



GRESHAM VISTA BUSINESS PARK

Eco-Industrial Development
Pilot Project

LESSONS LEARNED

Final Report
December 28, 2016

Prepared by Light House Sustainable Building Centre
for the Port of Portland and City of Gresham



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EXECUTIVE SUMMARY

The Gresham Vista Business Park (GVBP) was developed by the Port of Portland (Port), in collaboration with the City of Gresham (City). At present time, there is one new business, the Subaru Distribution Center, operating on Lot 4 (39 acres). Lot 4 was purchased and developed by the Trammell Crow Company on behalf of Subaru, which is leasing the site back from Trammell Crow. Trammell Crow has purchased Lots 1, 2 and 3 and plans to develop 3 speculative industrial buildings by 2018. Madison-Specht Vista Logistics LLC purchased Lot 9 and is building three speculative industrial buildings. Madison-Specht is a partnership between Specht Development Inc. (Portland) and New York Life Real Estate Investors LLC. Construction on Lot 9 will be completed in 2018. The Port continues its marketing efforts to sell the remaining lots.

Planning for the GVBP started at a time when the local industrial market was slightly slower, allowing the Port to take the time to consider alternative features for the GVBP and to pilot the implementation of the following eco-industrial development (EID) strategies:

1. Green (Stormwater) Infrastructure
2. Pedestrian Connectivity
3. Green Buildings
4. Marketing and sales for EIDs
5. Eco-Business Operations (Eco-Concierge)

The pilot was supported by a Community Planning and Development Grant from Metro Regional Government. As part of the pilot, the Port and City committed to preparing this lessons learned report, to help support future EID led by them or by others in the region. The lessons learned were gleaned from interviews with 18 stakeholders and a review of documents developed to support implementation of these strategies.

The lessons learned for each pilot eco-industrial strategy are summarized below, followed by a summary of some overall lessons learned. The GVBP was a successful pilot, and the outcomes support the Port's role as catalyst for change in the regional industrial market.

Eco-industrial development involves a conscientious effort to apply lessons from nature (e.g., through more biophilic and biomimicking design) and to take a systems approach to industrial development.

Site Plans: Set the stage for infrastructure, buildings and operations (e.g., to support wastewater re-use, include land for a wastewater treatment plant and illustrate extra piping rights-of-way allowances).

Infrastructure: Stormwater: Apply biomimicking design and a systems approach (e.g., the integration of stormwater infrastructure with connectivity elements or the re-use of stormwater by businesses).

Pedestrian connectivity: Integrate with eco-landscapes to increase access to nature. Connect people and catalyze symbiosis.

Goods movement: Roads minimize resource requirements, integrate natural landscapes, or utilize recycled materials. Pre-approved linear corridors support industrial symbiosis.

Water and 'wastewater': Ensure supplied water quality matches demanded water quality (e.g., cooling water re-used as truck wash water).

Landscape: Support and integrate nature; provide employee and public amenity; supports stormwater management; and improves building energy performance.

Buildings: 'Green' buildings (certified or not) that incorporate lessons from nature and catalyze resource conservation and industrial symbiosis. Large industrial can integrate with stormwater or energy infrastructure and/or visibly demonstrate innovation.

Business Operations: Businesses are integrated into a highly efficient and effective 'industrial ecosystem', practicing industrial symbiosis, where the wastes of one business become the inputs for another business, *and* mimicking other ecosystem elements, such as strategic and generally minimized use of toxic substances and reliance on renewable energy and materials.



Eco-Industrial Element: Green (Stormwater) Infrastructure

GVBP achieved exemplary green infrastructure via low impact stormwater management practices.

GVBP stormwater management comprises green infrastructure versus hardened 'grey' or concrete infrastructure. All stormwater infrastructure will be privately owned and maintained. In hindsight, some interviewees felt that the GVBP might have benefitted from master infrastructure. Green infrastructure ensures the GVBP meets the City's relatively stringent discharge standards for the area, and supported the GVBP Development Standards, which in turn reflected the Stormwater Management Plan. The Plan was useful in discussions between Port staff and lot developers, speeding up the development process by essentially providing conceptual design. Although there was a \$10,000 Green Infrastructure Incentive, the City's waiver of System Development Charges (SDC's) was thought to have contributed more to inclusion of green infrastructure. The **community benefitted** from a neighbouring industrial site that included more natural, and arguably more aesthetically pleasing, landscape features, as well as from increased flood protection to surrounding properties on the north side of the site.

Recommendation: EID master developers should implement development standards for green infrastructure for all EIDs. More stringent standards could be supported by incentives or SDC credit.

Recommendation: When timelines permit, EID master developers may want to consider investing in site specific conceptual green infrastructure scenarios to facilitate faster and more responsive lot design.

Recommendation: EID master developers should retain consultants experienced in innovative / low impact stormwater management design.

Recommendation: Metro Regional Government should support regional capacity building around green infrastructure, using the GVBP as a case study. The Port is well-positioned to support regional education efforts.

Eco-Industrial Element: Connectivity

GVBP was successful at increasing connectivity within the park versus a 'business-as-usual' scenario.

Although the GVBP is not yet fully built-out, significant pedestrian connectivity has been achieved. The **community benefits** from connectivity through a large block of land, with potential connections to bus stops on Stark and 223rd; the commercial node near Glisan and 223rd, and any future commercial development on Lot 11.

In general, the market appeared to view the trails as a constraint (i.e., land they pay for but can't use operationally) rather than an amenity. Lot owners also expressed security concerns. These concerns were mitigated by the conditions in the Development Standards that ensure lot owners retain ownership of, signage and fencing, and maintenance responsibility for pathways through their property, although there is some concern this model may result in degrading of pedestrian connectivity over time. The Development Standards very clearly presented the overall connectivity plan at build-out.

Recommendation: Future EID master developers should ensure that pedestrian connectivity is established, using Development Standards as a key tool. The GVBP Development Standards can be used as a template.

Recommendation: Where local government resources exist, public ownership or easements for pathways to maximize employee and community benefit should be considered.

Eco-Industrial Element: Green Buildings

GVBP will be home to LEED®-certified industrial buildings.

The GVBP will be home to at least 3 LEED® certified industrial buildings, representing a 10% increase above the number of LEED® certified industrial buildings in the entire state. One other building is incorporating some green building features, such as LED lighting or extra insulation because they had a good payback.

Overall, there appears to be substantial market resistance to industrial green buildings, especially LEED® certified ones, due to misconceptions about the costs and benefits of industrial green buildings. LEED® certification costs represent approximately 0.1 to 0.2% of the total construction costs for the type of industrial buildings found in GVBP. Experienced design teams and contractors should be able to achieve LEED® certified or LEED® Silver for very little to no extra cost, with extra cost frequently being associated with items that have an operational payback. Even without pursuing LEED® certification, the GVBP demonstrates that many green building features are frequently incorporated into industrial buildings because they have a good payback.

Progressive institutional investors, like those backing the development of Lots 1, 2, and 3, are most likely to pursue LEED® certification. It appears that very few end users, even those with strong sustainability policies on their operational sides, have real estate arms that are demanding green buildings. Lot developers felt that the LEED incentive did not affect their decision to (or not to) pursue LEED. However, the incentive provided a lever for a green building conversation between Port staff and developers.

Recommendation: EID master developers and local economic development offices should ensure marketing efforts reach institutional investors as well as progressive firms within local target sectors.

Recommendation: As the largest developer of industrial land in the region, the Port could support regional educational efforts related to industrial green building (new and retrofit).

Recommendation: EID master developers should continue to use development standards to signal a desire for green buildings, and consider mandating LEED® certification to a basic certified or Silver level. Alternatively, specific design strategies could be required.

Recommendation: Where resources exist, a green building incentive could be used to catalyze the green building conversation.

Eco-industrial Element: Marketing and Sales Efforts

It was difficult to market the GVBP as an EID because of capacity gaps in the market.

Because the GVBP was not marketed as an eco- / green / sustainable development, marketing efforts may not have reached or influenced like-minded developers or end-users.

Marketing efforts have been somewhat successful by conventional measures in that several lots are sold, at a slightly longer absorption rate than was expected but consistent with the overall regional market. However, none of the lot developers is believed to have been strongly aware of and attracted by the GVBP's EID goals.

Most interviewees believed that the promotion of 'green' goals would drive away some prospective purchasers and could scare away lenders to both the master developer and lot developer. Given the



financial risk undertaken by the Port (or any master developer), it is understandable that there is a desire to ensure that absorption rates and sales prices are not negatively impacted by eco-marketing efforts. There is clearly still a need for regional capacity building and education related to advancing EID.

As per recommendations in the marketing plan and feedback from site selectors, the GVBP marketing collateral and approach did not present a sustainability-focused brand, thereby possibly limiting efforts to reach sustainability-minded players within the target sectors. Although a general EID marketing campaign was difficult due to capacity gaps in the market, a strategically focused EID marketing campaign may have reached more developers or end users, especially progressive firms in the target sectors, more supportive of EID and sustainability.

Recommendation: Until there is greater market capacity, EID master developers should consider a two-pronged marketing approach targeting a general audience as well as progressive developers and end users. This may require that the EID master developer pursue more direct marketing such as via social media.

Recommendation: As the largest developer of industrial lands in the region, the Port could help support Metro Regional Government efforts to build EID capacity.

Recommendation: Metro Regional Government should consider updating its Eco-Efficient Toolkit.

Eco-Industrial Element: Sustainable Business Operations

Industrial symbiosis is difficult to achieve right from the start in a new EID.

Industrial symbiosis is best achieved by existing businesses, with greater opportunities to be found if symbiosis is pursued regionally.

There are likely future opportunities to continue to boost the sustainability performance of businesses at GVBP.

Currently, no industrial symbiosis (waste to input linkages) or other business-to-business collaboration (beyond the site connectivity and two lots sharing stormwater management systems) has been established in GVBP. ON Semiconductor has expressed interest in meeting with Subaru to explore collaboration opportunities. This does not represent a failure of the GVBP. This is consistent with the conditions of a democratic, market economy combined with the prevalent 'develop and exit' development approach that makes it infeasible to only sell lots to end users that can plan some industrial symbiosis. New EIDs can set the stage for symbiosis, but it is rare to achieve it during 'start-up'.

The Eco-Concierge Feasibility Study explored whether an Eco-Concierge Program that creates a support network for current and future GVBP business partners to reduce development operational costs and support workforce education, training and networking is feasible. The Eco-Concierge Feasibility Study conclusion that business collaboration, especially industrial symbiosis, is best fostered regionally with existing businesses is consistent with what is now seen as international best practice, such as with the National Industrial Symbiosis Program (NISP) model now running in 21 countries.

Aside from symbiosis, there are many other actions businesses can take to contribute to more sustainable industrial operations. These actions range from implementing environmental management plans to energy and water conservation to complete product redesign to phase out fossil fuel-derived inputs. Any one EID (or standard industrial park) is unlikely to require a dedicated Eco-Concierge, but a regional Eco-Concierge model, such as the two suggested in the feasibility study, could support businesses.

Recommendation: EID master developers should use design to set the stage for industrial symbiosis (e.g., extra utility corridors / easements or pre-approved symbiosis piping locations).

Recommendation: Local jurisdictions should ensure that zoning allows for uses that might support future symbiosis, such as private utilities (e.g., shared wastewater treatment plants or waste heat recovery plants; aquaculture; or greenhouses).

Recommendation: The Port and Metro Regional Government should champion regional industrial symbiosis, which would benefit businesses at GVBP as well.

Recommendation: The Port and Metro Regional Government should further explore the Eco-Concierge Feasibility Study recommended options.

Recommendation: The Port could act as an 'honest broker' between businesses in the GVBP, helping to bring companies together to share knowledge and explore collaboration to advance sustainability.

General Lessons Learned

It takes (and will continue to take) leadership, partnership and very hard work to realize an EID.

- The GVBP was well-served by the preparatory work undertaken by the Port.
- The amount of technical information, documents, and people involved in the project made it difficult to sustain broad knowledge and even buy-in for the life of the project. Not all stakeholders or consultants will have the same level of eco-industrial / sustainability literacy.

The GVBP was successful due to the significant leadership and efforts of the Port and City staff, above what would be required for a traditional industrial development. Much of the GVBP's success is due to the cooperative partnership between the Port and the City. The Technical Advisory Committee (TAC) structure reflected the partnership approach. Some stakeholders who became associated with the project part-way through reported that it was difficult to get up to speed, while others were frustrated by the number of documents to track.

