	Maintain Ranking 1 for watershed quality	10A. Watershed quality index	Ranking 1	Ranking 1		Source: NH Volunteer River Assessment Program NRWA 2012 Field Data Sheet
	Reduce Toxics Release Inventory (TRI) emissions per 1000 ft² of occupied space	10B. Total TRI emissions and TRI emissions per 1000 ft² occupied space	120 lb (0.13 lb per 1000 ft² occupied space)	461,579 lb (126 lb per 1000 ft² occupied space)		Source: 2010 EPA data, http://iaspub.epa.gov/triexplorer/release_chem?p_view=ZPCH&trilib=TRI_Q0&sort=VIEW&sort_fmt=1&state=&city=&spc=&zipcode=01434&zipsrch=yes&chemical=All+chemicals&industry=ALL&year=2010&tab_rpt=1&id=RELLBY&fid=TSFDSP
11. Are wastes reduced, reused or recycled?	Increase the percent of waste that is recycled	11A. Percentage of solid waste recycled	0.03%	56% (year 2004)		Source: Mass Dev; 3,023.7 tons recycled in 2010; 715.26 tons in 2011; DPW 2004 report.

DEVENS: SUSTAINABILITY INDICATORS continued...

Environmental Quality continued...

	Increase amount of solid waste reused	11B. Tons of solid waste reused as result of the Eco-Efficiency Center work	0 tons	60 tons		Source: 2011 data, Dona Neely, Devens Eco-efficiency Center
	Reduce total chemical use per 1,000 ft ² occupied space	11C. Total chemical use (lb) and lb per 1000 ft ² occupied space	10,518 lb total chemical use; 11.2 lb per 1000 ft ² occupied space	6,445,719 lb (1760 lb per 1000 ft ² occupied space)		Source: 2000 and 2009 TURI data, http://turadata.turi.org/report.php?action=report_community_quantity_current_year&community=DEVENS ; will vary by industry mix
	Increase landfill diversion	11D. Landfill diversion (tons diverted and diversion rate as % of all solid waste)	NA	50%		Source: 2013 Business Sustainability Practices and Indicators Survey
	Increase collection of hazardous household waste	11E. Number of days/year of HHW collection; total lbs of HHW collected	NA	20 days		Source: Eco-efficiency Center
	Increase composting	11F. Percent/number of organizations & households which are composting; total lb /tons composted per week/annual	NA	1 company; 900 lb /week		Source: Dona Neely, Eco-efficiency Center; the only organization composting in June 2012 was Hilton's Great American Grill Restaurant

Devens total area: 4,400 acres; Number of residents in 2000 -1,017; in 2010 – 1,840 people (U.S. Census)

Total ft² of commercial/industrial buildings in 2012: 6,200,413 ft²

Total occupied space:

- in 2012 - about 4,000,000 ft²;
- in 2010 - 3,662,758 ft²; in 2008 - 3,965,578 ft²;
- in 2000 - 938,439 ft²

4.1 Economic and business sustainability

Some of Devens' key redevelopment goals included attracting and retaining businesses and other organizations to Devens; promoting business sustainability; and creating employment opportunities and high-paying jobs. These are also goals for any community or region committed to sustainable development and long-term viability. Since 2000 Devens has made significant progress in these areas. Four (4) new indicators have been included in the 2012 study to evaluate sustainable economic progress more accurately: "number of organizations in Devens," "number of jobs/employees," "annual mean wage compared to Massachusetts average," and "percent of Devens organizations participating in the Eco-Efficiency Center Events."

One indicator from the original 2000 Indicator Study, intended to measure **productivity/revenue per employee**, was dropped for two reasons: First, because data showed that productivity varies significantly with the changing variety of local businesses and, second, because an increasing number of studies have demonstrated that this indicator is a poor measure of sustainability and economic progress (Jackson 2012).

While the local economy is closely linked to the U.S. economy and experienced significant contraction during the Great Recession of 2007-2009 in terms of business bankruptcies, relocation, and reduced revenues, overall, progress has been made in all areas except unemployment rate. The economic expansion of Devens over the past 10 years has been achieved without exceeding the Devens' carrying capacity, defined as the total build out area permitted as well as other threshold factors such as water consumption and traffic. A 2012 report by the UMASS Donahue Institute found that in 2010 Devens contributed more than \$1.45 billion to the Massachusetts economy (UMASS Donahue Institute 2012).

The number of organizations located in Devens (Indicator 1A) increased from 60 in year 2000 to 95 in 2012, and presently includes 65 businesses, 19 non-profits, and 11 government entities (UMASS Donahue Institute 2012). Some of the largest businesses attracted since 2000 are Bristol-Myers Squibb, Spring Hill Suites Marriott, Hilton Garden Inn Hotel, Northrup Grumman, American Superconductor, Devens Recycling, and, most recently, Quiet Logistics (for a most current list of organizations see <http://www.devenscommunity.com/business-industry/business-listing>).

The unemployment rate (Indicators 1B.1 and 1B.2) increased as a result of the 2007-2009 recession and in 2010 was 7.9% in the four host towns and 8.2% in the 24 Massachusetts communities, designated as impact region. This is above the 2010 Massachusetts average unemployment rate of 7.4%. This indicator was modified in 2012 to be a more accurate measure of local unemployment. Tracking only unemployment rate in the town of Devens is a poor measure because of the methodology that the U.S. Census employs in counting Devens residents (The Census counts as Devens residents a large number of veterans, those incarcerated at the U.S. Federal Medical Center, previously homeless families now living in Transitions housing, and Shriver residents.)

There were **3,208 jobs in Devens in 2010 (Indicator 1C)** with an **annual mean wage of \$68,794 (Indicator 1D)**, which is above the Massachusetts annual mean wage of \$57,799 (UMASS Donahue Institute 2012) and demonstrates the progress made in attracting high-paying jobs to Devens. When compared to Massachusetts overall, Devens includes much higher concentration of manufacturing (16.8% vs. 3.4%); public administration (9.5% vs. 1.6%); transportation and warehousing (8.4% vs. 2.0%); and educational services (6.3% vs. 1.7%).

