Repurposing the Wastewater Lagoon Site

City of St. Helens, Oregon

Strategic Action Plan

Prepared via EPA Brownfields Area-Wide Planning Technical Assistance

FINAL

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United States Environmental Protection Agency

City of St. Helens
FOUNDED 1850
Oregon

ICF

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EXECUTIVE SUMMARY

The City of St. Helens, Oregon owns three key properties that provide waterfront redevelopment opportunities. One of the three properties contains the City-owned wastewater treatment plant (WWTP) and associated lagoon. The City is considering repurposing the current lagoon to create developable land that will connect the existing St. Helens riverfront district and the proposed development of the former Boise Veneer site to the north with the Boise White Paper site to the south.

Stakeholders have identified the wastewater lagoon redevelopment as a critical component of a successful Waterfront Redevelopment Project. While it would be cost-prohibitive to pay for imported fill to develop the lagoon site, the City is exploring a revenue-positive option, i.e. repurposing the lagoon as a waste disposal facility designed to accommodate non-hazardous dredged sediments and similar materials.

The City commissioned a market study that assessed the competition for similar disposal facilities, provided cost estimates for material handling and transportation costs, and included a demand analysis for sediment disposal within the region over the next 20 years (MFA, 2016a). The study demonstrated that there is long-term regional demand for a non-hazardous fill disposal facility, primarily from planned dredging at the nearby Portland Harbor Superfund Site. St. Helens also commissioned a report that includes general cost information and provides details on permitting, site characterization, and conceptual site designs (MFA, 2016b). The City is currently evaluating different governance structures for the ownership and management of the landfill project and is investigating financing options.

Transitioning the lagoon site into a developable land parcel is a complex and long-term project. In 2017, EPA's Office of Brownfields and Land Revitalization (OBLR) provided a team of technical assistance contractors from ICF to work with the City to develop this Strategic Action Plan, which outlines the steps and activities needed to assess the viability of transitioning the current lagoon into a developable land parcel.

This Strategic Action Plan discusses several local, regional, and statewide opportunities and challenges associated with the project.

Opportunities include:

- Creation of developable land
- Improvement in waterfront connectivity
- Capitalizing on known dredging projects
- Creating a sustainable, green redevelopment
- Better fuel efficiency, emission reductions, and safety for dredging projects
- Synergies between the landfill and the wastewater treatment plant

Challenges include:

- Uncertainties in the quantity of non-hazardous dredged material
- Risk of missing the Portland Harbor dredging window
- Financial and funding risks
- Market risk of competing disposal sites
- Constructability complications

- Management of wastes from the existing lagoon
- Seasonal operation issues

The process to convert the current wastewater lagoon into a developable land parcel involves a number of regulatory, engineering, administrative, and stakeholder engagement paths. The steps along each path often overlap in time and require concurrent action. This Strategic Action Plan presents some overall schedule concerns as well as a step-by-step roadmap highlighting actions necessary along each path to accomplish the transition. In order to ensure that the landfill is operational when needed for the Portland Harbor cleanup, the City of St. Helens should pursue the critical path items without delay.

This Strategic Action Plan also lists several specific design requirements and options for a non-hazardous, non-municipal waste landfill and discusses potential issues or concerns that the City should consider during the planning, design, and implementation process. Several of the technical considerations will require decisions that will affect the schedule, cost, or operation of the landfill and should therefore be evaluated during the relevant steps of the roadmap described above.

Appendix A presents case studies of several successful landfill redevelopment projects in Oregon and other states. Each of these projects had similar technical and community challenges that St. Helens currently faces and demonstrates key lessons that can be incorporated into the wastewater lagoon repurposing project.

INTRODUCTION

The City of St. Helens, Oregon received technical assistance (TA) from EPA's Office of Brownfields and Land Revitalization (OBLR) to develop this Strategic Action Plan for transitioning its current wastewater treatment lagoon into a developable land parcel. This plan identifies key opportunities and challenges associated with the project and establishes a roadmap necessary to complete the project including regulatory, schedule, administrative, political, community engagement, and technical issues that must be addressed. The plan also documents select case studies and lessons learned from other similar projects.

St. Helens Waterfront Redevelopment Project

The small, northwest city of St. Helens, Oregon sits across the border from Washington State with striking views of nearby Mount St. Helens and Mount Hood. The City is approximately 25 miles northwest of Portland, Oregon and is situated at the confluence of the Multnomah Channel and the Columbia River (Figure 1). The City has an expanding population of 13,120 and has seen an almost 30% increase in size since 2010. (CITY WEBSITE, July 1, 2016.) This vibrant community's regional location near predominant rivers and mountain trails provides a suite of activities for outdoor enthusiasts, which coupled with the City's annual festivities, contribute to St. Helens' colorful character.

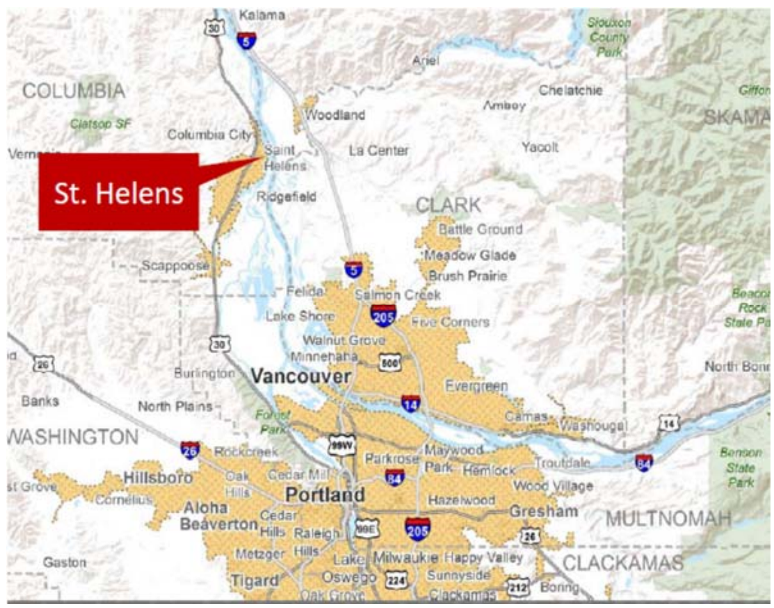

Figure 1. Location of St. Helens, Oregon

Founded in 1850 by a group of New England loggers, St. Helens has a long history of industrial use, stemming from the City's strategic location along key regional waterways and its close proximity to valuable timber lands. For several decades, St. Helens' economy prospered under the booming Western timber industry. However, declining profitability led the timber industries to retreat from St. Helens in the early 2000s. The loss of the main economic driver in the area has left a significant stock of vacant and blighted land, including several tracts of waterfront property. Recently, the City of St. Helens acquired approximately 225 acres of waterfront property with the intent to redevelop the space, attract employers to the region, boost the recovering local economy, restore the connection between downtown St. Helens and the Columbia River, provide public access to the waterfront, and preserve the natural and cultural heritage of St. Helens.

The City owns three key waterfront properties that provide ample redevelopment opportunities:

- The 24-acre Boise Veneer Property, located along the northern section of the City's waterfront.
    - This site was once occupied by a plywood veneer plant that has since vacated the area.

  - The site's close proximity to historic downtown St. Helens, views of nearby volcanoes, and access to Multnomah Channel and Columbia River offer significant redevelopment opportunities for the City.
- The 205-acre Boise White Paper site, located further to the south.
  - This site is occupied partially by Cascade Tissue, currently operating on approximately 20 acres.
  - The remainder of the site is post-industrial space along the river.
- The municipal wastewater treatment plant (WWTP) and lagoon property (approximately 48 acres in total), situated between the Boise Veneer Site to the north and the Boise White Paper Site to the south.
  - The lagoon occupies substantial waterfront acreage.
  - The lagoon area comprises two separate lagoons – a 2 acre primary lagoon (holding 7.1 million gallons) and a 36.5 acre secondary lagoon (holding 214 million gallons).
  - Despite the growing community in St. Helens, the WWTP and adjacent lagoon are oversized for the population it serves.
  - The WWTP and lagoon are barriers between the City and the river.

In 2016, the City of St. Helens determined that it should assess the viability, pros, and cons of repurposing the wastewater lagoon property as part of their long-term vision for the Waterfront Redevelopment Project.