The GVBP was successful in piloting green infrastructure and green buildings. The GVBP was successful in piloting green infrastructure and green buildings. The GVBP pilot also produced exemplary Development Standards that articulated the integrated vision for the site with EID elements above and beyond City code requirements. The Development Standards were an important tool for advancing green infrastructure and green buildings in the GVBP. Once all the lots are sold, the Development Standards will stay in force through the GVBP Owners' Association, and will continue to influence any retrofit or re-development in the GVBP. There are many other elements of an EID, such as incorporating renewable energy systems, even higher performing buildings, or wastewater re-use, that are worth exploring in other pilots. Any future EID developer, whether the Port or another organization, should be aware that EIDs will remain an innovative concept for some time.

Over the years, an integrated design process has become standard for green buildings as a means of ensuring the full benefits of inter-disciplinary collaboration are achieved, but also to create clear design principles and goals that can be readily referenced as the project moves forward. The same process holds tremendous value for EIDs.

Recommendation: EID master developers should engage local governments as early in the planning process as possible to identify common goals and a process for maintaining collaboration.



Recommendation: New EID projects should continue to be guided by multi-stakeholder Technical Advisory Committees.

Recommendation: EID master developers should use Development Standards as a means of articulating the EID vision and helping to advance design beyond local code.

Recommendation: Master developer marketing efforts should be supported by and integrated with local economic development efforts.

Recommendation: EID master developers and/or local governments should complete as much background work as feasible to create a more robust master plan and to facilitate lot development.

Recommendation: EID master developers should produce a single, integrated master plan¹, encompassing land use, access and movement, landscape and ecology, site servicing, and lot development goals.

Recommendation: Consultants should be required to deliver / participate in an Integrated Design Process (IDP). IDP training for the EID master developer and local municipal authority could also be beneficial.

Recommendation: EID master developers should seek design professionals and other consultants with demonstrated knowledge and experience in advancing sustainability and EID.

Recommendation: Future EID master developers should consider requiring some sort of training for any new staff (including at the local government) or consultants. The Port could help to develop such training.

Industrial park size / structure can affect implementation.

It was noted by several interviewees that the relatively small site made it difficult to pursue some of the EID strategies. The site structure and constraints, such as limited access points from perimeter roads and relatively few but large lots, did impact implementation. The site structure also allowed the Port to maximize developable land by not requiring an internal road network. The flip-side, though, is that the GVBP has no 'gateway' or internal road network to provide opportunities to incorporate more sustainable infrastructure. A few interviewees cited a lack of anchor tenant as a barrier. However, many of the historical EIDs with anchor tenants were not viable in the long-term as their reliance on an anchor tenant failed to foster resiliency and the projects collapsed when the anchor tenants collapsed. Furthermore, an anchor tenant development model does not generally reflect industrial development trends.

Recommendation: For future EIDs with planned internal roadways, the Port or other EID master developers should consider piloting eco-industrial road designs.

Recommendation: For future EIDs that do have a clear 'gateway', the Port or other EID master developer should use design to signal eco-efficient intent and to support marketing efforts.

Recommendation: For future EIDs, the Port or other EID master developers may want to consider sites where diverse lot sizes to broaden marketing potential and increase the potential for symbiosis.

¹ Examples of industrial park integrated site master plans in Oregon can be found at <http://www.corvallisoregon.gov/modules/showdocument.aspx?documentid=6232> or http://www.newbergoregon.gov/sites/default/files/fileattachments/planning/page/4676/south20industrial20area20master20plan_w20appendices.pdf.

Closing

With respect to physical development, the GVBP pilot provides valuable examples for advancing green infrastructure and green buildings in the industrial context, especially through the use of strategic green infrastructure planning and development standards. The pilot also demonstrates the impact of market knowledge on a developer's and/or local jurisdiction's efforts to advance EID, and underscores the need for complementary regional capacity building in addition to concrete pilot projects. Further, the GVBP pilot illustrates the importance of EID support and flexibility from local jurisdictions. Lastly, the GVBP demonstrates that, as with conventional industrial development, the physical characteristics of a site shape the final development; in this case, local drainage issues helped to drive innovative stormwater management, while the site configuration limited lot sizing and, therefore, ultimate business diversity.

The GVBP pilot also helps to clarify that industrial symbiosis is difficult to embed in a new development; it is easier to achieve industrial symbiosis by working with operational businesses. In addition, the GVBP pilot helped to clarify the role of scale and a coordinating third-party in achieving industrial symbiosis. The Eco-Concierge Feasibility Study rightly concluded that the GVBP would not have enough businesses to support widespread industrial symbiosis, and that industrial symbiosis was best pursued from a regional perspective.

On the whole, the GVBP pilot represents a very positive step towards achieving broader EID in the region, and demonstrates the merit of collaborative pilot efforts. Future developments in the region can directly incorporate some of the GVBP features, and can also springboard from the GVBP foundation to pilot deeper green buildings; other sustainable infrastructure systems; design that supports future industrial symbiosis; and alternative marketing approaches.

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INTRODUCTION

About Gresham Vista Business Park

The Gresham Vista Business Park (GVBP) was developed by the Port of Portland (Port), in collaboration with the City of Gresham (City), to “...create a signature business park that showcases environmental stewardship and eco-industrial innovation and attracts traded-sector businesses and industries providing family wage jobs and economic prosperity for East County.” The site is shown on Figure 1.

The GVBP site wraps around the existing ON Semiconductor facility, and is surrounded by residential uses. The site is located 0.8 miles from I-84, six miles from I-205 and 15 minutes from the Portland International Airport. The original site plan projected 11 new lots / 11 new businesses. Eight of these lots are zoned industrial; three lots are zoned for commercial mixed use development (Lots 6, 7, and 11 totaling 17.67 acres).

The 204 acres of industrially-zoned land in the GVBP represents an important opportunity to expand the industrial employment base in the City. The Port estimated that a full build-out of GVBP over 10 years could generate 4,970 direct, induced and indirect jobs (2,768 jobs-on site), \$220 million in wages, salaries and consumption impacts; \$337 million in business revenue, and nearly \$22 million in state and local taxes annually.

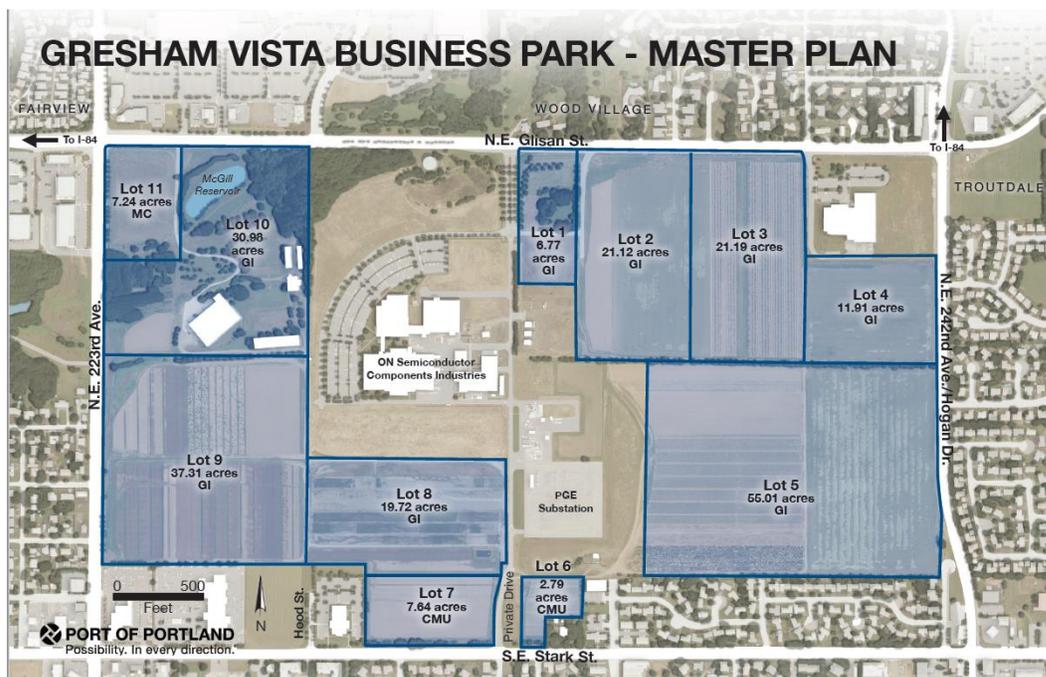


Figure 1: GVBP Site Master Plan



Market Context

The GVB development process was initiated at a time when the local industrial market was slightly slower, allowing the Port to take time to scope and pursue pilot eco-industrial initiatives with minimal impact on developer timelines. On the other hand, the Port does rely on its industrial development efforts to generate returns to support future industrial development, and was sensitive to pilot initiatives reducing the absorption rate of the GVB. Similarly, the City of Gresham had seen lower job gains than other areas of the region, and was interested in seeing the GVB site attract investment and support job creation in the near-term. Neither the Port nor the City was in a position to hold the site indefinitely for the 'ideal' developer or end-user.

Based on their experience at the time, the Port and the City believed the industrial market in general would not only be focused on conventional gray infrastructure² development, but would be generally unaware of, let alone supportive of, green or eco-developments. The Port was prepared to educate developers, and this influenced the decisions that were made around prioritizing eco-industrial strategies and implementation.

With respect to more specific market sectors, the City had developed a traded sector jobs strategy, aiming to strengthen and grow manufacturing, with a focus on advanced electronics (e.g., automotive electronics, avionics, electronic medical devices; micro-electronics; semiconductors; clean technology) and specialized machinery and equipment. Traded sector operations tend to be more complex versus other industries such as logistics. Advanced electronics firms, by their definition, are supported by a culture more receptive to innovation. Therefore, it is more likely that traded sector operations align with eco-industrial development goals. However, while there was early interest in the GVB from the manufacturing sector, it became apparent early in the marketing of the GVB that there was stronger market interest from the distribution and logistics operations more commonly linked to port and airport supply chains. These firms tend to require less sophisticated facilities and operations that may gain fewer benefits from eco-industrial development elements like green buildings. With its emphasis on technology and more sophisticated facilities, the advanced electronics sector tends to offer more opportunities to introduce LEED than the distribution and logistics sector.

It should be noted that the GVB site plan was re-configured to accommodate early sales; the current site plan is shown in Figure 2 on the following page. As of fall 2016, there is one new business, the Subaru Distribution Center, operating on Lot 4 (39 acres). Lot 4 was purchased and developed by the Trammell Crow Company on behalf of Subaru, which is leasing the site back from Trammell Crow. Trammell Crow has purchased Lots 1, 2 and 3 and plans to develop 3 speculative industrial buildings by 2018. Madison-Specht Vista Logistics LLC purchased Lot 9 and is building three speculative industrial buildings. Madison-Specht is a partnership between Specht Development Inc. (Portland) and New York Life Real Estate Investors LLC. Construction on Lot 9 will be completed in 2018.

The Port continues its marketing efforts to sell the remaining lots. It is worth noting that GVB had been on the market since 2004 with active development and marketing by the Port since 2011. The first industrial development on-site in 2015 with construction of the Subaru facility – a period of 11 years.