A 2013 Survey of Devens businesses found an increase in the **percent of firms that purchase together, share equipment or personnel (Indicator 1F)** from 36% in 2000, to 86% in 2012 (see Appendix I for survey results). A new indicator measuring business collaboration was also introduced as **Percent of Devens organizations participating in the Devens Eco-Efficiency Center events (Indicator 1E)**. Established in 2008 in response to business demands, the Devens Eco-Efficiency Center (DEEC) is a non-profit organization with the mission to “help area businesses and organizations reduce their environmental impacts and operating costs by providing education, enabling collaboration and offering technical assistance” (DEC 2008 Annual Report; DEEC 2012). In 2011, 35 of Devens’ 95 organizations (37%) had participated in DEEC’s events such as educational workshops, business roundtables, and recycling assistance. Many organizations from the neighboring communities have also been involved in the DEEC activities, thus expanding the sustainability collaborations and initiatives regionally.

4.2 Social sustainability

Social sustainability relates to a community’s social well-being and quality of life. While Devens is currently primarily a business community (in 2010 there were 1,840 people living in Devens and 3,208 people working there), a wealth of passive and active recreational open space and a residential population contributes to the region and the overall sustainability of Devens. Devens provides both an attractive place for business as well as a site for recreational events and housing at a variety of price points. Two new indicators in this area have been added to measure social goals more accurately: “the number of people participating in community events” (Indicator 2C) and “the percent of affordable housing” (Indicator 2D).

While limited in its ability to expand housing development and thus the number of people living locally (housing units are capped at 282 units by the Devens Reuse Plan and Bylaws), some progress in advancing the social health of the community has taken place:

- The **number of arts, cultural events and performances (Indicator 2A)** was challenging to compile due to the lack of good system for tracking. While in June 2012 five events were identified for 2011 (about the same number as in 2000), meetings with businesses indicated that this is a significant underestimate. There are a significantly larger number of private and other events organized by the Conference Center, Chamber of Commerce, UNIAC, Devens Museum, Shriver Job Corps, Parker Charter School, music events at the Devens Grille, etc. Overall the number of events has increased as a result of the increasing number of businesses located in Devens.

- **The number of public recreational events (Indicator 2B)** decreased from 75 to 34 in 2012. Part of the reduction can be explained by the opening of the Mass Youth Soccer Association fields in Lunenburg in the intervening time between reports. The data for 2000 remains unverified. On the positive side, since 2000 Devens has become well-known as a center for softball, soccer, and lacrosse games and tournaments.
- An estimated **300,000 people participated in local recreational events** in 2011 (**Indicator 2C**) compared to 120,000 in 2000.

Forty percent of the housing units in 2011 (50 out of 126 units in total) were classified as **affordable (Indicator 2D)**, significantly exceeding Devens' goal of having at least 25% of housing classified as affordable. According to the U.S. Department of Housing and Urban Development, housing is considered affordable if a family earns no more than 80% of the Area Median Income (AMI) (HUD 2012; WatchCDC 2009). (Twelve of the units constructed at Devens are categorized as McKinney Act Housing and do not count toward the Devens housing cap nor as state registered affordable housing).

4.3 Governance

Community governance is usually defined as “the processes for making all the decisions and plans that affect life in the community, whether made by public or private organizations or by citizens” (RTM 2012). Since DEC and MassDevelopment are the two organizations tasked with the responsibility to govern the redevelopment of Devens, this sustainability issue area aims to evaluate how well they are fulfilling this task. An effective community governance model includes three core aspects: a) engaging citizens, b) getting things done, and c) measuring results (RTM 2012). Good governance indicators should measure each of these three core aspects.

One indicator of governance was proposed in year 2000 – “**Public perception of government (DEC and MassDevelopment) responsiveness through a public opinion survey**” (**Indicator 3A**). This is an excellent indicator encompassing all three aspects of effective governance and meeting most of the criteria for an effective indicator listed in the previous section. The 2013 survey results in Appendix I show a high rate of satisfaction with local government responsiveness. Four new indicators were also added to evaluate Devens' governance practices: “average time to obtain a permit,” “number of annual meetings with citizens and businesses,” “number of website announcements per year and number of website hits,” and “percent of CERCLA sites that have been cleaned.”

The **average time to obtain a permit (Indicator 3B)** measures progress toward Devens' goal of offering expedited permitting process in less than 75 days. In both 2000 and 2011, the average time to obtain a permit was well below the established goal – 50 days and 46 days, respectively. In 2007, the Pioneer Institute's Better Government Competition Award recognized the DEC for its expedited permitting process, and in 2006 the DEC received the Environmental Business Council's Nicholas B Humber Award for its collaborative and fast-track permitting of Bristol-Myers Squibb facilities.

The **number of annual meetings with citizens and businesses (Indicator 3C)** measures community engagement and transparency. While no data is available for 2000, the DEC organized 25 meetings in 2011 – 21 of them with the general public (residents and representatives of businesses and organizations) and four with citizens' groups. MassDevelopment, the JBOS, DEAC, and Devens Community groups held another 30 public meetings. DEC Staff, on behalf of the Commission, continue to meet with business and organizational representatives; residents; members of the Devens Homeowners and Condominium Associations; and local and state government officials to ensure open lines of communication and transparency in government.

The DEC's main means of communicating with the public is its website, www.devensec.com, where all meetings and hearing dates are listed; agendas and minutes from meetings are posted; and policies and other initiatives are announced. To improve the measurement of transparency and citizen/business engagement, the following indicator is proposed: **number of website announcements per year and number of website hits (Indicator 3D)**. While no data exists for 2000, in 2011 30,997 people went to the Devenscommunity.com website, operated and maintained by MassDevelopment, which indicates significant interest in the information and local events. MassDevelopment also sends out a weekly email on Devens News and Events.

The Eco-Efficiency Center launched its website in 2008 and registered 19,263 visitors in 2011. The DEC website, www.devensec.com received 38,441 hits on this website. Overall, the three Devens websites received more than 88,000 hits in 2011. The DEC and MassDevelopment jointly paid to install cable TV cameras and audio devices to provide cable coverage to residents of both Devens and the surrounding towns.