Repurposing the Wastewater Lagoon Site

Previous Planning and Studies

Over the last few years, the City has been involved in several community engagement and visioning workshops to develop a cohesive concept to guide the redevelopment of these blighted areas along the waterfront. Most recently:

- In 2014, the City received design assistance from the American Institute of Architects Sustainable Design Assessment Team (SDAT) program. This program enabled the City to conduct several design workshops and perform community outreach to St. Helens residents to develop a vision and accompanying guidelines for redevelopment along the waterfront.

- In 2015, Business Oregon awarded the City an Integrated Planning Grant (IPG) to continue the momentum generated by the SDAT program. The IPG allowed the City to establish a community advisory group to convene local citizens, community leaders, and other stakeholders to formally direct the efforts of the Waterfront Redevelopment Project. The group further refined the community's vision for the end use of the waterfront properties and align the redevelopment goals to the community's priorities for the space.

- Building off this extensive planning and design work, the City received a Brownfields Area-wide Planning (AWP) grant in 2015 from the U.S. Environmental Protection Agency (EPA) to address the waterfront brownfield properties. The AWP capitalized on the existing efforts of the City's Waterfront Redevelopment Project to create an action-focused redevelopment framework plan that would reconnect the community to the waterfront and the Columbia River, and place the brownfields properties back into productive reuse. The *St. Helens Waterfront Framework Plan* (MFA et. al., 2016) outlines detailed steps for attracting beneficial redevelopment to the waterfront district, provides conceptual site plans for potential reuses of the Veneer Property site and a parcel level analysis for redeveloping the Boise White Paper site, and recommends zoning changes that would help to smoothly and successfully transition the area.

Suggestions & Studies for Future Uses of the Lagoon Property

Stakeholders identified the wastewater lagoon redevelopment as a critical component to creating a successful Waterfront Redevelopment Project. Future desired uses for the Veneer site suggested by the community or City include community amenities such as recreational fields, beach access, and a waterfront trail. These amenities could not all be placed within the Veneer site boundaries. Figure 2 illustrates a conceptual reuse plan for the wastewater lagoon property that could accommodate the community aspirations.

Figure 2. Conceptual reuse plan for wastewater lagoon (Credit: Maul Foster & Alongi, Inc.)

In 2016, The City contracted with Maul Foster & Alongi, Inc. (MFA) to conduct a market feasibility analysis to investigate the possibility of transitioning the wastewater lagoon into a useable landmass, suitable for accommodating amenities requested by the community.

An underlying premise of this work was that it is cost-prohibitive to pay for imported fill, and that revenue-positive options, if they exist, should be explored. To that end, the study researched the market in the surrounding counties to assess the competition for a RCRA Subtitle D disposal facility, provided cost estimates for material handling and transportation costs, and conducted a demand analysis for sediment disposal within the region over the next 20 years. The main waste streams identified to contribute to the wastewater lagoon site include:

- materials from the planned Lower Willamette Channel Deepening project to be conducted by the U.S. Army Corps of Engineers (USACE),
- potential disposal of non-hazardous material from the nearby Portland Harbor Superfund Site, and

- various other brownfields projects that would generate usable fill material.

The evidence and conclusions in the final report (July 2016) demonstrated to the City that there is long-term regional demand for a non-hazardous fill disposal facility, giving the City confidence to move forward with plans to complete technical analyses needed to determine whether this use can be conducted safely, can be permitted, and is otherwise viable (MFA, 2016a).

In November 2016, MFA outlined the major necessary actions and costs to fill the wastewater lagoon. The Process Summary Report includes general cost information regarding project logistics and provides details for the applicable permitting, site characterization steps, and conceptual site designs for the City. (MFA, 2016b)

Current Status of the Lagoon Property

Currently, the City is:

- actively evaluating different governance structures for the ownership and management of the landfill project,
- investigating potential state-level partnerships to solidify the governance structure of the lagoon if it undergoes transition to a buildable landmass,
- identifying possible funding streams to finance the project from various public sources, and
- examining other potential locations for the WWTP, including relocating the plant to an adjacent town. Decisions on the ultimate relocation of the current WWTP will be critical in deciding the timeline of the lagoon repurposing project.

STRATEGIC ACTION PLAN

Purpose

Transitioning the lagoon site from a WWTP into a developable land parcel is a complex and long-term project. In 2017, the EPA provided a team of technical assistance contractors from ICF to work with the City to develop this Strategic Action Plan which outlines the steps and activities needed to assess the viability of transitioning the current lagoon into a developable land parcel. [1]

ICF Preliminary Activities and Site Visit

ICF undertook several preliminary activities to more clearly understand the City's objectives and to evaluate previous work that had been performed by the City and other entities to advance the project goals. These preliminary activities included conference calls with City officials and other stakeholders, reviewing plans and studies related to the project, and inspecting the conditions of the current site and surrounding areas.

ICF participated in a site visit and onsite discussions on October 25, 2017 which included the following participants:

- John Walsh, City of St. Helens
- Ted Wall, Maul Foster & Alongi, Inc.
- Jacob Faust, Maul Foster & Alongi, Inc.
- Jennifer Purcell, Oregon DEQ
- Audrey O'Brien, Oregon DEQ
- Kevin Parrett, Oregon DEQ
- Susan Morales, U.S. EPA, Region 10, Brownfield Coordinator
- Margaret Olson, U.S. EPA, Region 10, Oregon RCRA and Brownfields Coordinator
- Jim McKenna, Governor's Office, Policy Advisor Portland Harbor
- Mark Ellsworth, Governor's Office, Regional Coordinator
- Karen Homolac, Business Oregon
- Kevin Palaia, ICF
- Ralph Grismala, ICF

[1] The project may also involve modifying or relocating the existing WWTP. This Strategic Action Plan does not cover actions that involve evaluating options for the siting, design, or operation of the WWTP at other, future sites; but to the extent information is available will address changes at the lagoon site itself related to the WWTP.

LAGOON REPURPOSING: OPPORTUNITIES AND CHALLENGES

The City of St. Helens is considering repurposing the current wastewater treatment lagoon by creating developable land that will connect the existing St. Helens riverfront district and the proposed development of the former Boise Veneer site with the Boise White Paper site to the south. The plan presents several key local, regional, and statewide opportunities and challenges.

Opportunities

- **Provide developable land –** The current wastewater lagoon property covers approximately 48 acres. After filling, the land could be developed as a built-up area or open space.
- **Improve waterfront connectivity –** The lagoon site lies between the Boise Veneer site to the north and the Boise White Paper site to the south, collectively forming about 250 acres of contiguous property along the waterfront.
- **Capitalize on known dredging projects –** The selected remedy for the Portland Harbor Superfund Site estimates that approximately 4.6 million tons (3.7 million cubic yards) of non-hazardous material will need to be disposed at a RCRA Subtitle D landfill over a 13 year period (EPA, 2017a), providing a potential source of fill material for a non-hazardous, non-municipal solid waste (MSW) landfill[2] at the lagoon site. Additional navigational channel dredging in the Lower Willamette River is expected to produce an additional 2.1 million cubic yards of non-hazardous dredged sediment suitable for disposal at a RCRA Subtitle D landfill.
- **Create a sustainable, green redevelopment –** The lagoon repurposing project would convert the majority of the 48 acre lagoon property into a beneficial reuse that could include open and recreational space for the community, add renewable energy features such as solar photovoltaic panels on roofs or otherwise unused land, and incorporate stormwater best management practices.
- **Improve fuel efficiency, emission reductions, and safety –** Providing a disposal option accessible by barges for sediments dredged from Portland Harbor or the Lower Willamette River provides significant benefits in fuel efficiency, reduced emissions, and safety. A multimodal study of freight options shows that barges are 36% more fuel efficient than rail and 346% more fuel efficient than trucks. Barge CO2 emissions per ton-mile are only 74% of rail emissions and 10% of truck emissions. As a result, the project would substantially reduce transportation-related carbon footprint of the known dredging projects compared to other currently available disposal options. For each injury to the general public per million ton-mile from a barge accident, there are 80 rail injuries and over 800 trucking injuries. For each barge-related fatality of a member of the public per million ton-mile, there are 22 rail deaths and 79 trucking deaths. (Texas A&M, 2017).
- **Use the new landfill for disposal of the lagoon sludge and liner –** A landfill of the size being considered would normally be constructed with several cells, both for technical and financial reasons. Therefore, part of the landfill could be operational before the lagoon is completely decommissioned. The lagoon could be subdivided and partially closed with the sludge and liner from

[2] Defined as a “non-municipal land disposal site” under OAR 340-095-0001.

the closed portion temporarily stored on site until the first landfill cell could accept the waste materials from the lagoon.