² "... 'gray infrastructure,' the human-engineered solutions that often involve concrete and steel." World Resources Institute, 2012 from <http://www.wri.org/blog/2012/06/green-vs-gray-infrastructure-when-nature-better-concrete>, accessed December 11, 2016

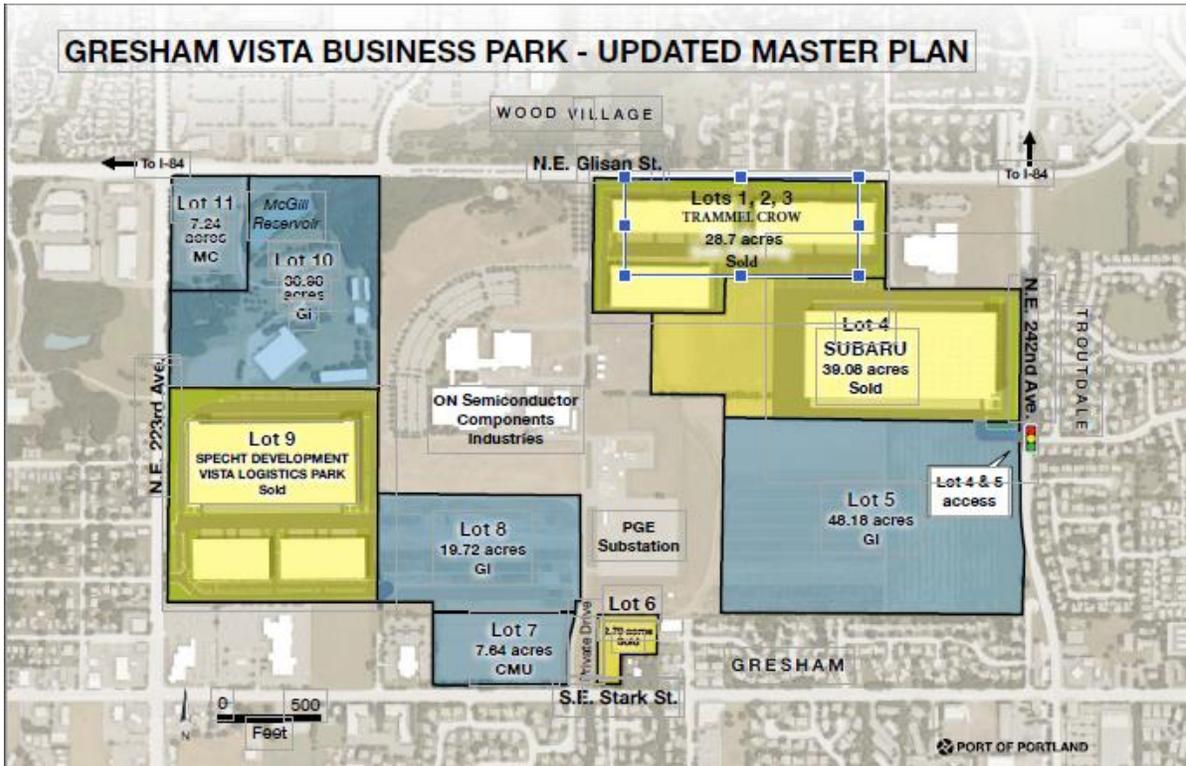


Figure 2: Revised GVBP Master Plan



Launching the Eco-Industrial Pilot

In September 2014, the City was awarded a Metro Regional Government Community Planning and Development Grant to help support planning and implementation of four (of seven) strategies identified in the Gresham Vista Implementation Action Plan (Mithun, January 2013). The four strategies were:

1. Integrated Site Master Plan
2. Green Infrastructure
3. Development Standards and Incentives
4. Eco-Concierge

The grant application requested funding to develop five deliverables associated with those strategies:

1. Stormwater Master Planning Analysis and Recommendations (completed July 2014)
2. Development Standards and Incentives (completed April 2014 and revised July 2015)
3. Eco-industrial Concierge Feasibility Study (completed April 2014)
4. Eco-industrial Marketing Study and Recruitment Plan (completed July 2014)
5. **Lessons Learned (this study, to be completed by December 2016)**

Light House Sustainable Building Centre (Light House) was retained by the Port and City to prepare the lessons learned report. Although some lots remain for sale in the GVBP, sufficient development has occurred to support a preliminary evaluation of the lessons learned, with a focus on:

- what worked and what did not;
- the marketplace context;
- what challenges were encountered compared to other eco-industrial models studied as part of the grant;
- community benefits of the work to date;
- general lessons learned that may help inform others interested in pursuing eco-industrial strategies; and
- opportunities for longer term implementation of eco-industrial strategies at GVBP and the region.

Defining Eco-Efficient / Eco-Industrial Development

Metro Regional Government's Eco-Efficient Employment Lands Toolkit:

- **High performance infrastructure** - Model approached for building more environmentally and economically sustainable infrastructure systems that reduce resource waste and the demand on our current systems.
- **21st century design** – Code changes and planning tools for designing vibrant employment areas that facilitate community, attract industry and reduce the impacts of climate change.
- **Revitalizing employment areas** – Strategies for redeveloping and reusing underutilized employment and industrial land for future economic growth

Cogan Owens Cowan / Re Tem report

"Eco-Industrial Development is a system approach to industrial development, enabling the sharing of resources between companies on a common property or an industrial district/region." (Mithun, 2014)

"Eco-Industrial Development is an integrated system of shared resources (material, knowledge, social, etc.) among industries, businesses and the local community that lead to economic gains, enhanced environmental quality, and improved human resources for the business and local community." (President's Council on Sustainable Development, 1996)

"An Eco-Industrial Park (area) is defined as: 'A community of manufacturing and service enterprises located together on a common property or in the same region. Members seek enhanced environmental, economic and social performance through collaboration in managing resources.'" (Lowe et al, 1996)

Mithun GVBP Implementation Action Plan

"Through workshops and drawing from policy and previously developed materials, the Working Group developed the following goals for Gresham Vista:

- Has a Strong Brand and identity that is attractive to users, employees, and differentiates the site
- Achieves Investment Returns including financial feasibility, revenue, and meeting target industry clusters
- Offers Development and Operational Advantages for users that maintains flexibility and leverages the large lots
- Provides Connectivity and Accessibility of utilities and transportation network to users
- Enhances Community Value as a regional model for sustainable development that is a good neighbor to surrounding communities and improves employment opportunities
- Achieves Environmental Performance including air quality, energy management, natural resource and waste minimization goals.

Eco-Industrial Development Models

Eco-industrial development seeks to advance sustainability beyond ‘business-as-usual’ by applying industrial ecology. This results in a conscientious effort to apply lessons from nature (e.g., through more biophilic and biomimicking design) and to take a systems approach. This should be reflected in site planning, infrastructure design, building design, and business operations. An Integrated Design Process (IDP)³ should inform every stage of an eco-industrial development. A brief overview of eco-industrial elements is presented below⁴.

Site Plans

The site plan sets the stage for the infrastructure, building design and business operations. Conceptual goals for these elements should be clearly established at this stage. For example, if conceptually, an eco-industrial development is aiming to support wastewater re-use, then a site plan should include land set-aside for a wastewater treatment plant and/or ensure that zoning is amenable to the inclusion of such uses and/or provide extra rights-of-way allowances, even if within existing road allowances, for business-to-business wastewater circulation. Similarly, if pedestrian access and movement is important, then the site plan should show these features.

The site plan should be informed by as much site information as feasible. Topographic, geotechnical, hydrological, and ecological studies should be conducted to as much depth as financing allows.

Ultimately, the site plan is likely best presented in a single, integrated master plan document that summarizes the regulatory context, including proposed changes; summarizes background technical information; and collects all development goals and concepts in a graphically attractive document that in turn supports early marketing efforts. Concepts may be presented on ‘layered’ site plan drawings, such as Land Use, Access & Movement, Utilities, and supplementary graphics such as those that illustrate building design goals.

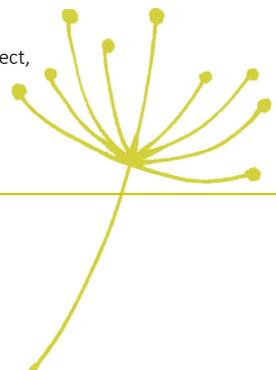
Infrastructure

Stormwater management within an eco-industrial park should reflect the applications of lessons from nature (e.g., the use of bio-mimicking design), as well as a systems approach (e.g., the integration of stormwater infrastructure) with connectivity elements or the re-use of stormwater by businesses.

Within eco-industrial parks, **pedestrian connectivity** can help to catalyze the interactions and build relationships between different company employees that facilitate industrial symbiosis or even just business-to-business mentoring or knowledge transfer. When integrated with ecological landscapes, pedestrian connectivity can also provide opportunities to increase employee access to nature, which recent research is showing improves health and well-being, and, therefore, productivity. Pedestrian connectivity can also provide educational opportunities through interpretative signage describing ecological features, green building practices, or sustainability achievements at operating businesses. Pedestrian connectivity can also be combined with bicycle connectivity, providing lower impact commuting options.

³ For more information, refer to the Whole Building Design Guide (National Institute of Building Sciences) available at <http://www.wbdg.org/design-objectives/aesthetics/engage-integrated-design-process>. While focused on a single building project, much of the IDP approach can be translated to master planning and infrastructure design as well.

⁴ A full eco-industrial park development guide may be found here: <http://www.caledon.ca/en/townhall/resources/CAO-2014-002Schedule.pdf>. Although developed for the eastern Canada context, much of the guide translates to other jurisdictions.



Goods movement in any industrial park, eco or not, is also important. Within an eco-industrial park, goods movement can be achieved traditionally through roadways, with eco-industrial principles can be reflected by designing those roads to minimize resource requirements, integrate natural landscapes, or utilize recycled materials. As with any development, double-loaded roadways (development on both sides) ensures the greatest value is achieved from the investment in roadways. Supporting efficient, multi-modal goods movement within the eco-industrial park can contribute to greater industrial symbiosis, but this can be achieved through more than just roadways. For example, pre-approved linear corridors can be used to circulate hot wastewater or support district energy.

From an industrial perspective, **water and 'wastewater'** simply represent water of different quality. The goal is to ensure that supplied water quality matches demanded water quality. For example, sometimes cooling water can be re-used as truck wash water. As many modern industrial operations are not water-intensive, this can be more about future-proofing (e.g., provision of pre-approved pipe corridors). The business case for wastewater re-use can be challenging in a low demand environment. Where water treatment or wastewater treatment is required, regardless of whether it is serving the site or a single user, it should incorporate biophilic and biomimicking design.

Landscape within an eco-industrial development serves multiple functions: supporting and integrating nature; providing employee and public amenity; supporting stormwater management; and contributing to better energy performance in buildings. Wherever possible, landscape should utilize species native to the ecosystem in which the eco-industrial development is located.

Building Design

Eco-industrial development goals are usually reflected via the design and construction of 'green' buildings. While the term 'green building' is now almost synonymous with one that is LEED® certified, in an eco-industrial development, buildings are designed to incorporate lessons from nature, integrate with nature, and catalyze resource conservation and industrial symbiosis, whether certified or not. From a green building standpoint, industrial buildings are interesting in that they frequently have large, unbroken exterior walls and large rooftop areas that present opportunities to integrate with stormwater or energy infrastructure and/or to visibly demonstrate innovation (e.g., such as through the installation of solar walls).

Business Operations

Theoretically, businesses operating in an eco-industrial development are integrated into a highly efficient and effective 'industrial ecosystem'⁵, practicing industrial symbiosis, where the wastes of one business become the inputs for another business, **and** mimicking other ecosystem elements (e.g., strategic and generally minimized use of toxic substances and reliance on renewable energy and materials). Industrial symbiosis (also called by-product synergy) has received by far the greatest attention, with many defining an eco-industrial development solely by the absence or presence of industrial symbiosis (which, unfortunately, neglects all the other aspects of development described above). Eco-industrial developments should help to advance industrial symbiosis, but it is also important that they support other business efforts such as reducing resource demand (i.e., efficiency and conservation) and increasing the consumption of renewable energy and materials.

⁵ Frosch, Robert A. and Nicholas E. Gallopoulos. 1989. Strategies for Manufacturing. Scientific American 189 (3) 152

Development Models

Eco-industrial parks can be achieved via new developments or the revitalization / retrofit of existing industrial parks.

For new developments, the general model in the U.S. is that a master developer services the site and sells lots to developers who: 1) build speculative developments and lease them out; 2) develop their own facilities and become owner-operators; or 3) build to suit for a single, long-term tenant whose needs drive the lot development features. The master developer can be a combination of private or public entity, under a for profit or not-for-profit structure. Lot developers are almost always private, for-profit entities.

It is rare in the U.S. context to find a master developer who maintains ownership of lots and develops an industrial park in which every business is a tenant.

Methodology

The GVBP lessons learned report was based on a review of the documents and deliverables prepared with the support of the September 2013 Metro Regional Government Community Planning and Development Grant, as well as interviews with key stakeholders. As additional context for the Port's interest in exploring eco-industrial development at GVBP, the consultant reviewed two other Port and Metro Regional Government initiatives related to eco-industrial development that helped inform development of the grant proposal and project approach. To provide regional context for this work, the consultant also looked at Metro Regional Government's Eco-Efficient Community Investment Toolkit.

The following documents, which were directly related to the Grant, were reviewed as part of this report:

1. Metro Regional Government Community Planning and Development Grant Application – April 2013: awarded to City of Gresham and administered by the Port of Portland.
2. Stormwater Master Planning Analysis and Recommendations – July 2014: funded in part by Metro Regional Government Community Planning and Development Planning Grant and Oregon Special Public Works Fund, written for the City of Gresham and Port of Portland by Williams Creek Consulting.
3. Internal Connectivity and Access Plan – July 2014: funded in part by Metro Regional Government Community Planning and Development Planning Grant, written for City of Gresham and Port of Portland by Mackenzie.
4. Declaration of Covenants, Conditions, and Restrictions – May 2014 and July 2015: written by Port of Portland.
5. Development Standards – May 2014 and July 2015: written by Port of Portland.
6. LEED Building Incentive – 2014: written by Port of Portland
7. Green Infrastructure Incentive – 2014: written by Port of Portland.
8. Eco-industrial Concierge Feasibility Study – 2014: funded in part by Metro Regional Government Community Planning and Development Planning Grant, written for the City of Gresham and Port of Portland by Cogan Owens Cogan.
9. Eco-industrial Marketing Study and Recruitment Plan – July 2014: funded in part by Metro Regional Government Community Planning and Development Planning Grant, written for the City of Gresham and Port of Portland by Johnson Economics, IronWolf, Cogan Owens Cogan.
10. GVBP Eco-Industrial Development Marketing One Pager – 2014: written by the Port of Portland.