To evaluate progress toward cleaning up all contaminated sites in Devens that have contributed to Devens listing as a Superfund site, a new indicator measuring the **percent of CERCLA sites remediated (Indicator 3E)** is included. While no 2000 data are available, as of June 2012 all 324 Army CERCLA sites have been remediated, and the land is presently suitable for re-development. All 200 known underground storage tanks (USTs) originally identified as part of the base closure have been removed to avoid contamination from toxic chemicals leaking in the ground. The Army has spent \$170 million to conduct the cleanup. Despite this great success, Devens is still listed as a Superfund site as other remediation efforts such as groundwater contamination will take many years (possibly decades) to complete.

4.4 Public health

Typical indicators measuring the health of a community population include prevalence of diabetes, heart disease, people with health insurance, and percent of mothers with adequate prenatal care (CHSI 2009). Two metrics were used in 2000 to track the health status of Devens' population – “percent of mothers with adequate prenatal care” and “total chronic disease related deaths per 100,000.” No public health data are, however, collected presently for Devens by the Massachusetts Department of Public Health (the MassCHIP database does not include Devens). In addition, with the adoption of universal health coverage in Massachusetts, the first indicator becomes less relevant. Therefore,

these two indicators were dropped, and five new indicators are proposed with focus on residents and employees health promotion and prevention: “total linear feet of sidewalks and % of roads with sidewalks,” “total linear miles of trails,” “total linear miles of bike lanes,” “OSHA reported Total Case Rate of injuries and illnesses,” and “OSHA reported Days Away from Work case rate.” The Devens survey of local companies conducted in January 2013 collected information on the number of businesses offering walking clubs or other programs to promote employee health and wellness. The number of companies offering such programs was limited. See Section 5.4 for a full review of the 2013 survey results.

Total linear feet of sidewalks and percent of roads with sidewalks (Indicator 4A) evaluates progress toward the goal to develop Devens as a walkable community, which promotes public health by increasing exercise, and reducing traffic and air pollution. Significant progress has been made by increasing the sidewalks from 40,673 linear feet in 2000 (when 35% of roads had sidewalks) to 65,482 linear feet in year 2011 (when 57% of roads had sidewalks). (For a detailed list of sidewalks on private and public ways, please see Appendix A.)

Another indicator promoting health and exercise is the **total linear miles of trails** available to people living and working in Devens (**Indicator 4B**), which shows an increase from 5.44 miles in 2000 to 12.46 miles presently (see the list of 16 trails in Appendix B).

The proposed new indicator measuring **total linear miles of bike lanes (Indicator 4C)** relates to both public health and transportation. While no bike lanes presently exist in Devens, this indicator will in the future help to evaluate intermodal accessibility and TDM benefits for residents and employees.

Two standard indicators that measure the health of people working in Devens are the Occupational Safety and Health Administration (OSHA) reported **Total Case Rate (TCR) of injuries and illnesses (Indicator 4D)** and **Days Away from Work (DAFWII) case rate (Indicator 4E)**. While these two indicators will vary depending on the mix of organizations based in Devens, an overall goal for many companies is to achieve zero workplace-related injuries and illnesses, and lost days from work. No data are available for 2000, but rates for 2009/2010 can be compared to the U.S. average if such a goal is established. The comparison reveals that 2009/2010 TCR for Devens is below the U.S. average (2.6 vs. 3.8 nationally), but DAFWII is above the U.S. average (1.97 vs. 1.9 national average).

4.5 Transportation

Providing adequate transportation facilities and alternatives to driving are critical to building a more sustainable community as these relate to air and water pollution, public health indicators and the preservation of natural resources. In most aspects of transportation, Devens has made significant progress since 2000 via the deployment of double tracks from South Acton to Ayer; the change in commuter rail schedule in December 2009 to allow an early express train from Fitchburg to North Station; the

expansion of parking spaces at the South Acton station along with a shuttle to commuter rail stops; the advancement of the Fitchburg Line Reverse Commute project, scheduled to be completed in early 2013; and the significant expansion of the total linear feet of rail available to local businesses. Two indicators were used in 2000 to evaluate transportation – “road conditions-level of service” and “percentage of commuters using transit.” The first indicator was dropped due to its subjective nature and the fact that no good data exist to measure Devens road conditions. The second one was modified to measure not just the use of transit but also carpool, biking, walking or working from home (all alternatives to driving). Two new indicators are added to evaluate progress in advancing more sustainable transportation options: “total linear feet of rail available to local businesses” and “vehicle miles traveled total and per 1000 ft² of occupied space.”

The percentage of commuters using alternatives to driving such as transit, carpool, biking, walking, or working from home (Indicator 5A) increased from about 4% in 2000 to 10% in 2010. According to the 2010 Devens Traffic Monitoring Report, 90% of people living or working in Devens drive, 6% carpool, 2% bike, 1% use transit, and 1% walk to work. For reference, on average 71.9% of people in Massachusetts drive, 9.4% use transit, 4.7% walk, 4.2% work from home, and 8.2% carpool.

Since 2000, the **total linear feet of freight rail available to local businesses (Indicator 5B)** – has significantly expanded from 8,000 feet to 14,300 feet, which helps reduce driving, cut air pollution, and mitigate climate change impacts (for more information on railroads see Appendix C).

While the overall **vehicle miles traveled (Indicator 5C)** increased from about 13,000 to 33,396 in 2010, even this higher amount falls short of the threshold of 59,625 VMT for Devens, and the distance travelled per 1,000 ft² of occupied space actually decreased from 13.9 to 9.1 VMT per 1,000 ft² (MassDevelopment 2010).

One area where a goal can be established and progress measured going forward is developing designated **bike lanes**. While currently included under Public Health (Indicator 4C), this indicator is also linked to the issue of promoting intermodal accessibility in Devens and is included in the recommendations in Section 5.