- **Use the existing WWTP to treat the lagoon fluid to discharge standards –** Regardless of whether the WWTP is ultimately modified or relocated, the existing WWTP could be used to process the fluids from any lagoons or portions thereof that need to be drained to create space for the landfill. The 36.5 acre secondary lagoon currently provides aeration for biological oxygen demand (BOD) and total suspected solids (TSS) removal. A 2017 WWTP lagoon repurposing study (Murray, Smith, and Associates, Inc., 2017) indicates that the 2 acre primary lagoon alone can treat 0.5 million gallons per day (MGD) of wastewater which means that once the WWTP stops accepting raw sewage, the wastewater from both the primary and secondary lagoon can be treated to discharge standards using the existing WWTP and the primary lagoon. Also, because the secondary lagoon is much larger than currently needed, if the initial landfill cell is built at the southern end of the lagoon, the WWTP should be able to operate with the remaining part of the lagoon for several years, allowing additional time for revenue generation (collection of landfill tipping fees) and for bringing the modified or replacement WWTP online.

Challenges

- **Uncertainty in quantity of fill material suitable for RCRA Subtitle D landfill [3]–** A solid waste landfill at the St. Helens lagoon site would not be permitted to accept hazardous waste and would not be able to charge non-hazardous solid waste disposal fees for material suitable for in-water placement or beneficial use. The estimates of available fill material from the Portland Harbor Superfund Site or from the Lower Willamette River channel maintenance dredging suitable for disposal in a Subtitle D landfill may change due to 1) lower volumes removed or 2) higher levels of contamination in the fill material. Depending on degree, these changes would significantly impact the long-term revenue generation and profitability of the project.

- **Risk of missing the Portland Harbor dredging window –** The landfill market analysis (MFA, 2016a) estimates that demand will exist for 4.5 million cubic yards of sediment disposal in the Portland area over the next 20 years. The Portland Harbor Superfund Site remediation accounts for 3.7 million cubic yards[4] of that projected demand. If the St. Helens landfill is not operational early enough to secure sediment disposal contracts from the Portland Harbor project, the City may lose revenue to competing disposal sites and have more difficulty filling the site in the desired timeframe.

- **Financial and funding risks –** If constructed, the landfill project is expected to generate significant net revenue for the City over time; however, significant capital investment would be needed before the landfill becomes operational and for its long-term operation. The selection of a landfill for the disposal of dredged sediments or non-hazardous, contaminated soils is not guaranteed and would be subject to competitor and project stakeholder considerations. A lower rate of fill than assumed in

[3] Dredge sediments may be classified into one of at least four categories under Oregon and federal RCRA regulations, i.e. suitable for in-water placement, suitable for beneficial use, non-hazardous solid waste, and hazardous waste.

[4] Initial estimates at the time of the MFA market study preparation (MFA, 2016a) were 1.7 million cubic yards of dredged sediment for disposal, which was updated to 3.7 million cubic yards of sediment suitable for disposal in a Subtitle D landfill in the Record of Decision (EPA, 2017a).

the financial projections would lower annual revenue and reduce the overall profitability of the project[5].

- **Market risk of competing disposal sites –** The City of St. Helens performed an analysis of competitor disposal sites as part of the 2016 market feasibility analysis (MFA, 2016a). Nevertheless, competitive market conditions may change over the projected 15 to 25 years required to completely fill the lagoon site. Other suitable disposal sites may be identified and could possibly affect the viability of the St. Helens project. Additionally, competitor MSW landfills may choose in the future to accept contaminated soil for daily cover at rates lower than the normal tipping fees, potentially offsetting some of St. Helens' cost advantage. However, MFA determined that the cost advantage of a St. Helens disposal site is predominately associated with greatly reduced transportation costs, so a reduced tipping fee at competitor landfills may not have a significant cost impact (MFA, 2016a).

- **Other business risks –** Even if the St. Helens landfill is competitive on price, the parties selecting the disposal site(s) may do so for reasons other than direct costs. For example, the responsible parties may select other facilities based on past working relationships, existing contractual arrangements, or shared ownership interests. In the Portland Harbor Superfund Site Record of Decision (ROD) (EPA, 2017a), the EPA says "EPA will consider the potential use of the proposed facility for disposal of contaminated sediments and soils ... contingent upon the proposed facility's ability to conclude the Subtitle D permitting process, meet EPA's requirements under the "Off-Site Rule", and be available for disposal during the implementation of remedial action at the Site. Since it is expected that responsible parties will be implementing cleanups, if a facility otherwise complies with the Off-Site Rule and is appropriate for the waste to be disposed, EPA cannot mandate or require the use of a particular disposal facility if other approved facilities are available and selected by the responsible parties."

- **Constructability complications -** If the water table elevation at the lagoon site is higher than the elevation of the bottom of the landfill, then placing a liner requires dewatering the site during construction and maintaining drawdown until the weight of the placed waste exceeds any uplift forces on the bottom liner.

- **Management of wastes from the existing lagoon –** The lagoon has an existing liner and contains approximately 65,000 cubic yards of sediments and sludge.[6] These materials will require removal and disposal in a Subtitle D landfill. The newly created landfill would be permitted to accept this material for disposal.

- **Seasonal Work Flow -** The Portland Harbor Superfund Site ROD (EPA, 2017a) assumes a dredge season of 122 days per year (July 1 to October 31) based on likely restrictions due to the migration patterns of threatened or endangered fish species. Since the vast majority of the expected material is derived from dredging, barge traffic may be negligible or non-existent during much of the year. Seasonal operation could complicate landfill staffing and require site maintenance during periods of little or no revenue generation.

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[5] The market feasibility analysis (MFA, 2016a) compared a fill-rate based scenario (200,000 CY of fill per year) to a time-based scenario (15-year fill period); for the maximum fill option the NPV was reduced from $137M to $110M by filling at a slower rate, extending the operational life to approximately 24 years.
[6] Dewatered volume, based on a 2013 pond survey.

STEP-BY-STEP ROADMAP

The City of St. Helens, working together with its consultants and state partners, has already completed much of the preliminary work required for repurposing the lagoon. This preliminary work includes long term planning, technical feasibility studies, market analyses, cost projections, financial analyses, conceptual designs, and public outreach. However, there are still a number of technical decisions that need to be made and regulatory approvals that need to be obtained regarding the design, construction, and operational details of the project. Many of these decisions have financial implications.

The process to convert the current wastewater lagoon into a developable land parcel involves a number of regulatory, engineering, administrative, and stakeholder engagement paths. The steps along each path often overlap in time and require concurrent action, as illustrated in Figure 3. This section presents some overall schedule concerns followed by a step-by-step roadmap highlighting actions necessary along each path to accomplish the transition.

Schedule Concerns

The financial projections for the landfill are based, in large part, on the market demand for dredged sediment disposal capacity to support the Portland Harbor Superfund Site cleanup, which is estimated to generate 3.7 million cubic yards of material destined for Subtitle D landfills. Having the St. Helens landfill facility operational during the Portland Harbor dredging substantially improves the probability that the landfill project is successful.

EPA's initial timeline for the Portland Harbor remediation estimated that baseline sampling and remedial design would occur from 2017 to 2019, followed by 13 years of remedy implementation ending in 2032 (EPA, 2017b; EPA, 2017c). The schedule has already been adjusted, which is not inconsistent with past projected and actual completion dates for milestones at this complex site. The updated schedule adjusts this timeline, such that the baseline sampling and pre-remedial design investigation are expected to continue through the end of 2019 (EPA, 2017d). The schedule for finalization of the design and subsequent commencement of dredging has not yet been determined.