For context, Figure 3 shows the timeline for key project activities.

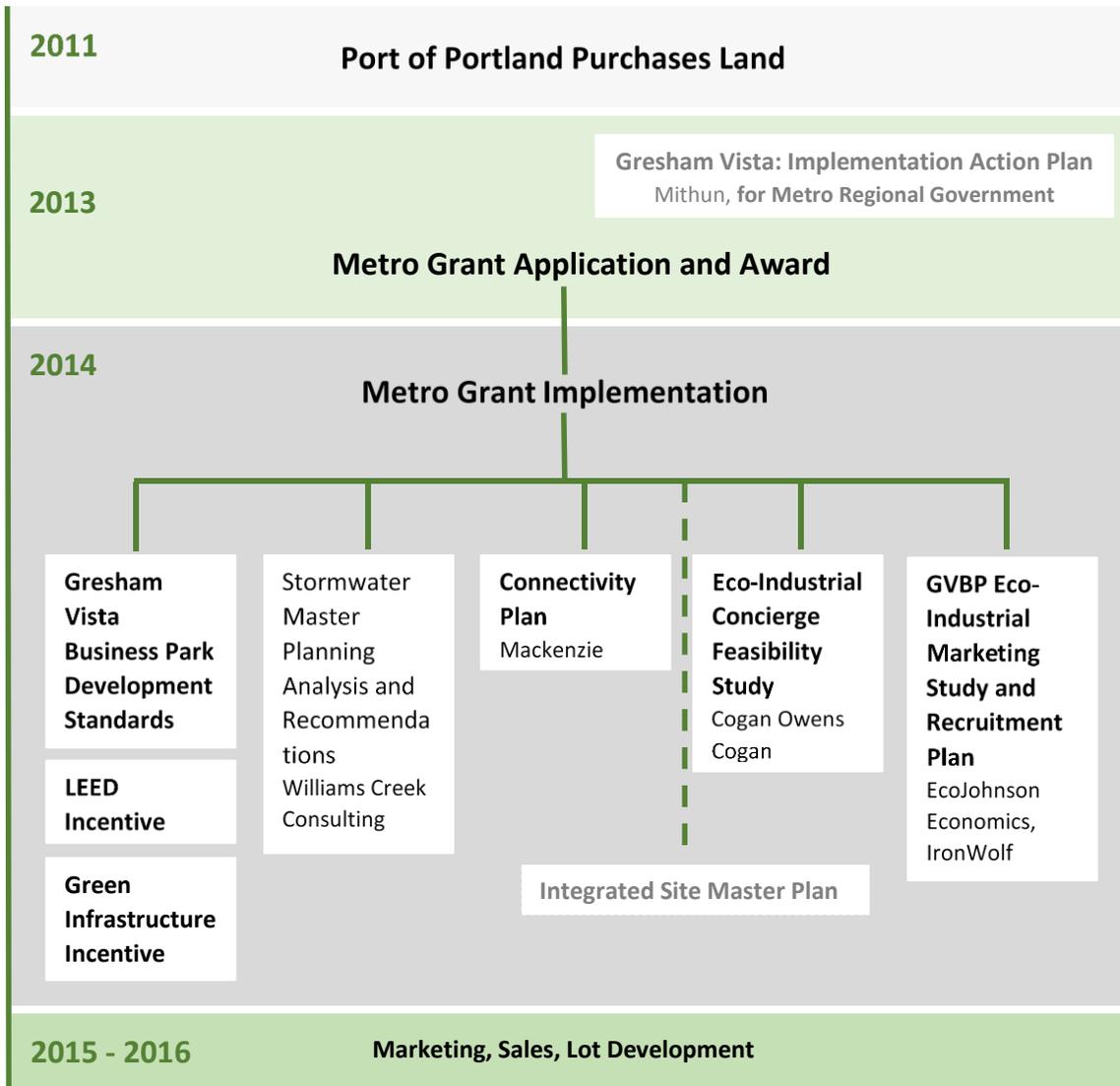


Figure 3: GVBP Timeline for Grant Documents / Deliverables

The following documents informed the Grant application, and were also reviewed for this report:

- Port Eco-Industrial Development Strategy – October 2012: funded by Port of Portland, written by Cogan Owens Cogan and Re-Tem.
- Implementation Action Plan: Gresham Vista – January 2013: funded by Metro Regional Government, written by Mithun.



The following documents were also reviewed as they are part of the broader regional context for eco-industrial development:

- Eco-Efficient Employment: Community Investment Toolkit – 2010: developed by Metro Regional Government.
- Eco-Efficient Pilot Program: Final Report—January 2013: funded by Metro Regional Government, written by Mithun.

Documents were reviewed with an eye to understanding their influence on the GVBP, especially with respect to intentions to create an eco-industrial development.

In addition to reviewing project documents, the lessons learned report was significantly informed by interviews with the following key stakeholders:

1. Ken Anderton, Senior Manager Industrial Development Program, Port of Portland
2. Miranda Bateschell, Community Development Planner/Grant Manager, Metro Regional Government (now Long Range Planning Manager with City of Wilsonville)
3. Jamey Berg, Industrial Development Environmental Planner, Port of Portland
4. Steve Bloomquist, Land Use Planner, Port of Portland
5. Tom Bouillion, Planning Manager, Port of Portland
6. Paul Breuer, Partner, Colliers International
7. Erin Christensen Ishizaki, Project Managers, Mithun
8. Steve Fancher, Environmental Services Director, City of Gresham
9. Steve Faust, Principal, Cogan Owens Cogan
10. Lise Glancy, Manager of Strategic Initiatives, Commercial Division, Port of Portland
11. Brent Hedberg, Project Manager, Specht Developments
12. Jerry Johnson, Principal, Johnson Economics
13. Robin McCaffrey, Engineering Project Manager, Port of Portland
14. Neil Myers, Principal, Williams Creek Consulting
15. Ryan Parker, Industrial Development Project Manager, Port of Portland
16. Shannon Stadey, Economic Development Director, City of Gresham
17. Jim Swier, Facilities Manager – ON Semiconductor
18. Bob Thompson, Mackenzie, Architect, Lot 9

Each interview was flexible, but was based on a framework that established the interviewees' roles in the project; level of familiarity and use of key project documents; expectations for this new eco-efficient versus a business-as-usual development; extent to which their expectations were met and why / how; and advice for future projects. The interviews informed the lessons learned; however, no statements or findings are directly attributed to any interviewee in this report.



ANALYSIS

Metro Regional Government Community Planning and Development Grant Application

Overview

The City, supported by the Port, sought a Metro Regional Government Community Planning and Development Grant to support implementation of eco-industrial strategies at GVBP as part of the overall planning and development efforts at GVBP.

The decision to pursue eco-industrial development at GVBP was inspired by two previous efforts. First, in the fall of 2011, Port staff visited the Devens, MA – a 5,000 acre eco-industrial park established on a former military base and subsequently participated in a working session with Cogan Owens Cogan and Re-Tem Global to explore eco-industrial development opportunities for the Port.⁶

Second, Metro Regional Government retained Mithun to scope potential pilot projects with implementable goals and strategies based on Metro Regional Government's Eco-Efficient Employment: Community Investment Toolkit (November 2010). The Mithun report⁷ considered the GVBP site specifically as an opportunity to apply the Toolkit to a new development site. The Mithun work included several workshops attended by multiple stakeholders, including staff at the City and Port. Mithun recommended eight strategies for GVBP:

Category 1: Plans, Studies and Strategies:

1. Integrated site master plan:
2. District energy
3. Water conservation and reuse
4. Waste management
5. Multi-modal site access

Category 2: Programs, Codes and Standards

6. Development standards and incentives
7. Eco-concierge

Category 3: Capital improvements

8. Green infrastructure (specifically stormwater versus other infrastructure)

The Grant Application proposed to deliver five elements for the GVBP as a means of pursuing four of the strategies from the Mithun report (Integrated site master plan; development standards and incentives; eco-concierge; and green infrastructure). The four elements are described below (excerpted from the Grant application):

Element 1 - Creation of a green infrastructure master plan for GVBP (stormwater, landscape, habitat, and internal connectivity/public access) that will provide the blueprint for successful green development at the site.

Element 2 - Creation of development standards and incentives that promote green development practices on the site, including connectivity.

Element 3 - Development of an eco-industrial marketing study and recruitment plan for GVBP that aligns with the City's Traded Sector Jobs Strategy and Port's Marketing Plan.

⁶ These efforts formed the basis for the Port Eco-Industrial Development Strategy prepared by Cogan Owens Cogan and Re-Tem Global in October 2012.

⁷ Implementation Action Plan: Gresham Vista (January 2013) and Eco-Efficient Pilot Program: Final Report (January 2013), both prepared by Mithun for Metro Regional Government

Element 4 - Implementation of sustainable development practices at GVBP through staff technical assistance, incentives and an eco-industrial concierge feasibility study.

The grant application stated that the GVBP was expected to bring the following benefits to the region:

“Vibrant communities – People live and work in vibrant communities where they can choose to walk for pleasure and to meet their everyday needs; Economic prosperity – Current and future residents benefit from the region’s sustained economic competitiveness and prosperity; Safe and reliable transportation – People have safe and reliable transportation choices that enhance their quality of life; Leadership on climate change – The region is a leader in minimizing contributions to global warming; Clean air and water – Current and future generations enjoy clean air, clean water and healthy ecosystems; and Equity – The benefits and burdens of growth and change are distributed equitably.”

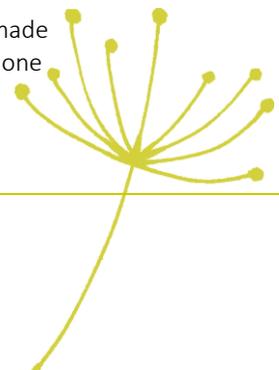
Analysis

Many interviewees recalled the Devens’ site visit and related workshops. Those events made a lasting impression regarding what an eco-industrial park should be, perhaps even more so than the GVBP site-specific Mithun report. However, the Devens’ site and examples cited in the Cogan Owens Cogan report (and, presumably, in the workshops) may not have been the best fit for the region’s industrial parks, and especially as examples for *new* eco-industrial developments. For example, the oft-cited Kalundborg, Denmark⁸ example involves business-to-business connections with the waste streams from one business flowing to other businesses, such as wastes from an enzyme manufacturer being turned into fertilizer. While this is a good example of the concept of industrial symbiosis (by-products being transformed into inputs), Kalundborg took 30 years to evolve among existing businesses and is not a new industrial park development. Devens is a mixed-use community developed on a brownfield site under a very unique quasi-municipal governance structure. With respect to new development, its green infrastructure (sustainable stormwater infrastructure) development standards are relevant, but are one of many such examples nationally. Its Eco-Enterprise Center also offers an inspirational model for how the Port or City could work with existing businesses to increase their sustainability performance, but does not inform new eco-industrial development. Overall, Devens has incorporated many sustainability features, but much of its success stems from the organization’s structure and continued presence in the development, elements which do not translate to the GVBP site. The Cogan Owens Cogan efforts inspired interest and support in the eco-industrial park concept, but may have contributed to unrealistic expectations regarding the ability of industrial park developers to foster industrial symbiosis from the outset, while missing opportunities to address eco-industrial potential in areas more relevant to a new development, such as for sustainable infrastructure (with the exception of stormwater).

The Mithun report, which was directly referenced in the grant application, does generally advance the notion that infrastructure and business operations (energy, water, waste management, stormwater and transportation) should reflect eco-efficient goals; that development standards and incentives will help to advance eco-efficient practices; and that an ongoing program (eco-concierge) is likely required to foster collaboration and industrial symbiosis among the businesses in GVBP. The Mithun report also touches on the importance of an integrated design approach by recommending an integrated master plan. However, it too may have contributed to expectations that industrial symbiosis can be easily achieved in a new eco-industrial development.

Based on the description of the Integrated Site Master Plan in the grant application, decisions were made at this stage to narrow its scope to stormwater and related landscape elements reflected in a standalone

⁸ <http://www.symbiosis.dk/en>



Stormwater Management Plan. Decisions were also made to not pursue district energy or other eco-efficient infrastructure systems (water, waste management, transportation except for pedestrian movement). This makes sense in light of the site structure and the limited degree to which feasibility for those systems was evaluated in the Mithun plan, although development standards could have encouraged eco-efficient water, materials, and energy use beyond that that would be achieved by buildings pursuing LEED® certification (as is discussed in more detail later in this report).