4.6 Natural resources

The availability of natural resources increasingly limits development and growth. In order to ensure sustainability, communities need to measure and manage carefully their use of resources like water, land, and energy. While all five indicators from 2000 are kept to evaluate progress, indicators 8A (Total annual MWh of electricity use) and 8B (therms of natural gas consumed) are both poor measures of excessive energy consumption, which varies significantly with the changing mix of Devens businesses. A better measure would look at the electricity and natural gas used by municipal buildings where a state-wide goal exists to reduce use by 20% in FY2012 and by 35% in FY2020, compared to a FY2004 baseline. Six new indicators are proposed to evaluate progress in this area: “percent of area permanently protected as open space,” “percent of impervious surface,” “total square feet of former military buildings reused,” “municipal buildings electricity

use,” “municipal buildings natural gas use,” and “green buildings square footage as percent of total occupied space.”

Overall, good progress has been made in the area of natural resources as described below and presented in Table 1.

As result of developing new sources of water supply, Devens **water consumption (Indicator 6A)** of 800,000 million gallons per day in 2011 was just 16.7% of the authorized withdrawal of 4.8 million gallons per day by the Massachusetts Department of Environmental Protection (DEP).

Devens continued to maintain **large, varied, unbroken, and connected wildlife habitat areas** as illustrated in the Green Infrastructure Map (**Indicator 7A**). A new indicator measuring **percent of area permanently protected as open space (Indicator 7B)** is added to evaluate progress toward the goal of maintaining at least 30% of land as open space. While the goal is not reached yet, progress has been made by increasing the permanently protected space by 1% or 45 acres since 2000 (see Appendix D). An additional 460 acres are pending permanent protection. Another new indicator measuring land and biodiversity preservation is the **percent of impervious surface (Indicator 7C)**, which shows the progress made in reducing the impervious surfaces in Devens from 454 acres to 444 acres between 2000 and 2012 to 10.1% of total area (for more details, see Appendix E).

Related to protecting biodiversity and land from excessive development, the new indicator “**Total square feet of former military buildings reused and as % of all former military buildings**” (**Indicator 7D**) makes sense given the resulting reduced demand for natural resources, energy, and transportation. As shown in Appendix F, significant progress has been made over the past 10 years in increasing the adaptive reuse of former military and other buildings from 271,237 ft² (or 18.2% in 2000) to 760,347 ft² (or 51% in 2012).

Evaluating whether energy consumption is excessive is challenging since Devens is primarily a business community; as a result of the changes in the local business and organizational mix, energy consumption varies significantly from year to year. While the two indicators measuring **total annual electricity and natural gas per 1000 ft² of occupied space** are maintained (**Indicators 8A and 8B**), in the future the only ones that remain should be those that measure municipal energy use, percent of renewable energy used, and “green” buildings (see Section 5).

While in 2011 there were just two houses with solar panels representing less than 0.25% of the **renewable energy portfolio in Devens (Indicator 8C)**, the proposed 3MW solar farm to be installed by Citizens Energy will increase renewable energy generated to about 3%.

No information is available about **municipal buildings electricity and natural gas use** in 2000, but we will track these two indicators (**Indicators 8D and 8E**) to evaluate

progress toward Massachusetts Executive Order 484 (2007) goals for 20% and 35% reduction in energy use in municipal buildings by FY2012 and FY2020, respectively.

“Green” building is a smart strategy for any community or business given the significant bottom-line benefits: an average energy and water savings of about 30% annually; improved employee productivity and reduced healthcare costs; improved property values; and the ability to attract and retain tenants (Watson 2011). Since 2000 Devens has significantly expanded the **percent of residential and commercial buildings certifiable “green” (Indicator 8F)** to 24% and 8%, respectively. In January 2011, two developers received approval to build eight zero-net energy single-family homes off of Cavite and Adams Circle. Some of the larger facilities certifiable as green include Bristol-Myers Squibb LSCC and Lab Office, and the U.S. Army OMS Building. Overall, 14% or 513,672 ft² of the total occupied space in 2011 was certifiable green (for more information see Appendix G).

4.7 Environmental quality

A key goal of the 1994 Devens Reuse Plan entailed redeveloping Devens while improving its environment and cleaning up sites contaminated by the U.S. Army. The main areas measured in 2000 involved water quality and solid waste. The indicator “open space and recreation plan in place” was dropped because such a plan now exists (and the goal has been achieved), and a new indicator measuring open space is introduced in this report (Indicator 7B). Six new indicators are added to evaluate air quality (not measured in 2000) and better examine progress toward reuse, recycling, and composting. The six indicators are: “total Toxic Release Inventory (TRI) emissions and TRI emissions per 1,000 ft² of occupied space,” “tons of solid waste reused,” “total chemical use and pounds per 1,000 ft² of occupied space,” “landfill diversion,” “number of days per year of HHW collection and total pounds collected,” and “percent/number of organizations and households which are composting as well as total pounds/tons composted per week.”

Including indicators to measure waste reduction at the source, reuse, recycling, and composting are critical for an eco-industrial park like Devens. Such indicators have gained in import as available landfill space declines, tipping fees go up, and new mandates require higher diversion rates. Despite the significant achievements in the area of environmental quality, more work remains to be done in the area of waste and emissions reduction where the Devens Eco-Efficiency Center can continue to provide leadership by educating and assisting companies.

Drinking water quality (Indicator 9A) has remained good between 2000 and 2010. There were no violations and 100% of the water is considered safe according to the 2010 Report to the Consumers on Water Quality. The **watershed quality (Indicator 10A)** remained with Ranking 1, another indicator of successful protection of the regional water resources.

No air quality indicator was included in the indicator set in 2000. Using a common indicator such as “number of days with poor air quality” is ineffective since most of

Massachusetts is considered a non-attainment area for ozone and other air pollutants from the Midwest. In seeking an indicator reflecting local contribution to air pollution, **total Toxic Release Inventory (TRI) emissions and TRI emissions per 1,000 ft² of occupied space (Indicator 10B)** is proposed. This indicator will vary with the mix of local businesses while still providing a measure of local air quality.