The City expects that the start of dredging will be delayed until at least 2020, and completion would subsequently be delayed as well. The City anticipates that additional factors could delay the start of dredging of material destined for the landfill, such as:

1) Prioritization by EPA of removal of hazardous sediment destined for Subtitle C facilities,
2) Completion of the allocation process which will determine cost-sharing between and/or indemnification by Potentially Responsible Parties (PRPs), and
3) Negotiation between PRPs and EPA of remedial actions via administrative orders on consent.

Dredging contractors may negotiate business terms and rates with disposal sites while preparing bids during the dredging procurement stage, so the landfill operational date and fees may need to be known before removal of Portland Harbor sediment appropriate for disposal at the landfill actually begins. There are also other area projects which are expected to require dredge disposal space in the next few years, such as the planned Lower Willamette Channel Deepening project.

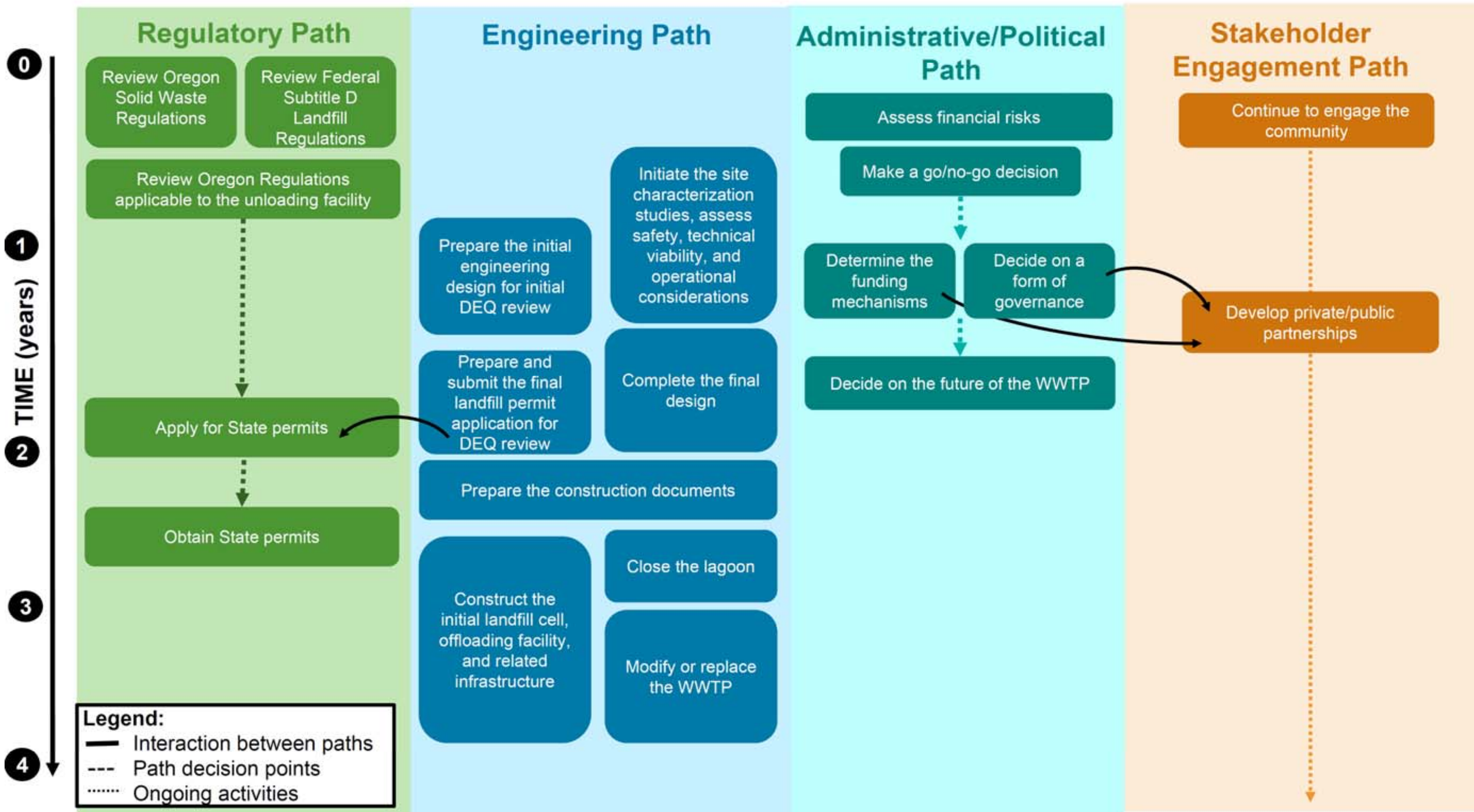

Figure 3. Schedule for completion of lagoon repurposing project

A minimum of 3 years are likely to be necessary for the landfill to become fully operational. Designing and permitting a Subtitle D landfill in Oregon may take 2 to 2.5 years. Performing preliminary studies at the St. Helens site, preparing the Subtitle D landfill permit application, and reaching a consensus with DEQ that the facility is likely to be permitted may take about 1.5 years, with a total of perhaps 2 to 2.5 years needed to negotiate and finalize the permit conditions. Landfill design, site preparation, and some lagoon closure could overlap with the permitting process.

Although the known, anticipated, and potential delays may push the start of dredging past 2021 and the design and permitting of the landfill could reasonably be completed by the time removal of Subtitle D sediment commences, taking the necessary steps to ensure that the landfill would be available when needed would allow the parties responsible for making decisions on Portland Harbor dredge spoil disposal sites to incorporate the St. Helens landfill in their plans.

Regulatory Path

Landfills are regulated at both the federal level and at the state level. The applicable regulations depend primarily on the type of waste to be allowed in the landfill. The major landfill waste categories are hazardous waste; municipal solid waste (MSW); and non-hazardous, non-municipal solid waste.

The City's plans specify that the landfill would only accept non-hazardous, non-municipal waste.[7] The City anticipates that the landfill would accept only three waste streams, as follows:

- Dredged sediment that does not meet the criteria for in-water placement,
- Soil that does not meet the criteria for clean fill, or
- Sludge from wastewater treatment plants.

Hazardous materials, MSW, highly organic waste, and construction debris would not be permitted.

Review Oregon Solid Waste Regulations

Oregon solid waste landfill regulations are documented in Oregon Administrative Rules (OAR) 340-093 through OAR 340-097, which "prescribe requirements, limitations, and procedures for storage, collection, transportation, treatment and disposal of solid waste". The City should continue to review and understand the regulatory requirements for the landfill, including the permitting process and associated fees. Some of the regulations contain specific design requirements that would need to be complied with during the steps along the engineering path.

- OAR 340-093 General Provisions presents definitions; permit requirements; minimum requirements for landfill site characterization reports, plans, specifications, and construction certification; and specific requirements for collecting recyclable materials, handling cleanup materials contaminated with hazardous substances, and wastes requiring special management; and provisions covering solid waste storage, collection, transportation, and beneficial use.
- OAR 340-094 Municipal Solid Waste Landfills covers location restrictions, operating criteria, design criteria, groundwater monitoring and corrective action, closure and post-closure care,

[7] According to the market study (MFA, 2016a), "The St. Helens facility would receive only sediment, sludge from its wastewater treatment plant, and soil. No construction debris or putrescible, industrial, or hazardous waste would be accepted."

and financial assurance for MSW landfills. Because the solid waste landfill would not accept MSW, which contains putrescible waste, OAR 340-094 would not apply.

- OAR 340-095 Land Disposal Sites Other Than Municipal Solid Waste Landfills covers location restrictions, operating criteria, design criteria, groundwater monitoring and corrective action, closure and post-closure care, and financial assurance for non-MSW landfills.
- OAR 340-096 Special Rules for Selected Solid Waste Disposal Sites "applies to energy recovery facilities and incinerators ..., composting facilities, conversion technology facilities, sludge disposal sites, land application disposal sites, transfer stations, material recovery facilities and solid waste treatment facilities". Because the solid waste landfill would accept sewage sludge, the Special Rules Pertaining to Sludge and Land Application Disposal Sites in OAR 340-096-0030 would apply.
- OAR 340-097 Permit Fees establishes solid waste facility permit fees and disposal fees.