Eco-Industrial Element: Green (Stormwater) Infrastructure

Overview

Stormwater Management Plan

The Stormwater Management Plan, developed by Williams Creek Consulting, provided the Port guidance and recommendations for the development of Port-built master infrastructure and lot level infrastructure within GVB. The goals were to maximize development flexibility and increase marketability of individual lots in a manner that provides benefit to the Port, City and developers through the implementation of sustainable infrastructure. The Master Plan was supported by separate lot-specific scenario analysis that evaluated business as usual versus low impact design options. The Stormwater Management Plan discusses sustainability and triple bottom line benefits, consistent with eco-industrial development.

The Stormwater Management Plan helped to confirm the site's infiltration capacity and clarify area-specific stormwater management constraints and related City policy. This was especially helpful in providing certainty to developers.

Development Standards – Green Infrastructure

The Stormwater Management Plan and City stormwater management policies specific to the GVB informed the preparation of the development standards for green infrastructure. Rather than requirements, the green infrastructure development standards were presented as a toolkit from which lot developers could select the best tools for their site. The development standards also reflected the Port's desire to not build master infrastructure (as well the City's limited capacity to own and maintain such infrastructure), but to keep the responsibility and control of stormwater infrastructure in the hands of the lot owners.

Green Infrastructure Incentive

The Port offers an incentive to facilitate green infrastructure design at GVB consistent with the development standards. The incentive supports the developer in exploring green infrastructure options during the preliminary design phase. This is a one-time, \$10,000 incentive per lot. The lot developers can (and should) retain green infrastructure consultants at any time outside of preliminary design, but the incentive would not apply then.

Analysis

The GVBP stormwater infrastructure constructed to date reflects ‘natural’ stormwater management systems, through infiltration and other low impact development (LID) practices. The GVBP has achieved the development of green infrastructure, supported by a Stormwater Management Plan and Development Standards that were consistent with eco-industrial development, and driven by relatively stringent neighborhood-specific stormwater design requirements at the City. The **community benefitted** from a neighboring industrial site that included more natural, and arguably more aesthetically pleasing, landscape features, as well as from increased flood protection to surrounding properties on the north side of the site.

The Stormwater Plan was reported to be useful in discussions between Port staff and lot developers in demonstrating the viability of designing for infiltration, and influenced negotiations with the Lot 9 purchaser. The Port’s groundwork on stormwater management was beneficial to the lot developers in one other way – it sped up the development process by essentially providing conceptual design.

While the owner of Lot 9 did not end up claiming the green infrastructure incentive, the City’s regulations, supported by the Port’s knowledge of infiltration capacity and conceptually feasible green infrastructure design options, facilitated the kind of engagement and design envisioned by the Port. Ultimately, the more ecologically desirable infiltration also proved to be the most cost-effective option for Lot 9.

Ultimately, the Port’s policy was to avoid the need to construct infrastructure before lots were sold to maintain maximum flexibility for lot purchasers and to minimize the Port’s upfront capital costs. This policy, combined with the lack of internal road requirements, meant that all stormwater infrastructure will be the responsibility of lot owners. There are no plans to implement Port-built master stormwater infrastructure. However, some staff acknowledge that, in hindsight, master stormwater infrastructure might have benefitted the GVBP.

Eco-Industrial Element: Connectivity

Overview

Connectivity and Access Plan

The Port and Technical Advisory Committee (TAC) worked with Mackenzie to develop the Internal Connectivity and Access Plan, funded in part by Metro Regional Government Community Planning and Development grant. The intent is to design this connectivity to support pedestrian access while minimizing impacts at final build out and allow for integration with green stormwater infrastructure and other improvements.

The Connectivity Plan focused primarily on pedestrian movement due to the ultimate lack of new public / park-wide road infrastructure planned within the GVBP. Consistent with eco-industrial development, the Connectivity Plan also referenced a triple bottom line approach, and included a discussion of sustainability with respect to materials selection. The Connectivity Plan influenced the Development Standards.

Development Standards – Connectivity

The Development Standards clearly specify the intent for the GVBP to maintain connectivity within the site as well as with surrounding public roads. The Development Standards include a graphic (recently updated) showing the overall connectivity master plan, also shown in Figure 4. The Development Standards do



encourage artwork to be incorporated, but there is no specific encouragement of interpretative materials. The Development Standards also encourage pedestrian pathways to be integrated with other facilities on-site.

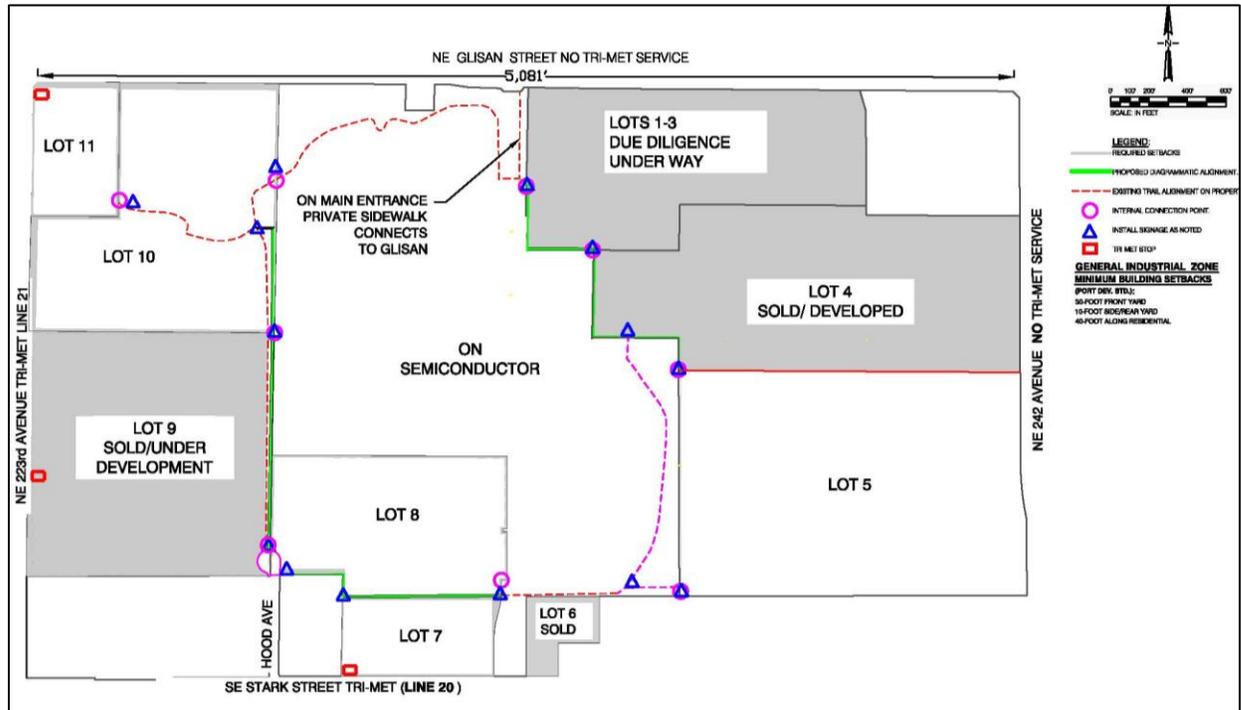


Figure 4: GVB Pedestrian Connectivity Concept, 2016

Analysis

Although the GVB is not yet fully built-out, significant pedestrian connectivity has been achieved. Interviewees reported walking paths are frequently used by workers. The **community benefits** from connectivity through a large block of land, with potential connections to bus stops on Stark and 223rd; the commercial node near Glisan and 223rd; and any future commercial development on Lot 11.

However, some challenges were reported. In general, the market appeared to view the trails as a constraint on the site development (i.e., land they pay for but can't use operationally) rather than an amenity. The developer of the Subaru site was concerned about a potential wind tunnel effect that would draw in trash and debris. Lot owners also expressed security concerns. These concerns were mitigated by the conditions in the Development Standards that ensure lot owners retain ownership of, signage and fencing, and maintenance responsibility for pathways through their property, and supported by proactive negotiations with lot owners. The pathways are not publicly maintained easements. Due to financial constraints, the City was hesitant to undertake the financial responsibility for pathways. ON Semiconductor was long-supportive of the trails, and reports that their employees use them. The ON Semiconductor trails are marked private, as the existing ON Semiconductor site was not subject to the Development Standards.

It remains to be seen whether the pedestrian pathways achieve their full potential as an amenity for all employees in the GVB as well as for the public. Some stakeholders worry that the model, in which full-control of the pathways is given to lot owners, will result in employees generally using paths owned by

their employer as a 'lunch-time' amenity versus as movement corridors and that there will be shrinking public use and access, especially if any businesses feel they must increase screening or fencing.

There are no primary internal roadways in the GVBP. Due to the large lot size and relatively few number of lots, as well as sufficient access from existing periphery roads, no primary internal roadways were required. This also maximizes developable land within the GVBP. A joint access was ultimately included for Lot 9 (Subaru) and its neighbor. Overall, the lack of internal roadways, especially publicly owned and maintained ones, meant that this opportunity for eco-industrial design was not applicable to the GVBP.

Eco-Industrial Element: Green Buildings

Overview

Development Standards: Enhanced Building / Site Design

The document encourages buildings to be developed to the LEED-certified standard, which if pursued has the potential to address multiple sustainability elements, including energy and water conservation, stormwater management, and sustainable materials selection. Specific stormwater (green infrastructure) standards also align with LEED® requirements.

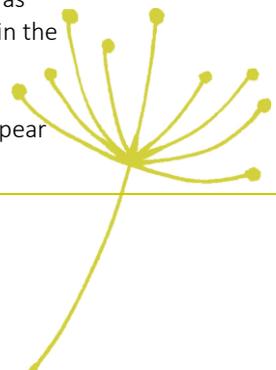
LEED® Incentive

The Port offers an incentive for LEED certification in an effort to help companies within the GVBP realize lower operating costs, increased asset value, and a healthier more productive environment for their occupants. The Port offers a one-time \$20,000 incentive per lot to help offset the cost of certification. The incentive does not specify which level of certification is to be achieved. As certification can take 6-12 months post-occupancy, the LEED incentive does not reduce any up-front project costs associated with LEED® registration fees or documentation management, but a reimbursement for LEED® registration and certification fees. However, the existence of the LEED® incentive offers a leverage point for a conversation with potential and actual developers regarding green buildings generally, and the LEED® certification standard specifically.

Analysis

In principle, some level of building performance above and beyond existing codes and regulations (the legal minimum standard) should be achieved by every building in an eco-industrial development. This is usually achieved through specific requirements in Development Standards and/or requiring that a green building certification be achieved. When specific elements of green building design are targeted through Development Standards, the requirements are often modelled on specific credits from certification systems. LEED® building continues to have the highest market penetration particularly in the commercial/office sector. Industrial LEED is less prevalent in the marketplace although growing. There are more than 1,755 LEED-certified industrial facilities worldwide - 63% of which are in the U.S., with 29 in Oregon, 48 in Washington, and 200 in California - plus another 2,710 projects in the "certification queue". GreenGlobes®, seen to be less stringent than LEED® is also gaining market share. Other systems such as Passive House, Living Building Challenge or the WELL Standard have not yet made significant inroads in the industrial sector, although there are now some Passive House industrial examples.

Based on interview responses from the Port and City staff, as well as the design sector, there does appear to be local market resistance to LEED® certified industrial buildings. However, based on interview



responses, many LEED® compliant elements are incorporated, especially on the energy side, such as LED lighting and higher levels of insulation. This occurs in addition to the relatively stringent state energy code.

Certainly, for the building archetypes likely to be built in the GVB (simple industrial facilities that are greater than 100,000 square feet), design elements that reduce heating and lighting costs are likely to have acceptable simple paybacks, and should be pursued regardless of certification requirements. Therefore, those design elements should be required by development standards without as much market pushback. The selection of materials with low embodied energy and durability and that contribute to air-tightness would likely have also have a business case to the building owner and, at a minimum, should be strongly encouraged.

Where local policy exists to manage stormwater on-site or to increase green space / biodiversity, then features such as green roofs can help to meet those policy goals. The direct benefits of such features to the lot owner, however, are less than for features that improve energy or materials performance. This is one area where incentives and local pilot projects may still be needed.