Measuring only the residential waste generation per capita is not recommended as it is a small part of Devens' total waste – just 26% of all waste in 2004. An alternative measure is the **total waste generated per 1000 ft² of occupied space**, but this is also not a great indicator as total waste will vary with the mix of Devens businesses. Moreover, no recent data exists as Devens organizations use different contractors for waste removal. The latest available data are for 2004 – 11,900 tons of waste were generated from companies and 232 tons from residents. In addition, the initial question related to this issue (“Is waste generation reasonable?”) is subjective and makes judging progress challenging. For all of these reasons, we decided to drop this indicator and replace it with four new indicators listed below (11A, 11B, 11C and 11D) while still recommending the use of a survey to track generated waste to track the proposed new indicators (see Section 5).

No recent data are available to measure the **percent of solid waste that is recycled (Indicator 11A)**. Looking back at 2004 – the last year for which complete data are available – about 56% of the total waste was recycled, significant progress compared to the 0.03% recycled in 2000. This percentage will likely increase due to work done by the Devens Recycling Center since 2007 (see <http://www.devensrecycling.com/>).

A main goal for any eco-industrial park like Devens is to promote **reuse of solid waste** among local businesses (**Indicator 11B**). Such practices not only eliminate the negative environmental and health impacts of obtaining new raw materials but also the adverse impacts from recycling (e.g., energy use, transportation, worker exposures, and air emissions). DEEC has played an instrumental role in advancing such practices - 60 tons of solid waste was reused in 2011 as result of the Great Exchange Program started in 2008. Overall, more than 400 tons of waste has been repurposed between 2008 and 2012.

A new indicator measuring **total chemical use and pounds of chemicals used per 1000 ft²** is proposed (**Indicator 11C**) to measure efforts to reduce waste at the source. Similar to the energy consumption and waste generation, this is not a great measure to evaluate progress due to the changing chemicals' use as result of the changing mix of local businesses or the economy. The indicator does allow the tracking of the impact of the local economy in terms of chemical use and source reduction. According to Toxics Use Reduction Institute data, total chemical use in Devens increased from 10,518 pounds in 2000 with one reporting company, to 6,445,719 pounds in 2009 and five reporting companies. Now bankrupt Evergreen Solar alone reported the use of 6,166,481 pounds, or 96% of all TURA chemicals used in Devens in 2009.

An important indicator to measure going forward is **landfill diversion** or tons diverted and diversion rate as percentage of all solid waste (**Indicator 11D**). This standard and commonly reported metric also serves as a key indicator used by eco-industrial parks

(NISP 2009). The 2013 survey results, provided incomplete data but did show that a number of firms are diverting 50% or more of their waste streams. Obtaining more complete data on solid waste generated, reused, recycled, and composted in future surveys will help improve the accuracy of this important metric.

Some household products such as oil-based paint, rechargeable batteries, cleaning solvents and fluorescent bulbs are potentially dangerous to living things and the environment when disposed of improperly. Offering a convenient way for residents and small businesses to drop off such hazardous products is the key to diverting HHW from the municipal solid waste stream, preventing illegal dumping or spills when stored onsite. With the leadership of the DEEC, the Devens Household Hazardous Products Collection Center was opened in early 2011 to serve residents and small businesses in Devens and neighboring communities (see www.devenshhw.com). To measure progress in this area, a new indicator is proposed – **number of days per year of HHW collection and total pounds of HHW collected (Indicator 11E)**. Measuring only the pounds of HHW collected per year is not sufficient to evaluate progress as with the growth of green products and environmental preferable purchasing HHW collections will decrease.

Finally, an indicator measuring composting practices – **percent and number of organizations and households in Devens that are composting and the total pounds/tons composted per week (Indicator 11F)** – is proposed for two main reasons. First, food waste was the largest amount of material in Devens’ waste stream in 2004 (the latest year for which complete data are available), representing 14% of all waste generated (DPW 2004), thus providing significant opportunities for waste reduction. Hotels, restaurants, schools, and food stores generate even greater quantities of food waste, anywhere between 40% and 80% of total waste (DEEC 2012). Second, legislation under consideration in Massachusetts would establish a waste ban on commercial and institutional food waste by 2014 (Hasek 2012). As of June 2012, one company – Hilton’s Great American Grill Restaurant – was composting about 900 pounds of food waste per week, but more organizations will likely join as pressures to reduce organic waste increase.

5. Recommendations

Most of the recommendations for adding and dropping indicators were presented in the previous section and included in Table 1. This section primarily discusses some overall recommendations for improving the process for measuring sustainability in Devens as well as a few specific suggestions for considering new indicators and dropping existing ones. In addition it discusses the results of the 2013 survey of Devens businesses conducted to supplement the information gathered in this report.

5.1 Overall recommendations

Since promoting business sustainability is such a core element of Devens, it is recommended to **either create a separate issue area for “Business Sustainability” or**

measure sustainable business practices. Indicators 1E and 1F in Table 1 (“Percent of Devens organizations participating in the Eco-Efficiency Center events” and “Percent of firms that purchase together, share equipment or personnel”) already measure such practices. Additional indicators related to the DEEC and EcoStar initiatives could be included, such as percent of companies utilizing environmentally preferable purchasing and percent of EcoStar achievers.

While a smaller set of indicators is easier and can be more cost effective to manage, limiting the indicators will not provide the necessary comprehensive feedback on all key sustainability goals pursued in Devens. Considering that updating the indicators will take place every 5 or 10 years, it is recommended **to keep the number of indicators around 35-40. A larger number of indicators allows for improved analysis and evaluation of progress made in each of the seven core issue areas** (for reference, 20 indicators were used in 2000).

Indicators are only tools and in order to be meaningful and actionable, they must be related to and measure specific goals, targets, or thresholds. Some thresholds were included in the 2000 progress report, but it is recommended to include **specific goals, targets, or thresholds for each issue area and indicators to assess progress.** In fact, developing effective indicator systems should always begin with identifying the main community goals and targets, and then formulating specific indicators to measure progress over time. Table 1 in Section 4 lists some goals and thresholds identified in the research.

In order to promote transparency, data verification and easy updating of the indicators in the future, **providing the source of information for each of the indicators is critical.** Such information is presently listed in the last column of Table 1 (“comments/source of information”) in section 4.