Review Federal Subtitle D Landfill Regulations

Under federal law, the landfill would be a RCRA Subtitle D landfill regulated primarily under 40 CFR 257.1 through 257.4. If the non-hazardous, non-MSW landfill were to receive conditionally-exempt small quantity generator (CESQG) waste, then it would also need to comply with the regulations in 40 CFR 257.5 through 257.30.

40 CFR 257.3 contains specific location and operating criteria related to floodplains, endangered species, surface water, groundwater, disease, air, and safety. For non-hazardous, non-MSW landfills that also receive CESQG waste, additional requirements are imposed related to floodplains (40 CFR 257.8), wetlands (40 CFR 257.8), and groundwater monitoring and corrective action (40 CFR 257.21 through 257.30). As with the Oregon regulations, the specific federal regulations would need to be addressed along the engineering path, but the City should be familiar with the requirements.

In order for a RCRA Subtitle D landfill to accept waste from a CERCLA remedial or removal action, the disposal facility must receive a determination of acceptability from the EPA in accordance with the Off-Site Rule (40 CFR 300.440).

Review Oregon Regulations Applicable to the Unloading Facility

The City's project plan includes a waterfront facility to offload dredge spoils from barges, either by modifying the existing dock and offloading facility at the Boise White Paper site or by constructing a new facility. Although the details of the barge offloading facility have not yet been developed, any waterfront facility that extends below the line of ordinary high water would require a waterway use authorization from the Department of State Lands under OAR 141-082 Rules Governing the Management of, and Issuing of Leases, Licenses and Registrations for Structures On, and Uses of State-Owned Submerged and Submersible Land. The development of the offloading facility would also require close coordination with other Federal agencies, including the National Oceanic and Atmospheric Administration (NOAA) and USACE.

Apply for State Permits

The Oregon landfill permitting process includes the preparation and submittal of the DEQ Application for Solid Waste Disposal Site Permit. The permit application requires basic applicant, landowner, and facility information as well as several attachments. The attachments include a land use compatibility statement, a recommendation from the local government, a certificate of business registry, a list of other DEQ permits for that business, and a list of nearby property owners. Landfills typically also require a site characterization report, detailed plans and specifications, a written closure plan, and evidence of financial assurance. The minimum requirements for the landfill site characterization reports, plans, and specifications are detailed in OAR 340-093.

The waterfront barge unloading facility would also require authorization from the Department of State Lands. Application details and forms are available from the Department of State Lands website.[8] This would be a Joint Permit Application that joins the Federal and state permitting processes.

The existing National Pollutant Discharge Elimination System (NPDES) permit for the WWTP will likely be modified as a result of WWTP modification or relocation. The landfill and the unloading facility will require NPDES permits that address stormwater runoff and the discharge of any water from dewatering of the dredged sediments. If dewatering liquids are treated at the future WWTP, they would be covered under the WWTP NPDES permit. The contaminants in the dredged sediments may affect the discharge limits in the WWTP NPDES permit.

Engineering Path

In order to ensure that the landfill is operational when needed for the Portland Harbor cleanup, the City of St. Helens should pursue the critical path items without delay. Some of the key steps along the engineering path include:

- Initiate the Phase I site characterization and safety studies
- Prepare the initial engineering design for initial DEQ review
- Complete Phase II site characterization
- Complete the final design
- Prepare and submit the final landfill permit application for DEQ review
- Prepare the construction documents
- Modify or replace the WWTP (requires separate studies and design)
- Close the first portion of the lagoon
- Construct the initial landfill cell, offloading facility, and related infrastructure

Some of the above activities will overlap, allowing compression of the schedule. In addition, activities related to financing, local political authorization, and community outreach must occur concurrently and far enough in advance not to impede the design, permitting, and construction schedule.

The initial landfill cell will probably cover only part of the lagoon area. If the initial cell is built at the southern end of the lagoon, the WWTP should be able to operate with the remaining part of the lagoon for several years, allowing additional time for bringing the modified or replacement WWTP online.

Administrative/Political Path

Make a Go/No Go Decision

The City of St. Helens has advanced the project to the point that many of the next steps will require financial or land use commitments. If the City intends that the landfill is operational in time to benefit

[8] Application details and forms are available from the Department of State Lands at http://www.oregon.gov/dsl/WW/Pages/Waterways.aspx.

from planned dredging projects such as the Portland Harbor Superfund Site cleanup, it must make the decision to proceed with the activities required for permitting.

In 2017, the City pursued $1,544,500 in emergency funding from the Oregon state legislature "to continue the feasibility evaluation, initiate permitting and site characterization efforts, and conduct proof of concept analyses for the City of St. Helens central waterfront redevelopment and Portland Harbor cleanup support project." The legislative bill, HB 2950, received a recommendation for passage from the Economic Development and Trade committee, but was not acted upon by the Ways and Means committee before adjournment. In 2018, being an even-numbered year, the Oregon legislature is only in regular session for 35 days ending on March 9th (versus 160 days in odd-numbered years). The shorter legislative schedule may make it more difficult to achieve passage of the bill, so the City should be prepared to pursue alternate financing.

Decide on the Future of the WWTP

The future of the WWTP is tied to the potential elimination or downsizing of the lagoon. In 2017, the City conducted a WWTP lagoon repurposing study (MSA, 2017) which analyzed three (3) alternatives to meet the future wastewater treatment needs for the City.

- Alternative 1 involves modifying and reducing the overall secondary lagoon to about half its current size.
- Alternative 2 involves modifying the existing WWTP to an activated sludge process and closing the secondary lagoon.
- Alternative 3 involves relocating the WWTP to a new location.

The alternatives and their projected costs from that study are presented in Table 1. The MSA report does not provide a cost estimate for a No Action alternative which would not involve the creation of a landfill, but the City expects that some WWTP modifications would still be required to meet increasingly stringent water quality effluent standards.

Table 1: Summary of WWTP Alternative Capital Costs

WWTP Alternative	Total Estimated Project Cost
Alternative 1 – Modify Lagoon	$25.7 Million
Alternative 2 – Modify Existing WWTP	$31.6 Million
Alternative 3 – Relocate WWTP	$42.0 Million

WWTP Alternatives 1 and 2 retain parts of the existing WWTP infrastructure, limit the space available for the landfill, and therefore reduce the projected landfill revenues. The market analysis estimates that even leaving the small, primary lagoon in place decreases the net present value of the landfill by at least $30 million.

Each of the three alternatives involves modifying the WWTP or the treatment process. The design of the modified treatment process would consider the potential loading from dewatering the dredged sediments and from treating landfill leachate from the leachate collection system to ensure that the effluent meets all permit discharge requirements.

Decide on a Form of Governance

The landfill could be managed under a number of different governance structures including a state-city partnership, direct city control, a public-private partnership, or a non-profit development corporation. Each of these structures gives the City of St. Helens a different level of control, has different funding sources, and carries different risks to the City. The selection of the governance model is apt to be determined only after numerous discussions among stakeholders, a detailed analysis of potential funding sources, and detailed assessment of the financial and management risks.

In order to achieve the City's objective of creating developable land, the governance model should ensure that the City maintains ownership or control of the property after the landfill closes.

In 2015, Oregon passed Land Bank Authority (LBA) legislation (Oregon Laws 2015, HB 2734) [9] which permits municipal governments to create a separate municipal corporation to acquire and redevelop brownfield properties. An LBA is managed by a Board of Directors and may also establish an advisory committee. LBAs may buy, sell, and lease property; issue bonds; and acquire debt. As a distinct entity, an LBA provides some liability protection to the municipality that created it – including insulating the municipality from the LBA's debt obligations. Under Oregon law, an LBA does not acquire owner liability when it acquires a brownfield, but it does not alter federal CERCLA liability.

Determine the Funding Mechanisms

Although the market study determined that the landfill project is expected to generate net revenue for the City of St. Helens, significant capital investment would be needed before the landfill becomes operational. The capital investment for predevelopment costs such as permitting, construction, seismic retrofit, lining, regulatory approvals, and off-loading facilities is approximately $40 million (MFA, 2016a). This includes:

- approximately $1.5 million for initial site characterization, conceptual design, permitting for site investigations, an environmental risk assessment, analysis of WWTP impacts, and public outreach efforts;
- about $4 million for detailed design, project permitting, and preparation of bid documents; and
- about $35 million for construction.