With respect to LEED® certification costs, it is important to note that they represent a very small portion of industrial costs. Using a base cost of \$50 per square foot (rough estimate using median cost index for warehouses in Portland from the cost estimator at www.buildingjournal.com), the maximum LEED® Building Design+Construction registration and certification costs would be as follows:

Building Size	Registration + Certification Cost	Registration + certification cost per square foot	Registration + certification costs (% of building costs)
200,000 sf	\$16,100	\$0.08	0.2%
400,000 sf	\$29,900	\$0.07	0.1%
600,000 sf	\$40,500	\$0.07	0.1%

Interviewees felt that in addition to the above costs, there would be additional project costs to achieve even the minimal LEED® certification, let alone Silver, Gold, or Platinum. This perception is not borne out by market data, which suggests that LEED® certification and LEED® silver can be achieved with minimal extra cost or extra cost that is associated with a quick payback especially if an experienced design team is engaged. In theory, for experienced industrial developers and investors, there should be very little extra design or construction cost because they have the potential to easily apply their LEED® compliant elements and certification process to other industrial projects. There is frequently enough similarity project to project in the industrial sector that the argument regarding LEED® certification costs becomes weak for an experienced developer working with experienced, qualified design staff. Investments in energy performance and quality materials will benefit operating businesses / tenants by minimizing operating costs and will benefit building owners by maintaining the asset value for a longer period of time. This holds true regardless of whether the development is advanced under a build-to-suit, speculative, or owner-occupier model. For a speculative development, there should be no negative impact on marketability or financial performance, especially for an experienced developer using an experienced design team who, therefore, managed design and construction costs.

Currently, the owners of Lots 1, 2, 3 are targeting LEED® certification, while the owner of Lot 9 did not, although the building incorporated some energy reduction measures beyond code requirements. The development of Lots 1, 2, 3 is partly backed an institutional investor; such investors have tend to be progressive but also seek green buildings as a means of protecting the value of assets in their portfolios. On the other hand, Subaru, the Lot 9 tenant, did not appear to have explicitly LEED® goals, despite significant

sustainability efforts in its operations. Leverage points for advancing sustainability in the various development models (build to suit, speculative, and owner-occupier) are further discussed in the Marketing section.

It should also be noted that lot developers felt that the LEED incentive did not affect their decision to (or not to) pursue LEED. However, the existence of the incentive provided a lever for a green building conversation between Port staff and potential / actual developers.

Finally, there is clearly a need to support green building education within the industrial sector. As the region's largest developer of industrial land, the Port could play a key role in this. This could include developing and disseminating additional resources, such as Industrial Green Building case studies or green lease⁹ templates. There are some strong regional organizations, such as the US Green Building Council (USGBC) and NAIOP (Commercial Real Estate Development Association Oregon Chapter), with whom the Port could collaborate on education initiatives. Building regional capacity would also facilitate future eco-industrial marketing and sales efforts.

Eco-industrial Element: Marketing and Sales Efforts

Overview

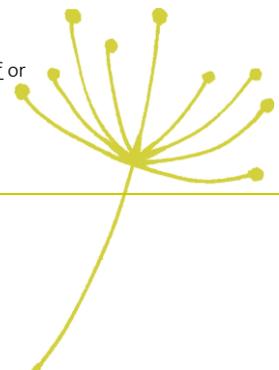
Marketing Study and Recruitment Plan

Johnson Economics, IronWolf Community Resources and Cogan Owens Cogan were retained by the City and Port to conduct an Eco-industrial Marketing Study and Recruitment Plan ("Marketing Plan"). The Marketing Plan focused on industry trends and target industries for the eco-industrial park concept which allowed them to formulate a series of strategies for recruitment but identified significant issues regarding market knowledge and acceptance of the concept. It proposed a threefold strategy involving collaborative marketing to local and regional companies, international/trade investment and targeting suppliers or existing local companies. The report outlines potential motivations for firms and developers.

The Marketing Plan did not establish a brand (e.g., logo and a tag line), but did present target sectors and means of reaching them. The study reinforced "[T]he branding of an EIP can be a good tool for recruiting firms which have corporate goals for sustainability", but because of perceived market confusion about the eco-industrial concept, the study then recommended that the GVB *not* be branded as an eco-industrial park in marketing material. The report was thorough in identifying target sectors and even specific target firms within those sectors, but missed the point that many of those firms, such as Pepsi Co, have demonstrated very strong sustainability leadership. Subsequent testing with site selectors apparently strengthened the report's proposition that sustainability-related marketing might harm sales.

Based on this recommendation from the Study and subsequent conversations with site selectors, the marketing collateral and approach did not present a sustainability-focused brand (or a strong brand otherwise), thereby possibly limiting efforts to reach sustainability-minded players within the target sectors. There were some early Port marketing materials (see next section) built around the eco-efficient goals, but these were discontinued following discussions with developers and a site selector.

⁹ For example, see <https://industry.gov.au/Energy/EnergyEfficiency/Non-residentialBuildings/Documents/glsTenantsGuide.pdf> or <http://www.greenleaselibrary.com/lease-forms--case-studies.html>



As has been standard practice for such developments, the Port relied on brokers and developers to drive buyers to the site and undertook limited direct marketing itself.

GVBP Eco-Industrial Development Fast Facts

This two-page brochure was developed early in the marketing and sales process. It was not widely used since, as noted above, the Marketing Plan and subsequent conversations with site selectors, advised against branding the site as an eco-industrial development.

The brochure notes the Port's experience as a developer, as well as the advantages of Gresham as a location. It also includes a definition of eco-industrial development, an overview of available incentives, a discussion of available EID opportunities, and benefits of an EID. There is no site plan or lot pricing on the brochure.

Some of the EID opportunities listed may have been difficult to implement at GVBP, which may have confused marketing efforts. For example, other than encouraging LEED® certification, the development standards did not promote energy or water conservation or waste minimization. Similarly, although the Port does have water rights at GVBP and has done extensive work on the use of non-potable water for industrial development, there was no specific background technical work or corresponding development standards at GVBP to promote the use of non-potable water by GVBP businesses. Furthermore, without a pre-defined resource (e.g., an eco-concierge or dedicated Port / City staff person) dedicated to working with businesses to improve their operations, it's not clear how operating businesses would achieve further resource conservation or synergies.

The EID benefits are well-presented, although there are no case studies or references.

Analysis

Marketing efforts have been somewhat successful by conventional measures in that several lots are sold, at a slightly longer absorption rate than was expected but consistent with the overall regional market. However, none of the lot developers is believed to have been strongly aware of and attracted by the GVBP's sustainability goals. Further analysis is provided below, based on the lot development model. The discussion focuses on relationship of sales and marketing to goals related to building and site design, since there were no explicit operational goals implemented or promoted.

Build to Suit Model

Sustainability can be driven by the end user or by the developer. Marketing efforts should reach sustainability-minded developers and end-users.

For end users, green buildings and more natural sites can contribute to reduced operating costs and better employee attraction, retention and productivity. For some end users, a green building represents means to demonstrate a sustainability ethic that may in turn align with operations (e.g., FedEx¹⁰). With respect to end users, the fact that even Subaru, which elsewhere in the U.S. is lauding its zero waste efforts, was not engaged in the sustainability discussion during negotiations or facility planning and design speaks to a capacity gap in the industrial sector (as well as to the classic situation wherein the right hand – operations – not being aware of what the left hand – real estate and facilities – is doing). Nonetheless, it is worth attempting to reach sustainability-minded end users during the marketing stage. For example, the

¹⁰ <http://www.ccjdigital.com/fedex-pursues-leed-certification-for-new-buildings/>

TaigaNova master developer worked with the industry trade magazine Oilsands Journal to secure a feature article about proposed sustainability and innovation at the TaigaNova industrial park in Fort McMurray, Alberta. While interviewees on both sides of the sales process reported that direct contact between the seller and an end user would be frowned upon; there is some precedent in our experience. For example, the Toronto & Region Conservation Authority sponsored an innovative stormwater management mini-design workshop for a proposed 400,000 square foot logistics facility that engaged both the developer, his design team, and his end user (Canadian Tire, a large firm competitive with Home Depot in the Canadian market).

For developers, green buildings represent a strategy to protect the value of their assets, which they may hold for longer than the original end user is in place. Green buildings are more durable, and are also more future-proof with respect to maintaining relevance in the face of certain long-term building code and market evolution. Many institutional investors, such as New York Life Real Estate, which is backing the development of Lots 1, 2, and 3, already recognize this. Marketing efforts should reach as sustainability-minded developers as possible.

Speculative Model

Sustainability is primarily driven by the developer, since end-users are often not identified until after construction is underway. In addition, speculative developments frequently contain more than one end-user. Some end-users with more complex operations can drive sustainability by exerting pressure through a green lease or negotiating sustainability-driven fit-outs (e.g., targeting LEED®-Commercial Interiors certification). Complementary marketing material would help the developer to attract eco-friendly tenants.

For developers, the situation is the same as discussed above under the Build to Suit Model.

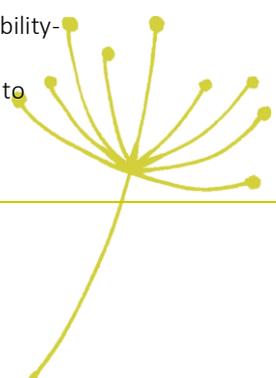
Owner-Occupier Model

This model is the least prevalent in the industrial sector as more companies seek to remove real estate assets from their portfolios, preferring to operate in long-term leases instead. From a marketing standpoint, the owner-occupier can be considered as both an end-user and developer and the situation is as described above.

General Comments

Most interviewees believed that the promotion of 'green' goals would drive away some prospective purchasers and could scare away lenders to both the master developer and lot developer. The market expects a discount on sites with significant development restrictions, regardless of whether they are natural (e.g., poor soil quality) or regulatory. Given the financial risk undertaken by the Port (or any master developer), it is understandable that there is a desire to ensure that absorption rates and sales prices are not negatively impacted by eco-marketing efforts, especially since the Port relies on revenues from its industrial development to help finance subsequent industrial developments. When the master developer is solely a government or government-owned organization, profit targets are usually lower, with some governments supporting investments (or subsidies, depending on the government philosophy) to achieve other goals such as job creation or advancing sustainability demonstration projects.

However, there is merit in at least a two-pronged approach, with some effort made to reach sustainability-minded end-users or developers. This might require that the Port (or other master developer or local government economic development office) undertake greater and more direct marketing in addition to standard methods.



With respect to reaching sustainability-minded end users and developers, some other considerations are listed below:

1. Early engagement with the market, such as during master planning, should be used to get a broad read on the actual, versus perceived, market tolerance for sustainability requirements. For example, master developers can pursue an integrated design process during master planning that engages archetypical or use focus groups to vet draft development standards.
2. Conventional site selection features, such as lot size, level of servicing, location with respect to major transportation routes, and pricing need to be clearly presented, even when pitching to a 'greener' audience.
3. Make sustainability goals clear and part of the branding, at least for the related marketing efforts.
4. Support marketing with a social and conventional media strategy.
5. Leverage the sales process itself. For example, TaigaNova issued a Request for Purchase and Development Proposals, which included a submission form that helped potential purchasers to explore and develop their sustainability efforts. Their proposals were attached to and referenced in the final Purchase and Sales Agreements.
6. Target investors with known sustainability policies, such as New York Life Real Estate Investors or Sunlife / Bentall Kennedy.
7. Target progressive end users within the existing traditional target sectors. For example, if the region is a hub for food processing, research companies with strong corporate social responsibility policies.
8. Tap the burgeoning 'green' scene in Portland to support marketing. The USGBC's industrial facilities committee includes two members from Portland. NAIOP and the Urban Land Institute have local chapters, and have supported green building elsewhere.
9. Integrate marketing efforts with general capacity building efforts. For example, offer green industrial building webinars in the months leading up to a marketing campaign or incorporate case studies developed as part of educational efforts into marketing materials.

Eco-Industrial Element: Sustainable Business Operations

Overview

Eco-Industrial Concierge Feasibility Study

The Eco-Industrial Concierge Feasibility Study explored options for providing waste minimization and resource efficiency services to support traded-sector businesses at GVBP and make connections to existing businesses in the Columbia Corridor that are interested in sustainable business practices.

The Eco-Concierge Feasibility Study was a first step in exploring whether an Eco-concierge Program that creates a support network for current and future GVBP business partners to reduce development operational costs and support workforce education, training and networking is feasible. The study recommended two options for an eco-concierge program. Option 1 involves working with multiple partners to build on and expand the existing ResourceFull Use program, adding services related to "...resource efficiency, energy efficiency, networking, sustainability consulting and marketing." GVBP would be targeted by the program, but the program would be delivered in the greater region (corridor). Option 2 also involves regional delivery via either a new non-profit whose board would draw from multiple stakeholders or a partnership with an existing non-profit. Option 2 would be linked to positioning the region as a 'living laboratory'.

Analysis

Neither option from the Eco-Concierge Feasibility Study was implemented, as neither option ultimately met triple-bottom line requirement for the GVBP. Currently, no industrial symbiosis (waste to input linkages) or other business-to-business collaboration (beyond the site connectivity and two lots sharing stormwater management systems) has evolved in GVBP.