5.2 Improving Future Indicators

The existing 43 indicators serve as effective tools to help guide sustainable policy-making in the future. The following are recommendations for future improvements to some of the indicators that will help maximize their ability to provide useful data to further aid in measuring Devens progress towards sustainable redevelopment:

- **Percent of firms that purchase together, share equipment, or personnel** (Indicator 1F): Future surveys of local businesses should include more direct questions to gauge the level of joint-purchasing and collaboration between businesses.
- **Total linear feet of bike lanes** (Indicator 4C): as outlined in Section 4, this indicator relates to public health, transportation, and Devens’ goal to promote intermodal accessibility and TDM benefits.
- **Public health:** Evaluating the public health status of people who live and work in Devens is challenging as no data are currently available from the Massachusetts Department of Public Health. Yet evaluating whether adopted sustainability

policies and practices have led to improved overall health is important. Most studies in this area have focused on the link between air pollution and health (Pope III et. al. 2009) and indoor environmental quality and absenteeism (Veleva et. al. 2011), but we do not yet understand the impact of eco-industrial parks on worker and public health. Therefore, we recommend undertaking further research into developing and implementing a public health indicator (e.g., using a survey or other tool to evaluate health status of residents and employees), which can also provide a new tool for other communities and advance the scientific knowledge about the health-related impacts of eco-industrial parks.

- **Landfill diversion** (Indicator 12D): This standard indicator used by businesses, communities, and eco-industrial parks like Devens is an aggregate measure of waste reuse, recycling, and composting. Thus implementing such an indicator would replace three indicators with a single one (although reuse, recycling, and composting will still be tracked separately to calculate the diversion rate).
- **Waste generation** (Indicator 11A): While total waste generated is not a great indicator for a community like Devens where the changes in local organizations can bring significant changes in the solid waste generated, it is recommend to look at measuring waste generation in the future to improve tracking of diversion rate and other waste-related indicators. Data can come from a survey of residents and local organizations.
- **Governance:** One or both of the following governance indicators might be considered instead of or in addition to a survey of public perceptions:
 - **Number of sustainability awards** (e.g., 2007 Smart Growth/Smart Energy Award to EcoStar, and EPA New England Merit Award to EcoStar for its “outstanding contributions on behalf of our region’s public health and our natural environment”).
 - **Number of sustainability incentives, guidelines, regulations, and initiatives** such as: Vegetated roof construction policy (974 CMR 3.00 – Site Plan); regulations related to well protection, stormwater and low-impact development standards, renewable energy standards, and greenhouse gas mitigation standards (974 CMR 4.00); and public health regulations related to well protection requirements, recycling, anti-idling, and event permits (974 CMR 8.00) (DEC 2011, p. 21).

5.3 Indicators to consider dropping in the future

The following three indicators highlighted in Section 4 are less effective in measuring progress toward sustainability in Devens because they will vary significantly as result of changes in the mix of local organizations; therefore, they are good candidates to drop or replace:

- kWh of electricity consumed per 1,000 ft² of occupied space (Indicator 8A)
- Therms of natural gas consumed per per 1,000 ft² of occupied space (Indicator 8B)
- Devens unemployment rate (Indicator 1B)

The first two (Indicator 8A and 8B) could be replaced with similar indicators tracking electricity and natural gas use by municipal buildings (Indicators 8D and 8E in Table 1)

to evaluate progress toward Massachusetts Executive Order 484 (2007) for reducing energy use in municipal buildings.

It was recommended to replace the third indicator – Devens unemployment rate – with two new indicators measuring local area unemployment rate. The first one will track the average unemployment rate in the four hosting communities (Ayer, Harvard, Lancaster and Shirley), and the second one – the average unemployment rate in the 24 Massachusetts town considered the impact region. These indicators will help to evaluate more accurately the employment picture in the area.

5.4 Devens Enterprise Commission Survey Spring 2013

As the overseers of Devens moved into their second decade of promoting sustainable local development, the Devens Enterprise Commission (DEC), Devens Eco-Efficiency Center and MassDevelopment wanted to make sure they better understand, measure and communicate Devens' achievements as well as address barriers to greater collaborations among local companies. This 2012 study to update the 2000 Devens Sustainability Indicators Report revealed a lack of data for measuring some indicators (e.g., government responsiveness, percent of firms that collaborate, landfill diversion, employee health and wellness). To obtain such data as well as feedback from local organizations, the DEC partnered with the UMASS Boston Center for Sustainable Enterprise and Regional Competitiveness to conduct a survey in the first quarter of 2013. The survey was also intended to help the DEC, the Devens Eco-Efficiency Center and MassDevelopment gain more insight to local companies' current practices, challenges and opportunities to advance mutually beneficial collaborations with other Devens organizations to improve environmental, economic and social (triple bottom-line) efficiencies and business competitiveness.

Twenty-nine out of the 95 Devens businesses and service organizations were randomly selected to complete the survey which was followed by in-person interviews with key staff from participating organizations. This approach resulted in a 100% response rate. The majority of those surveyed were businesses (79%), with non-profits representing 14% and government entities - 7%. Most organizations classified themselves in the manufacturing industry (91%). While over half (53%) of those organizations surveyed have more than 500 employees in the U.S., the majority of organizations surveyed were in the 10-49 employee range (48%).

Key findings from the survey include:

Main reasons to locate to Devens:

- Access to good infrastructure (67%)
- Lower cost of real estate (59%)
- Tax benefits (52%)
- Expedited permitting process (37%)
- Ability to collaborate with other businesses (33%)
- Availability of highly-skilled workforce (30%)
- Sustainability vision and policies (22%)

These results demonstrate MassDevelopment's investment in redeveloping Devens infrastructure, along with tax incentives, have worked well to attract businesses to Devens. These incentives, along with the DEC's expedited permitting process and co-location of business and industry round out the top five reasons for businesses choosing to locate at Devens. While the sustainability vision and policies of the Devens Reuse Plan and the DEC were not one of the top contributing factors to businesses locating in Devens, the programs and services of Devens Eco-Efficiency Center Devens continue to offer a unique value-added component for organizations choosing to locate at Devens. As corporate sustainability objectives continue to receive more attention, it is expected that the programs and services of the Devens Eco-Efficiency Center will become more of a contributing factor for organizations choosing to locate at Devens.