These costs do not include the estimated $26 to $42 million needed to modify or replace the WWTP if the lagoons are eliminated or downsized.

Potential capital funding mechanisms include federal grants, state grants, state budget appropriations, City general funds, revenue bonds, general obligation bonds, direct private investment, or funding arrangements tied to future development rights for the newly created land.

Specific federal funding possibilities include:

- **USDA Rural Development Solid Waste Management Grants in Oregon[10]** – for technical assistance or training to improve the planning and management of solid waste sites. (https://www.rd.usda.gov/programs-services/solid-waste-management-grants/or)

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[9] https://olis.leg.state.or.us/liz/2015R1/Downloads/MeasureDocument/HB2734/C-Engrossed

[10] The USDA programs listed here only include the loan and grant programs. USDA also offers other types of support including loan guarantees and revolving loan funds.

- **USDA Rural Development Water and Waste Disposal Loan and Grant Program in Oregon** – provides funding for clean and reliable drinking water systems, sanitary sewage disposal, sanitary solid waste disposal, and storm water drainage. (https://www.rd.usda.gov/programs-services/water-waste-disposal-loan-grant-program/or)
- **USDA Rural Development Water & Waste Disposal Predevelopment Planning Grants** - assists communities with initial planning and development of applications for USDA Rural Development Water and Waste Disposal direct loan/grant and loan guarantee programs. (https://www.rd.usda.gov/programs-services/water-waste-disposal-predevelopment-planning-grants)
- **USDA Rural Development Community Facilities Direct Loan & Grant Program** - provides low interest direct loans and grants to develop essential community facilities in rural areas. (https://www.rd.usda.gov/programs-services/community-facilities-direct-loan-grant-program)
- **USDA Rural Development Community Facilities Technical Assistance and Training Grant** – makes grants to provide applicants with technical assistance or training for planning and financing essential community facilities. Allowable uses are to identify public and private resources to finance community facilities, to prepare reports and surveys necessary to request financial assistance, and to prepare applications for financial assistance. (https://www.rd.usda.gov/programs-services/community-facilities-technical-assistance-and-training-grant)
- **EPA, Clean Water State Revolving Fund (SRF) Loan Program** – provides assistance in constructing publicly-owned municipal wastewater treatment plants. May be applicable to modifying or relocating the WWTP, as well as reducing combined sewer overflows. (CRS, 2016)
- **HUD, Community Development Block Grant (CDBG) Program** – CDBG funds support activities that promote decent housing and a suitable living environment, including about $400 million/year for water and waste disposal projects. (CRS, 2016)
- **Economic Development Administration (EDA), Public Works and Economic Development Program** – provides public works grants to revitalize, expand, and upgrade physical infrastructure in distressed communities to attract or retain private sector jobs. Grant-funded projects often include a sewer or water supply component. (CRS, 2016)

Potential state funding resources include the following:

- **Business Oregon,** the state economic development agency, provides a number of resources to Oregon communities. Potential funding sources include the Oregon Brownfields Redevelopment Fund, the Oregon Coalition Brownfields Cleanup Fund, Community Development Block Grants, the Special Public Works Fund, and the Water/Wastewater Financing Program.
- **The Regional Solutions Program** helps to integrate state agency work and funding for community and economic development. The program manages a Regional Infrastructure Fund that provides grants and loans to local governments for infrastructure projects.

Depending on the ultimate governance structure, other potential funding sources are available, including the following:

- **Prospective Purchaser Agreements (PPA)** limit the environmental liability to DEQ of a purchaser or lessee of contaminated land. Entering into a PPA may encourage a developer to contribute to the initial capital costs at the site, although the long lead time before developable land is available may pose a significant deterrent. In order for the City to meet its objective to retain ownership of the land, the PPA would have to be structured as a lease.

Although many of the startup costs need to be completed before landfilling operations can begin, there may be opportunities to reduce the initial financing costs and risks by phasing the development of the facility. The entire landfill area need not be operational immediately. For example, if an initial landfill cell covering a fraction of the final footprint were to be constructed and made operational while much of the lagoon remained, the revenue stream from operations could help finance the remaining construction cost. Similarly, the unloading facility could start operations with just mechanical unloading and transfer to trucks before investing in a hydraulic barge unloading and transport system (see the discussion of unloading and transportation options in the Technical Issues section below).

Assess the Financial Risks

In 2016, MFA prepared a cost and revenue projection for the landfill construction, operation, and closure. Relative to the financial projections, the potential financial risks fall into two basic categories, i.e. costs will be higher or revenues will be lower. Although future events and prices cannot be forecast with certainty, the paragraphs below discuss components of the projections relative to typical or example costs reported by the U.S. EPA (EPA, 2014).

Table 2 compares the projected costs for the maximum fill option (MFA, 2016a) to example values or typical ranges for MSW landfill construction, operation, and closure. The area of the maximum fill option for the landfill is approximately 41.5 acres.

The projected costs for the St. Helens landfill are, with the exception of design and permitting, close to the typical or example costs reported by the U.S. EPA[11]. The range of the various cost components demonstrates the potential variability due to local conditions. For example, the projected design and permitting costs and the operational costs exceed the EPA-reported costs, but the total cost and the cost per acre essentially match the upper end of the EPA-reported cost ranges. The St. Helens cost projection includes a 30% contingency so the actual costs may fall well within the typical cost range. It is unlikely that the projected St. Helens costs substantially underestimate the landfill costs.

Table 2: Comparison of Landfill Construction, Operating, and Closure Costs

Item Description	St. Helens Estimated Costs[(1)]	Typical or Example MSW Landfill Costs[(2),(3)]
Design and Permitting	$6,120,000	$825,000 - $1,320,000
Construction	$40,131,000	$17,700,000 - $45,400,000
Operation, 15 years	$17,812,500	$11,700,000
Closure	$30,160,000	$6,800,000 - $34,200,000
Post-closure, 30 years	$3,600,000	$3,400,000 - $4,700,000
Total	**$97,823,500**	**$40,400,000 – $97,300,000**
Total Cost per Acre	**$2,357,193**	**$1,100,000 - $2,300,000**

[11] Costs in this category are primarily associated with atypical system features, e.g. in-water structures, conveyance systems, lagoon closure, and development of the solid waste facility on a former lagoon site.

NOTES:
(1) (MFA, 2016a)
(2) MSW landfills have more stringent technical requirements than non-MSW landfills, so MSW landfills would be expected to be more expensive than a non-MSW landfill like the St. Helens facility addressed in this report.
(3) Because the EPA-reported costs are from source publications published between 2005 and 2014, all costs have been escalated to 2016 dollars using the annual inflation rate of 2.4% used in the MFA, 2016a calculations. Reported per-acre costs have been converted into total costs for a 41.5 acre landfill. (EPA, 2007; EPA, 2014)

The revenue projections (MFA, 2016a) are based on conservative assumptions. For example, dewatering and transportation costs to the nearest landfills that are considered likely competitors range from $66/ton to $81/ton versus an estimated $38/ton to St. Helens. With tipping fees for contaminated soils added, the transport and disposal costs are $96/ton or more. Subtracting the estimated $38/ton dewatering and transportation costs to St. Helens suggests that a tipping fee of $58/ton or less would be competitive. The revenue projections are based on a tipping fee of $55/ton. Breakeven tipping fees for the landfill are calculated to be between $18/ton and $28/ton.[12] The market analysis also demonstrates that the market demand from planned dredging projects in the Portland area is several times greater than the capacity of the St. Helens landfill. (MFA, 2016a)

Stakeholder Engagement Path

A critical component of any successful redevelopment project, especially one as complex and long-term as the St. Helens lagoon repurposing project, is frequent and effective communication and outreach to project stakeholders including the community, private and public partners. Without the stakeholders' active engagement and ultimate acceptance, the project is likely to fail. St. Helens has initiated community engagement on this project as part of overall community and stakeholder engagement for the Waterfront redevelopment. This report recommends continuing to build on the effort already underway, and considering the inclusion of some of the best practices outlined below.

Redevelopment activities on former landfill sites are on the rise across the country, and especially within the Pacific Northwest area. Although not a direct comparison to the innovative project ongoing in St. Helens, the process of redeveloping a former landfill site often includes similar challenges and opportunities as the wastewater lagoon repurposing project.