The Eco-Concierge Feasibility Study conclusion that business collaboration, especially in a manner that results in industrial symbiosis, is best fostered regionally with existing businesses is consistent with what is now seen as international best practice. While this outcome runs counter to some of the earlier documents that suggest that industrial symbiosis is almost a necessary condition for eco-efficient employment lands, it is actually rare that *new* developments, especially in democratic, market economies, achieve industrial symbiosis from the start. Furthermore, the 'develop and exit' model that prevails in the North American market makes it difficult to work with potential businesses in a new eco-industrial park.

However, our research indicates that the United Kingdom-developed National Industrial Symbiosis Program (NISP) model, now running in 21 countries and endorsed by groups like the European Union Directorate General for the Environment and Global Green Growth Forum, is the best model for advancing industrial symbiosis regionally. A feasibility study documenting this research can be found here: <https://nispcanada.files.wordpress.com/2016/06/nispcanadafeasibilitystudy20160725.pdf>. With respect to advancing sustainability within individual businesses, such as improving energy efficiency, the models suggested by the Eco-Concierge Feasibility Study are appropriate.

Industrial Symbiosis in Action: Case Studies from NISP-UK

Guinness Power

Quality control batches of Guinness Beer (which become unsaleable) used to be discharged to sewer. Now, they are sent to Diageo's power producing anaerobic digester.

A Fruitful Collaboration

Terra Nitrogen Ltd by-products of CO₂, and steam are now with a 38 acre greenhouse owned by John Baarda Ltd. Now, British greenhouse tomatoes compete Spanish ones in the winter!

Unlikely Playdate

Clean offcuts of light insulation foam used by Dunlop Marine to make hoses for offshore oil & gas industry are diverted by landfill and now used by North Lincs in the manufacture of children's teddy bears.

Although the Port will not retain ownership of any lots, they continue to have strong relationships with businesses located in Port developments. As such, the Port could support continued business sustainability improvement and the implementation of industrial symbiosis regionally, including in the GVBP, through one of the proposed Eco-Concierge models or a NISP-type program. The Port could also include green building retrofit education in any industrial green building education, thereby targeting existing businesses and building owners.

Lastly, specifically within the GVBP, Subaru reported that it recycles 95% of its waste at its distribution facility, and is striving for 100% to match their manufacturing facility operations. ON Semiconductor has implemented a significant water reuse project and has an internal Green Team working to expand its recycling efforts. Not only could these companies serve as mentors for other GVBP or regional businesses, but they may be able to collaborate and share knowledge between them as well. ON Semiconductor has already expressed interest in meeting with Subaru to explore collaboration opportunities; the Port could help to facilitate such a meeting and support implementation efforts, such as any feasibility studies.



LESSONS LEARNED

Eco-Industrial Element: Green Infrastructure

GVBP achieved exemplary green infrastructure via low impact stormwater management practices.

The example of the owner of Lot 9 re-designing their site to accommodate infiltration, and saving money in doing so, is a compelling one. This outcome was made possible by the revisiting of site geotechnical conditions and shaped by the Port's proactive analysis of site-specific traditional versus low impact scenarios; development standards; and the City's willingness and ability to waive system development charges (SDCs). The consultant retained to complete the GVBP stormwater management plan was also well-versed and experienced in innovative stormwater management design.

The lot developers did not perceive the incentives as large enough to drive their decision-making. Low impact stormwater management was achieved in response to the City's relatively stringent discharge standards for the area, and supported greatly by the technical scenarios developed by the Port and its consultants. However, the City's willingness and ability to waive SDC's may have contributed more to the incorporation of infiltration techniques than the incentives. A stronger pitch on potential incentives by the Marketing team may have enhanced the use of incentives; however, developers often are reluctant to alter their standard development team.

Recommendation: EID master developers should implement development standards for green infrastructure for all EIDs. This is a key means by which to demonstrate eco-industrial principles, and there is now regional precedent. The GVBP Development Standards and City GVBP stormwater policies can be used as a template. The extent to which practices are required versus encouraged should be tested in the market before such standards are adopted, keeping in mind an EID should aim for leading not just best practice. More practices may be required, and/or higher quality and quantity goals may be established, if the master developer or local government is able to offer green infrastructure incentives or SDC credit. Incentives can offer a lever for green infrastructure discussions early in the lot development process.

Recommendation: When development timelines permit, and especially for highly constrained sites, future EID master developers, including the Port, should also consider completing upfront technical analysis and developing site specific traditional versus low impact stormwater management scenarios that can be used by lot developers. These will support higher development standards and negotiations with developers with respect to implementing more innovative stormwater management development.

Recommendation: EID master developers should ensure that consultants retained for stormwater management plans are well-versed and experienced in innovative / low impact stormwater management design. Green Infrastructure Incentives can be offered where feasible to encourage lot developers to do the same.

Recommendation: The Port is well-positioned to lead regional education efforts regarding the benefits of green infrastructure for industrial developments. The Lot 9 stormwater management design could be developed into a case study that supports capacity building for marketing staff, civil engineering / landscape architecture consultants, and the development industry. Such education would create more interest and buy-in from lot developers.

Eco-Industrial Element: Connectivity

GVBP was successful at increasing connectivity within the park versus a ‘business-as-usual’ scenario.

Several interviewees felt a strong attachment to the connectivity piece, supporting it as a goal early on, and expending effort to ensure it was implemented. One interviewee reported that if you visit the site, you are likely to see ON Semiconductor or other employees walking along the site path. This amenity contributes to employee health and well-being (and, therefore, productivity and retention) and supports the overall intention of eco-efficient employment lands.

Recommendation: Future EID master developers should ensure that pedestrian connectivity is established as a goal in the planning stages, and is then reflected in the master plan and development standards. The GVBP Development Standards can be used as a template.

Recommendation: GVBP’s success in achieving pedestrian connectivity should be developed into a case study two years after full build-out of the GVBP, and included in any EID education offered by the Port, Metro Regional Government or other regional partners.

Recommendation: Where local government resources exist, local governments should consider public ownership or easements for pathways to maximize employee and community benefit where appropriate. In some cases, retaining private ownership may make more sense.

Eco-Industrial Element: Green Building

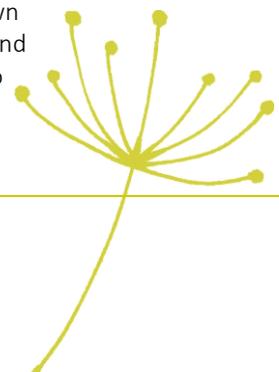
GVBP will be home to LEED®-certified industrial buildings.

The GVBP likely will be home to 10% of the LEED® certified industrial buildings in Oregon with three LEED buildings on Lots 1-3. This represents a 10% increase in the market penetration of green building in the industrial sector (a total of 32 buildings statewide) – a significant increase as industrial LEED has been slower to catch on than commercial LEED. In addition, some of the other buildings designed to date were reported to incorporate some green building features such as LED lighting or extra insulation because they had a good payback.

While the incentives did not influence the investors’ decision to build to LEED® standards, the incentives and design standards clearly signaled that the GVBP was open for ‘green business’. In the same way that developers building business-as-usual buildings feel that higher green standards might delay their projects, especially if they are inexperienced, developers experienced with green buildings know the inverse can also be true – it can be difficult to design and build to a higher standard if the local regulatory authorities are not open to approving different designs.

Overall, there appears to be substantial resistance to green buildings, especially LEED® certified ones, in the industrial market. Some of this resistance is due to misconceptions about green buildings. There is an opportunity for the Port and its partners to build regional capacity around industrial green building.

Recommendation: EID master developers and local government economic development offices should ensure marketing efforts target institutional investors and other large real estate investors with known sustainability efforts. Most large investors now seek out green buildings as a strategy for increasing and maintaining the value of their portfolios. The US Green Building Council’s LEED® database can help to identify such companies.



Recommendation: EID master developers and local government economic development offices should ensure marketing efforts reach progressive firms within their target sectors.

Recommendation: As the largest developer of industrial land in the region, the Port should lead regional educational efforts related to industrial green building (new and retrofit). These efforts could include the delivery of in-person and webinar based training in partnership with groups like the USGBC or NAIOP as well as the development of more passive resources such as an informational website. The Port should develop case studies for the GVBP green building successes (for the LEED® certified buildings as well as for some of the specific green building features incorporated in other buildings) to be incorporated into educational efforts. Case studies could be developed pre-construction to reflect design goals, and then updated after 1-2 years to reflect construction and operation.

Recommendation: EID master developers should continue to use development standards to signal a desire for green buildings, especially given that, by definition, EIDs are meant to perform above the business-as-usual benchmark. In future projects, EID master developers should consider mandating LEED® certification to a basic certified or Silver level, citing GVBP and other Oregon precedents as examples of LEED® industrial buildings and /or GreenGlobes® which was reported by one interviewee to be making inroads in the industrial market. Alternatively, specific design strategies with more current market penetration, such as those that reduce building heating and lighting-related energy consumption, could be required via development standards.

Recommendation: If the local government or EID master developer has financial resources to support green building incentive, they could implement a green building incentive like the one at GVBP to provide an opportunity to discuss green building with developers. Financial resources may catalyze greater eco-efficient activity they support an award (e.g., for the building that achieves the most LEED® points) or education and capacity building, especially in the design and development industries.

Eco-Industrial Element: Marketing & Sales

It was difficult to market the GVBP as an EID because of capacity gaps in the market.

While some marketing materials can simultaneously act as educational materials, their role as such is limited. In a market where there are still many misperceptions or a lack of accurate information about the costs of green building, the implementation of industrial symbiosis, or the benefits of sustainable infrastructure systems, the effectiveness of *general* EID marketing materials is minimized, and, as several interviewees noted, may even weaken sales. Greater regional capacity around sustainable industrial development is still needed to support the advancement of EID.

Recommendation: As the largest developer of industrial lands in the region, the Port should lead efforts to build this capacity, focusing on green building and sustainable infrastructure (including green / stormwater infrastructure, but also around water, wastewater, roads, energy, landscape and amenities). Target audiences include developers, financial institutions, planners, architects, and engineers. The Port could support the delivery of active education (e.g., courses and study tours) and passive education (e.g., online case study libraries). There are many regional organizations with which the Port could partner to develop and deliver sustainable industrial development education, such as the USGBC, NAIOP, Metro Regional Government, local governments like Gresham or Portland, and utilities.

Recommendation: Metro Regional Government should consider updating its Eco-Efficient Toolkit, ensuring it represents best *and* emerging practice for sustainable industrial development and operations, but only if there are also enough resources to support broad and sustained dissemination of the updated toolkit. For example, the GVBP successes and lessons learned should inform the next version. Additional case studies,

backed by 'model pro forma' and more detailed business case information, would be helpful. It would also be helpful to more strongly distinguish between strategies for new developments versus strategies for retrofit / revitalization. As the region's largest developer of industrial land, the Port could be a strong partner in creating the next toolkit. Other organizations such as the Urban Land Institute and NAIOP could be supportive.

Because the GVBP was not marketed as an eco- / green / sustainable development, marketing efforts may not have reached or influenced like-minded developers or end-users.

Although a general EID marketing campaign was difficult due to capacity gaps in the market, a strategically focused EID marketing campaign may have reached more developers or end users more supportive of EID and sustainability. This does not mean ignoring sectors known to be interested in the region; rather, it is a means of reaching progressive players within those sectors.

Recommendation: Until there is greater market capacity, EID master developers should consider a two-pronged marketing approach targeting a general audience via conventional channels such as site selectors as well as targeting developers and end users more inclined to support EID goals. This may require that the EID master developer pursue more direct marketing via less traditional avenues such as social media. Market research can help to identify relevant developers and end users.

Eco-Industrial Element: Eco-Industrial Operations

Industrial symbiosis is difficult to achieve right from the start in a new EID.

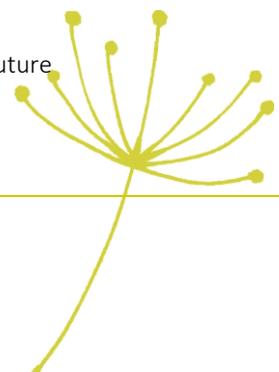
Some of the work that influenced the GVBP, like the Cogan Owens Cogan workshops and report and Metro Regional Government's Toolkit seemed to suggest that industrial symbiosis could be achieved in a new EID setting. There currently is no industrial symbiosis among the first two on-site businesses (if ON Semiconductor is included). It is not likely that there will be symbiosis among any of the new businesses without eco-concierge assistance. This is consistent with the conditions of a democratic, market economy combined with the prevalent 'develop and exit' development approach that makes it infeasible to only sell lots to end users that can plan some industrial symbiosis. No master developer has capital that patient, and there are legal implications of refusing to sell land for a use that complies with local zoning.