Top sustainability challenges:

- Reducing cost of energy/improving efficiency (61%)
- Reducing cost of materials/improving efficiency (61%)
- Availability of highly skilled employees (39%)
- Reducing waste; engaging employees around sustainability and employee health and well-being (each at 21%)

The Devens Eco-Efficiency Center, partially funded by the DEC, offers a number of programs and technical assistance to organizations in Devens and the surrounding region to help them reduce costs through energy efficiency, material reuse, and waste reduction and diversion programs. These survey results confirm that the Center's current programming is in line with the top sustainability needs of the majority of local organizations. The State as a whole contributes to the availability of high skilled employees and MassDevelopment capitalizes on this fact by working to attract business and industry to Devens to support a highly skilled labor force and grow the Massachusetts tax base and employment rate.

Local government responsiveness:

- Very responsive (66%)
- Somewhat responsive (24%)
- Not responsive (3%)

Overall, respondents were very satisfied with the level of service of the DEC and MassDevelopment. In follow-up interviews with organizations, many commented on the attractiveness of the redevelopment (landscaping and maintenance of public spaces). In addition to the streamlined permitting of the DEC, respondents also praised the coordination and accessibility/availability of DEC and MassDevelopment staff for day to day issues.

Practices around employee health and wellness:

- Walking clubs or other programs to encourage employee fitness (39%)
- Offering flex time for employees (38%)
- Encourage alternatives to single occupancy vehicle to get to work (30%)

Employee health and wellness initiatives appeared to be a lower priority for most of the businesses surveyed, however some businesses in Devens do offer employee wellness programs such as fitness reimbursement and walking clubs. A number of organizations

did comment that some of their employees do take advantage of the numerous trails, sidewalks and open spaces within Devens. With sustainability becoming more important to business and industry, coupled with increased awareness of the relationship between employee health and productivity, more businesses are starting to look into developing employee health and wellness programs. The Devens Eco-Efficiency Center offers opportunities to engage organizations and their employees in outdoor activities and community betterment projects such as trail maintenance, guided walks, and tours. These activities promote active living and connect people and businesses with each other and the Devens landscape.

While the number of businesses that encourage carpooling and flex time was fairly low, the DEC continues to require new developments to implement transportation demand management initiatives as per the Final Environmental Impact Report for Devens. The DEC also continues to actively work on reverse commute options on the Fitchburg commuter rail line, in addition to shuttle service options that will provide residents and employees in the Devens region with additional public transportation options. These initiatives have the ability to significantly reduce single occupancy vehicle trips to and from Devens.

Current sustainability practices:

- Product take-back for reuse or remanufacturing (59%)
- Selling services vs. products (21%)
- Using other companies waste as a raw material (45%)
- Contingency planning for improved resilience in cases of weather and other disruptions (50%)
- Use of local/U.S. suppliers to reduce supply chain risk (68%)

The number of organizations that participate in product take-back programs (59%) is encouraging and supports the reuse and waste reduction goals and programs of the Devens Eco-Efficiency Center such as The Great Exchange. These survey results provide additional insight into some of the current sustainability practices of Devens organizations and will assist the Devens Eco-Efficiency Center in developing future programming and outreach to help organizations improve their triple bottom-line.

Collaborations:

- 86% currently collaborate with other organizations in Devens (on average each surveyed organization collaborates with 2.5 other Devens firms)
- 79% see opportunities to benefit from partnerships with other organizations (e.g., shared space and contingency space use, joint purchasing, services & waste disposal, training; sharing contractors and suppliers)
- 36% consider participating in employee shuttle to the commuter rail terminal in Littleton (first train to arrive 8:30 am)

Collaboration among businesses is one of the key objectives of the Devens Eco-Efficiency Center, which continues its work to bring businesses and organizations in the Devens region together to reduce their environmental impact, while improving social and economic (triple bottom-line) conditions in the region— a key goal of the DEC and the Devens Reuse Plan. The survey results and follow-up interviews revealed that many

organizations have benefited from the collaboration activities of the Eco-Efficiency Center and that many more are open to the idea of collaboration. This is good news for the continued growth and expansion of Center's waste reduction services. As discussed previously, reverse commute options and shuttle service are also important considerations for organizations in Devens and these collaborative efforts will aid in meeting some of the Transportation Demand Management objectives for Devens.

Forty-four percent of respondents were aware that Devens is internationally recognized as an Eco-Industrial Park. DEC Director Peter Lowitt, with full support from the DEC, has been instrumental in promoting Devens as an internationally recognized eco-industrial park that attracts visitors from all over the world. As the Devens Eco-Efficiency Center and EcoStar environmental branding and achievement program continue to grow and offer more sustainability services to more organizations in Devens, it is expected that more local organizations will begin to recognize Devens as an eco-industrial park and see these services as a value-added component to locating here. More organizations may even factor this into their decision to locate at Devens.

The survey results will be used to assist MassDevelopment, the DEC and the Devens Eco-Efficiency Center in focusing future programming, marketing, policy and regulatory initiatives to help further the sustainable redevelopment directive of the Devens Reuse Plan and provide insights into how Devens Eco-Industrial Park services can further support and grow local organizations' sustainability practices and business competitiveness. Complete survey results are included in Appendix I.

6. Conclusion

As described by many visionaries such as Paul Hawkin, Jeremy Riffkin, Tim Jackson and Chuck Collins, we are at the turning point of major economic and social changes where some communities and regions will thrive and others will decline. McKinsey Global and The Brookings Institution have also emphasized the importance of cluster development in the future (The Brookings Institution 2011; McKinsey Global Institute 2011).