Figure 4. Astoria, OR athletic complex – former municipal landfill redevelopment (Credit: Maul Foster & Alongi, Inc.)

The case studies presented in Appendix A illustrate just a select few of the successful landfill redevelopment projects from the area. These include the Astoria, OR athletic complex (see Figure 4, former municipal landfill), Cully Park in

[12] The breakeven tipping fee depends on the landfill capacity scenario and filling rate option.

Portland, OR (former landfill), Bridgeport Village in Tualatin, OR (former quarry), and the West Covina Sportsplex in West Covina, CA (former hazardous waste landfill). Each of these projects had similar technical and community challenges that St. Helens currently faces and demonstrates key lessons that can be incorporated into the wastewater lagoon repurposing project to ensure overall project success.

The details of each case study are presented in Appendix A. Some of the most common lessons learned from these case studies are provided below.

Continue to Engage the Community

Community engagement from project conception to completion is key to successful redevelopment. Involving the residents around the area in a meaningful way throughout the project builds community support and guarantees that the outcomes are beneficial to those nearby. The City has already successfully incorporated community-based ideas into the potential future uses and design of the site. Building upon the activities undertaken so far, the City can continue the inclusive community involvement until project completion by acting upon the successful examples provided by the case studies in Appendix A.

It is important to keep in mind that community engagement events and resources should be as accessible as possible to the community so that participation is encouraged. When hosting events, consider the location, transportation accessibility, timing during the day, and childcare opportunities to ensure residents can participate fully. If informational materials for the project are created, provide copies in Spanish or other languages, as appropriate, and consider posting links to online versions on the City's website.

Examples of beneficial community engagement practices at each stage of the project are summarized below:

- **Visioning Sessions, Open Design Charrettes, and Surveys** of local residents, community organizations, and school or business groups. These can be especially helpful in the design stage to ensure the final end use of the site accommodates and responds to the community needs. St. Helens should continue to involve local residents in these activities specifically, as plans for the site change over time.
- **Printed or Online Resources and Project Branding.** Providing informational resources to the community on the project's plan and progress can provide valuable updates to the community. Often overlooked is the branding of a project, including a color scheme, target audiences, and cohesive use of icons and photography that incorporates the character and history of the community. By creating materials, presentations, and signage with a brand in mind creates a cohesive message with which to market the vision of the project to both the community and potential developers down the road.
- **Roundtable Workshops and Panel Q&A Sessions.** Opportunities for residents to interact with the project team in person can promote conversations on key community issues. For St. Helens, it is critical that communication is very clear on the types of wastes accepted at the landfill to assuage any concerns of hazardous materials or smells affecting the community. A roundtable of project leaders and decision-makers ready to answer questions on topic of concern can make the project a more transparent and trustworthy process for the community.

- **Open Houses** to showcase project progress. Inviting residents and local organizations to see how the project is moving along will allow open dialogue on the impacts of construction and keep the project moving forward by avoiding adverse community complaints.
- **One-on-One Meetings with Abutting Property Owners.** By meeting face-to-face with property owners adjacent to the project site at the beginning of the project, an effective and communicative relationship can be established between the project team and those living on or owning property near the site. Individuals are more likely to express concerns with a project in a one-on-one setting versus in large group settings. The team can then respond to concerns through an open dialogue as they come up before, during, and after construction.
- **Site Tours.** Allowing residents to visit the complex, either during construction (as permitted) or after the site is complete encourages residents to interact with the newly finished project and builds excitement for the new community asset.
- **Surveys** distributed to residents after the site is complete can elicit feedback on the process while building rapport with the community. Building trust throughout the process between the City and community can be important in addressing any issues that come up at the site down the road.
- **Activity Programming at the Site.** Hosting city-sponsored events or allowing community groups to plan events at the site will continue to engage the community, even after project completion. By providing community events such as concerts, festivals, or volunteer opportunities at the site will ensure the local residents fully embrace and interact with the new space within St. Helens.

Develop Partnerships

Developing collaborative partnerships with public, private, non-profit, and community-based organizations can be an effective way to improve the likelihood of a successful redevelopment project.

Private-public partnerships can be important tools for project financing and management when municipalities are unable to support the full site remediation required by state departments. There are often creative negotiation strategies that can be used to entice future developers to participate in bringing the site to a level for redevelopment to occur. Partnering with a private entity may reduce governmental controls over future management and uses of the site. However, local government can benefit from an interested and committed partner sharing the responsibilities of a project.

Other partnerships with non-profits or community organizations can also be beneficial in engaging the community, gathering support, and attracting additional fundraising.

Several groups were present at the site visit that expressed positive interest in seeing the successful completion of the lagoon repurposing project. By building upon this interest, the City can leverage local and state partnerships to help accomplish the various steps outlined in the roadmap, reduce the individual burden of effort and coordination on the City, and continue the existing momentum for the project. Consider how the other groups within the City (e.g., St. Helens School District, Chamber of Commerce, and local businesses, community organizations, environmental advocacy groups, or religious organizations) can aid in providing comprehensive community engagement that can sometimes be difficult for a single entity to accomplish alone.

In addition, the City may need the expertise of qualified specialists to assist with complicated environmental, geotechnical, legal, or financial issues which municipalities may not be equipped to handle alone. The use of dedicated and knowledgeable experts to guide the necessary steps of a project can ensure projects are completed in a more efficient manner and in compliance with Federal, state, and local regulations.

TECHNICAL CONSIDERATIONS

This section lists several specific design requirements and options for a non-hazardous, non-MSW landfill and discusses potential issues or concerns that the City will need to consider during the planning, design, and implementation process. Several of the technical considerations will require decisions that will affect the schedule, cost, or operation of the landfill and should therefore be evaluated during the relevant steps of the roadmap above.

Rate of Fill

The anticipated rate of fill will impact the required landfill equipment capacity and staffing levels. Based on a maximum landfill volume of 2,635,000 cubic yards[13], the total volume of loose material arriving by barge or other means is estimated to be approximately 3.5 million cubic yards. Based on a 122 day dredging season and a 15 year filling period, this equates to 13,400 cubic yards or about 7 barges per week, on average.[14] If other transportation options were used, 830 trucks or 260 rail cars per week would be required to move the same amount of material.

Siting and Design Criteria

The minimum design criteria for non-hazardous, non-MSW solid waste landfills are set forth in the state and federal regulations. The major siting and design considerations are discussed below.[15]

Location restrictions prohibit siting a non-hazardous, non-MSW solid waste landfill where it would harm any endangered or threatened species of plant, fish, or wildlife or its habitat; within a floodplain if it would restrict flood flow, reduce water storage, or result in washout of the waste; or where it would threaten a protected groundwater aquifer or well (OAR 340-093-0010). **Error! Reference source not found.** below illustrates the FEMA specified limits of the 100-year and 500-year flood events (FEMA, 2017). The wastewater lagoon is outside of these limits, however the barge unloading facility would fall within these limits.

OAR 340-095 does not unconditionally require a liner or a leachate collection system for a non-hazardous, non-MSW landfill. However, "Where required by the Department [DEQ], leachate shall be collected and treated or otherwise controlled in a manner approved by the Department."[16] If DEQ requires leachate collection, a liner would be necessary for the collection to be effective unless the bounding geological materials had very low hydraulic conductivity. The current plans call for the landfill facility to be constructed with a full geomembrane liner and a leachate collection system (MFA, 2016b).

Surface drainage controls are required to divert stormwater from areas containing solid waste (OAR 340-095-0010). 40 CFR 257.3-3 further prohibits the discharge of pollutants to surface waters or to an underground drinking water source.

[13] Email communication from Maul, Foster, & Alongi, Inc., 3 November 2017
[14] Based on 2,000 cubic yards per barge, 25 tons per truck, and 80 tons per rail gondola (EPA, 2017a)
[15] The descriptions of the regulations are only intended to convey their principal meaning. The reader is advised to consult the full text of the regulations for details.
[16] 340-095-0030 Design Criteria

Figure 5. FEMA Flood Insurance Rate Map (Credit: FEMA Flood Map Service Center)

The Process Summary Report prepared by MFA (MFA, 2016b) notes that a geotechnical investigation will be performed to inform seismic design and identify any potential unstable areas that would require engineering controls (MFA, 2016b). Although the specific seismic and slope stability requirements imposed on MSW landfills (OAR 340-94-030) do not apply to non-MSW, non-hazardous waste landfills, DEQ does consider the geological setting in the permitting process for non-MSW, non-hazardous waste landfills.