Furthermore, there is also a perception from some stakeholders that an EID should target specific industries and their supply chain (i.e., a sectorally-themed EID) to better support symbiosis. This means that marketing efforts should target those sectors, and that sales should be limited where possible to those sectors. Not only is this infeasible for the reasons discussed above, but international experience indicates that symbiosis is frequently achieved across diverse sectors, establishing relationships outside conventional supply chains. For example, the National Industrial Symbiosis Program (NISP) model, which is now running in 21 countries worldwide, has determined that at least 50% of its implemented symbiosis involves businesses from different sectors.

New EIDs can set the stage for symbiosis, but it will be rare to achieve it during 'start-up'.

Recommendation: EID master developers should use design to set the stage for industrial symbiosis (e.g., extra utility corridors / easements or pre-approved symbiosis piping locations).

Recommendation: Local governments should ensure that zoning allows for uses that might support future symbiosis, such as private utilities (e.g., shared wastewater treatment plants or waste heat recovery plants); aquaculture; or greenhouses.



Industrial symbiosis is best achieved by existing businesses, with greater opportunities to be found if symbiosis is pursued regionally.

The Eco-Concierge Feasibility Study rightly noted that symbiosis opportunities within a single EID are generally limited. There are some exceptions, like the 1,300 business Burnside Industrial Park in Halifax, Nova Scotia, Canada, but new industrial parks at that scale are unlikely to be developed in the Portland region (or in the United States). A regional approach results in more symbiosis opportunities for businesses.

Recommendation: Although the Port does not retain ownership of the industrial lands it develops, it does maintain good relationships with lot owners and end users. The Port, working with Metro Regional Government and other stakeholders like the Urban Land Institute, is well-positioned to champion regional industrial symbiosis, which would benefit businesses at GVBP as well. Based on several international studies, the National Industrial Symbiosis Program (NISP) model¹¹ appears to be the most successful at identifying and implementing symbiosis opportunities. However, other methods such as databases and technical audits / studies have also supported the implementation of industrial symbiosis.

There are likely opportunities to continue to boost the sustainability performance of businesses at GVBP.

Aside from symbiosis, there are many other actions businesses can take to contribute to more sustainable industrial operations. This ranges from implementing environmental management plans to energy and water conservation to complete product redesign to phase out fossil fuel-derived inputs. As discussed earlier, marketing efforts can help to attract companies already working on improving their environmental performance. However, any business, 'green' or not, likely has room for improvement and could benefit from support to do so. Any one EID (or standard industrial park) is unlikely to require a dedicated Eco-Concierge, but a regional Eco-Concierge could support businesses. The Port is well-positioned to support or champion the creation of an Eco-Concierge.

Recommendation: The Port should further explore the Eco-Concierge Feasibility Study recommended options.

Recommendation: The Port could play a role as an 'honest broker' between businesses in the GVBP, helping to bring companies together to share knowledge and explore collaboration to advance sustainability. (Note: Should a regional Eco-Concierge be established, then this would become the responsibility of the Eco-Concierge.)

General Lessons Learned

It takes (and will continue to take) leadership, partnership and very hard work to realize an EID.

The GVBP was successful due to the significant leadership and efforts of the Port and City staff, above what would be required for a traditional industrial development. Much of the GVBP's success is due to the cooperative partnership between the Port and the City. City staff worked well and in a coordinated manner with Port staff. City incentives such as reduced SDCs were helpful in advancing green infrastructure goals. Future EIDs will still require this strong commitment and co-ordination with the local government.

¹¹<https://nispcanada.files.wordpress.com/2016/06/nispcanadafeasibilitystudy20160725.pdf>

The Technical Advisory Committee (TAC) structure reflected the partnership approach, engaging representatives from multiple departments at the Port and City, as well as representatives from Metro Regional Government and ON Semiconductor, throughout the entire project.

The GVBP was successful in piloting green infrastructure and green buildings. The GVBP pilot also produced exemplary Development Standards that articulated the integrated vision for the site with EID elements above and beyond City code requirements. The Development Standards were an important tool for advancing green infrastructure and green buildings in the GVBP. Once all the lots are sold, the Development Standards will stay in force through the GVBP Owners' Association, and will continue to influence any retrofit or re-development in the GVBP.

There are many other elements of an EID, such as incorporating renewable energy systems, even higher performing buildings, or wastewater re-use, that are worth exploring in other pilots. Other development models, such as Port-partner joint ventures or even private EIDs, may also require piloting. Any future EID developer, whether the Port or another organization, should be aware that EIDs will remain an innovative concept for some time.

Recommendation: EID master developers, whether the Port or others, should engage local governments as early in the planning process as possible to identify common goals and a process for maintaining collaboration as the development proceeds. EID master developers should consider how their EID can support local goals such as for stormwater management, job creation, investment attraction, and resource conservation.

Recommendation: New EID projects should continue to be guided by multi-stakeholder Technical Advisory Committees, including representatives from the master developer's team, local government, and Metro Regional Government. Other TAC members could include representatives from businesses or associations in the target sectors; the real estate industry (site selectors, developers, commercial brokers); financial institutions; utilities, or local research institutions.

Recommendation: EID master developers should use Development Standards as a means of articulating the EID vision and helping to advance design beyond local code.

Recommendation: Master developer marketing efforts should be supported by and integrated with local economic development efforts.

The GVBP was well-served by the preparatory work undertaken by the Port.

Recommendation: Where time and resources permit, EID master developers and/or local governments should complete as much background work as feasible (e.g., geotechnical studies, topographic surveys, ecological site assessments) to create a more robust master plan and to facilitate lot developers' due diligence and design efforts.

The amount of technical information, documents, and people involved in the project made it difficult to sustain broad knowledge and even buy-in for the life of the project.

Some stakeholders who became associated with the project part-way through reported that it was difficult to get up to speed, while others were frustrated by the number of documents to track. Still others appeared unaware of previous or related efforts that could have possibly influenced their efforts.

Over the years, an integrated design process has become standard for green buildings as a means of ensuring the full benefits of inter-disciplinary collaboration are achieved, but also to create clear design



principles and goals that can be readily referenced as the project moves forward. The same process holds tremendous value for EIDs.

Recommendation: EID master developers should produce a single, integrated master plan¹² to guide EID planning and development. Integrated master plans bring all project plans into one document, encompassing land use, access and movement, landscape and ecology, site servicing, and lot development goals. Integrated master plans are supported by discipline specific technical studies, such as stormwater management plans, but help to synthesize and integrate such studies. Integrated master plans can also support marketing by having all project goals in one place and providing an opportunity to present case studies or precedents to build capacity and inspire innovation. Integrated master plans usually contain visual renderings that can be included in marketing collateral materials as well. For an EID, such plans should indicate which elements are more innovative or advance sustainability. The integrated plan should also describe interactions between individual elements (e.g., the sustainable stormwater features will provide a more natural feeling and employee amenities).

Recommendation: To ensure an integrated process for concept planning, master planning, *and* site design / engineering, consultants should be required to deliver / participate in an integrated design process (IDP), and should have experience in doing so. IDP training for the land developer and local municipal authority could also be beneficial.

Recommendation: The EID master developer should prepare a short document or presentation that acts as a ‘touch-stone’ for the project. Anyone working on an EID should have had a clear vision and goals to check back against and ask “do my efforts align with the overall vision and goals?” An executive summary of an integrated master plan would serve this function. (Note: the GVBP Fast Facts brochure was meant to serve this function, but some of its content did not align with later project efforts.)

Recommendation: By requiring pre-design meetings, Development Standards can be used to lever a conversation with lot developers around integrated design. (The GVBP development standards did include pre-design and preliminary design meetings, but this requirement was modified to accommodate the development schedule which created some design and compliance issues.)

Not all stakeholders or consultants will have the same level of eco-industrial / sustainability literacy.

As discussed in the Analysis, there are still some misperceptions regarding the prevalence, cost, and business case for green buildings; the implementation of industrial symbiosis; and eco-industrial models (e.g., is an anchor tenant required or not). Misperceptions in the market can be addressed through marketing and sales recommendations presented earlier, which, in turn, will be easier to implement if there is an integrated master plan from which to work (also addressed in earlier recommendations). However, in addition to a need for general capacity building to support EIDs, it is also critical that the master developer’s staff, local government staff, and third-party consultants working on EIDs all have a common foundation of sustainability literacy. While an integrated design process will help address this, the EID master developer may also need to provide other education to the broad team.

Recommendation: EID master developers should seek design professionals and other consultants with demonstrated knowledge and experience in advancing sustainability and EID. More traditional

¹² Examples of industrial park integrated site master plans in Oregon can be found at <http://www.corvallisoregon.gov/modules/showdocument.aspx?documentid=6232> or http://www.newbergoregon.gov/sites/default/files/fileattachments/planning/page/4676/south20industrial20area20master20plan_w20appendices.pdf.

professionals / consultants can provide insight via consultation that informs EID deliverables, but they will, by definition, not be able to produce deliverables that support a successful EID.

Recommendation: Future EID master developers should consider requiring some sort of training for any new staff (including local government staff) or consultants. This will ensure that everyone has the same understanding of EID in general as well as the specific project goals. The Port, Metro Regional Government, local Urban Land Institute, NAIOP and US Green Building Council chapters could be helpful partners in developing general information, while the integrated master plan would provide content related to the specific EID.

Industrial park size / structure can affect implementation.

It was noted several times that the relatively small site made it difficult to pursue some of the EID strategies. While the overall size of the site (204 developable industrial acres not including the ON Semiconductor campus and the PGE substation) is not a barrier, the site structure and constraints, such as limited access points from perimeter roads, did impact implementation. The site structure meant that relatively few but fairly large lots, and therefore, very few new businesses, made the most sense. While there is local demand from some sectors for such large lots, there is also demand for smaller lots. A mix of lot sizes can broaden marketing reach and create a diversity that better supports future industrial symbiosis opportunities.

The GVBP site structure also allowed the Port to maximize developable land by not requiring an internal road network. The flip-side, though, is that the GVBP has no 'gateway'. Gateways can provide a physical point at which to underscore EID branding and identity. Internal road networks can also provide opportunities to incorporate sustainable infrastructure, such as an alternative cross-section that includes rights-of-way for symbiosis piping or a narrower carriage way to reduce materials consumption.

A lack of anchor tenant was reported by a few interviewees as being a barrier for the GVBP. However, many of the historical EIDs with anchor tenants (e.g., Cape Charles, Londonderry) were not viable in the long-term as their reliance on an anchor tenant failed to foster resiliency and the projects collapsed when the anchor tenants collapsed. Furthermore, an anchor tenant development model does not generally reflect industrial development trends in North America, particularly in the Pacific Northwest. Industrial and business parks tend to comprise businesses of varying sizes and sectoral representation, even when there is a sectoral theme.

Recommendation: For future EIDs with planned internal roadways, the Port or other EID master developers should consider piloting eco-industrial road designs.

Recommendation: For future EIDs that do have a clear 'gateway', the Port or other EID master developer should use design to signal eco-efficient intent and to support marketing efforts.

Recommendation: For future EIDs, the Port may wish to consider sites where diverse lot sizes may be possible. This will broaden marketing potential, including tapping regional retention and expansion needs, which can provide a greater return on investment than the straight attraction market. This will also increase the potential for symbiosis.



Closing

With respect to physical development, the GVBP pilot provides valuable examples for advancing green infrastructure and green buildings in the industrial context, especially through the use of strategic green infrastructure planning and development standards. The pilot also demonstrates the impact of market knowledge on a developer's and/or local jurisdiction's efforts to advance EID, and underscores the need for complementary regional capacity building in addition to concrete pilot projects. Further, the GVBP pilot illustrates the importance of EID support and flexibility from local jurisdictions. Lastly, the GVBP demonstrates that, as with conventional industrial development, the physical characteristics of a site shape the final development; in this case, local drainage issues helped to drive innovative stormwater management, while the site configuration limited lot sizing and, therefore, ultimate business diversity.

The GVBP pilot also helps to clarify that industrial symbiosis is difficult to embed in a new development; it is easier to achieve industrial symbiosis by working with operational businesses. In addition, the GVBP pilot helped to clarify the role of scale and a coordinating third-party in achieving industrial symbiosis. The Eco-Concierge Feasibility Study rightly concluded that the GVBP would not have enough businesses to support widespread industrial symbiosis, and that industrial symbiosis was best pursued from a regional perspective.

On the whole, the GVBP pilot represents a very positive step towards achieving broader EID in the region, and demonstrates the merit of collaborative pilot efforts. Future developments in the region can directly incorporate some of the GVBP features, and can also springboard from the GVBP foundation to pilot deeper green buildings; other sustainable infrastructure systems; design that supports future industrial symbiosis; and alternative marketing approaches.

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