With its establishment as an eco-industrial park and its ability to attract a variety of organizations, Devens is ideally positioned to address emerging social, environmental, and economic challenges such as:

- Increasing focus on reuse, remanufacturing, and extending products' life;
- Decoupling consumption from growth and reliance on fossil fuels and other raw materials (dematerialization or offering services versus selling products);
- Growing focus on worker health and well-being, public health, and disease prevention;
- Reducing inequality and promoting better, more sustainable quality-of-life;
- Partnering with educational organizations to address the workforce development needs of Devens;

- Building more resilient and self-sufficient communities to withstand climate disruptions and global/national economic downturns; and
- Promoting transparent, inclusive community development decision-making.
- Providing a needed service to the business community through the Devens Eco-Efficiency Center to assist them as they make their entities more sustainable and “green”.
- Model utilizing a balanced holistic approach to integrate regenerative design into the continued redevelopment program.

The next sustainability indicator review should not only evaluate progress in each of the seven issue areas and related indicators, but also consider making some bold commitments and establishing goals that will help Devens successfully transition to a low-carbon, competitive local economy based on protecting natural resources, developing human capital, and advancing shared prosperity for all.

References

CHSI, <http://www.communityhealth.hhs.gov/homepage.aspx?j=1>

Devens Eco-Efficiency Center (DEEC), “About the Devens Eco-Efficiency Center,” 2012, http://www.ecostardevens.com/index_files/Page1421.htm

Devens Enterprise Commission (DEC), 2007 Annual Report, January 2008.

Devens Enterprise Commission (DEC), Annual Report, 2008, <http://www.devensec.com/news/2008%20DEC%20Annual%20Report.pdf>.

Devens Enterprise Commission, “5-year review 2006-2011”, 2011.

Devens Sustainability Indicator Report, 2000, <http://www.devensec.com/sustainreport.html>.

EPA, “Evaluation Guidelines for Ecological Indicators”, Office of Research and Development, EPA/620/R-99/005, May 2000, http://www.epa.gov/emap/html/pubs/docs/resdocs/ecol_ind.pdf.

MassDevelopment, “Devens Traffic Monitoring Program 2010 Five-Year Traffic Report,” October 2010.

Devens Public Works (DPW), “Analysis of solid waste management activities in Devens and proposed action plan for further management,” September 2004

Institute for Sustainable Communities (ISC), “What is sustainable community?” 2012, http://www.iscvt.org/what_we_do/sustainable_community/

EPA, “Green Communities,” 2012, <http://epa.gov/greenkit/indicator.htm>

Hasek, G. “Massachusetts planning food waste ban for businesses”, GreenBiz, May 24, 2012, <http://www.greenbiz.com/blog/2012/05/24/massachusetts-planning-food-waste-ban-for-businesses>.

Institute for Sustainable Communities (ISC), “What is a Sustainable Community?” 2012, http://www.iscvt.org/what_we_do/sustainable_community/

Jackson, T. “Let’s be less productive,” *The New York Times*, May 26, 2012, http://www.nytimes.com/2012/05/27/opinion/sunday/lets-be-less-productive.html?_r=2&goback=.gde_2760912_member_119763043

McKinsey Global Institute, “An economy that works: Job creation and America’s future,” June 2011, http://www.intelligentcommunity.org/clientuploads/PDFs/MGI_us_jobs_full_report.pdf
National Industrial Symbiosis Programme (NISP), 2012, <http://www.nisp.org.uk/>

Penn Institute for Urban Research, “Developing a Sustainability Indicator System,” April 12, 2011, http://www.communityindicators.net/system/medias/205/original/Sustainability_Session_1_Part_3.pdf?1307633134

Pope III, A. et. al., “Fine-Particulate Air Pollution and Life Expectancy in the United States,” *The New England Journal of Medicine*, Special Issue, 2009, <http://www.nejm.org/doi/pdf/10.1056/NEJMsa0805646>

Sustainable Measures, “Indicator Projects for the United States,” 2010, <http://www.sustainablemeasures.com/projects/Sus/Sustainability/5>

Watson, R. “Green Building Market and Impact Report 2011,” GreenBiz group, December 2011, http://www.greenbiz.com/sites/all/themes/greenbiz/doc/GBMIR_2011.pdf

Results that Matter (RTM), “Effective Community Governance: An Overview,” 2012, http://www.rtmteam.net/page.php?section=overview_of_ecg&pageID=25

UMASS Donahue Institute, “Business and Organizations Located in Devens: Profile and Economic Contributions,” June 2012, http://www.devenscommunity.com/sites/default/files/devens_commercial_report_062012.pdf

M.E. Swisher, Sandra Rezola and James Sterns, “Sustainable Community Development Step 4: Develop Sustainability Indicators to Measure Progress,” University of Florida IFAS Extension, 2009, <https://edis.ifas.ufl.edu/pdf/CD/CD02900.pdf>

The Brookings Institution, “Sizing the clean economy: A national and regional jobs assessment,” 2011, http://www.brookings.edu/~media/Files/Programs/Metro/clean_economy/0713_clean_economy.pdf

U.S. Department of Housing and Urban Development, “Measuring Sustainability,” 2011, <http://www.huduser.org/portal/periodicals/em/summer11/highlight2.html>

U.S. Department of Housing and Urban Development, “Affordable Housing,” 2012, <http://www.hud.gov/offices/cpd/affordablehousing/>

Vanasse Hangen Brustlin, Inc. “Devens by-laws,” The Joint Boards of Selectmen of the Town of Ayer, Town of Harvard, Town of Lancaster, Town of Shirley, The Massachusetts Government Land Bank, 1994.

Veleva V., Mladenova I. and M. Gresty, “Managing Indoor Air Quality,” Sustainability Roundtable, October 2011, <http://sustainround.com/library/?q=node/852>

WatchCDC, “Affordable Housing Development,” 2009, <http://watchcdc.org/affordable-housing-development>

World Commission on Environment and Development, “Our Common Future,” Oxford: Oxford University Press, 1987.

Appendices

Appendix A: Sidewalks on private and public ways

Appendix B: Trails within DREZ

Appendix C: Railroads

Appendix D: Permanently protected open space

Appendix E: Impervious Surface Lot Coverage (by Zoning District)

Appendix F: Existing Military Building Adaptive Reuse

Appendix G: LEED Certified/Certifiable Buildings

Appendix H: Unemployment rate in the Devens region – 2000 and 2010

Appendix I : Business Sustainability Practices and Indicators for Devens, MA Survey Monkey 2013