DEQ may require a permittee to install and monitor groundwater monitoring wells to determine the effects of the disposal site on groundwater, to collect and analyze groundwater or surface water samples, and to remediate unacceptable releases of constituents. The Process Summary Report does envision the installation of monitoring wells upgradient and downgradient of the landfill (MFA, 2016b).

Dock and Offloading Facilities

The former Boise White Paper property has a marine terminal that was used for offloading bulk materials for the plant (Figure 6). Much of the existing structure is in disrepair, but some of the infrastructure could possibly be incorporated into a new dock and a barge offloading facility.

Although no conceptual design yet exists for the offloading facility, both hydraulic and mechanical barge unloading systems have been discussed. A hydraulic system would use a hydraulic barge unloader which consists of a large pump on an articulated boom. Water jets near the pump head fluidize the dredge material into a slurry which is then pumped to the disposal site. A mechanical system uses buckets or clamshells to transfer the sediment from the barge to trucks that then transport the material to the site. The design could also include both mechanical and hydraulic systems to accommodate materials with different characteristics.

Figure 6. Existing Boise White Paper terminal (Credit: Maul Foster & Alongi, Inc.)

Mechanical vs. Hydraulic Unloading

There are several differentiators between a mechanical unloading system and a hydraulic loading system for unloading barges and transporting material to the landfill.

Mechanical System

A simple mechanical system would unload barges using an excavator bucket or clamshell attached to an articulated boom or suspended from a crane. Dredged sediment would be lifted from the barge and deposited directly into trucks for transport to the landfill. On the landfill working surface, the trucks would deposit the sediment at or close to its final position where earthmoving equipment would spread the material into layers for dewatering and compaction.

Although a mechanical system might be more appropriate for material with higher solids content and less water, the facility design would still need to consider the possibility of water draining from the sediments during truck loading and transport to the landfill. Mitigation measures would likely include a loading area with runoff and drainage controls and either leak-proof trucks or similar runoff and drainage controls along the entire roadway from the truck loading point to the landfill.

A mechanical system based on truck transport may require more personnel than a hydraulic system, primarily truck drivers. Approximately 100 truck trips would be required to unload each barge.[17]

- **Advantages of Mechanical Barge Unloading –** Mechanical barge unloading relies on simpler, more readily available equipment and is more capable of handling any debris or large rocks in the sediment. It is more scalable than hydraulic unloading systems by simply adding more trucks and drivers, at least until the excavator or crane reaches peak loading capacity. Truck transport to the landfill allows more placement flexibility. The arriving sediment would be at or closer to a condition suitable for handling with standard earthmoving equipment. The movement of loaded trucks on the landfill could contribute to the compaction of the fill.

[17] Based on 2,000 cubic yards per barge and 20 cubic yards per truck (EPA, 2017a)

- **Disadvantages of Mechanical Barge Unloading –** Mechanical barge unloading is generally considered slower and less efficient than hydraulic unloading. Mechanical unloading requires truck access to the dock for loading, requires enough trucks and drivers to avoid downtime at the dock, generates greater emissions from fossil fuel combustion, and creates more noise. Mechanical unloading may require pier facilities to be designed for heavier loads.

Hydraulic System

A hydraulic system would unload barges using a dredge pump attached to an articulated boom or suspended from a crane. The hydraulic system would agitate the sediments in the barge using water jets or a cutterhead, extract the resulting material with the dredge pump, and then transport the material to the landfill through 4 to 10 inch diameter pipes or flexible hoses. A hydraulic dredge unloader can handle materials with up to 40% to 60% solids content by volume[18], with some manufacturers claiming the capability to pump material with up to 80% solids content.

A typical discharge setup would begin with 100 to 200 feet of flexible, abrasion-resistant hose connected to the unloader pump. The flexibility allows the excavator or crane to move along the length of the barge and for the pump to be moved within the barge. Shorter hose lengths are possible if the barge is progressively moved along the wharf during the unloading process, rather than moving the pumping equipment. The initial flexible hose is then connected to fixed, HDPE pipe from the unloading facility to the landfill. At the landfill, a system of pipes or hoses would distribute the discharge over the surface of the landfill, with final placement and compaction performed with earthmoving equipment.

- **Advantages of Hydraulic Barge Unloading –** Hydraulic barge unloading efficiently transports slurried sediment to the placement site where it can be distributed over the fill surface by varying the locations of the discharge points. Because the hydraulic pump remains in the barge during unloading, the unloading requires less movement of the excavator or crane than with mechanical unloading. The water for slurry transport can be recycled and reused to lower water requirements.

- **Disadvantages of Hydraulic Barge Unloading –** Sediment removed using a hydraulic barge unloading pump must be relatively free of large rocks or other debris that could block the pump or discharge line. To maintain slurry pumpability, the water content in the sediment removed from the barges must be higher than with mechanical removal. The higher water content, typically 50% to 80% of the slurry volume, would require additional dewatering at the landfill and could result in lower in-place soil density, slower consolidation, greater total settlement, lower slope stability, and lower seismic stability. All of these disadvantages become greater as the soil particle size decreases. The hydraulically placed fill could undergo segregation by particle size, potentially leading to differential settlement throughout the landfill. Hydraulic unloading would also require maintaining a decant water lagoon or storage tank to collect and recycle decant water for creating a pumpable slurry. Failure of the dredge pump or discharge pipeline could completely interrupt operations.

Multimodal Considerations

The landfill would have maximum flexibility to receive sediment and soil if it could accept material by barge, rail, and truck. Barge unloading is understood to be required for project success because barge access provides a competitive advantage compared to alternative Subtitle D disposal sites.

[18] Solids content defined as the volume of solids divided by the total volume of solids and liquid.

Truck access would facilitate acceptance of materials from upland sites. The landfill site is easily accessible from Rt. 30 via Gable Road to Old Portland Road to Kaster Road, although other routes are also possible. Other than a handful of residences along Gable Road, the route between Rt. 30 and Kaster Road is bordered by open space or commercial properties. If the unloading facility includes a truck transport option, the landfill would already include the infrastructure to accept material arriving by truck.

The former Boise White Paper property includes an existing rail track in use by Cascade Tissue. If material arrived by rail, it could be dumped onto a staging area (with appropriate runoff and drainage controls) for subsequent loading into trucks or it could be unloaded from the rail cars directly into trucks. The Portland Harbor Superfund Site ROD (EPA, 2017a) assumes that each rail car holds 80 loose cubic yards of material.

Dredged Sediment Material Properties

The project presumes that most of the fill material will be dredged sediments from the Portland Harbor Superfund Site remediation and from navigation dredging in the Willamette River. The dredged sediments are expected to vary from sands to silt. Some of the Portland Harbor Superfund Site remediation material may be riverfront soils excavated above the waterline.

When placed on a barge, sediment removed by a bucket or clamshell dredge is often near its in situ density (USACE, 2015). The Portland Harbor Feasibility Study assumed sediment removal via mechanical dredging with enclosed, environmental dredge buckets. Environmental dredge buckets are sealed to minimize the loss of turbid water into the water column, so in addition to the saturated sediment, the bucket will release free water onto the barge. During precision dredging using this equipment, the average fill factor may be as low as 50%, meaning that each bucket may be half full of free water.

According to the Portland Harbor Superfund Site FS (EPA, 2016):

> Mechanical dredging is assumed for all sediment assigned for dredging. Dredged material is assumed to be loaded directly into barges and transported for dewatering, treatment, or further transport. Sediment transport barges would be dewatered as necessary to prevent overflow and releases to the Willamette River.

The Portland Harbor FS recommends implementing the best management practice (BMP) of removing excess water during barge loading and directing it to a water management system (EPA, 2016).[19] The discussion below assumes that the excess water would be removed from the barges and managed at or near the dredging site and that this water would not need to be managed at St. Helens.

The Portland Harbor ROD estimates the total unit weight of dredged sediments at 3,100 lb/cy (EPA, 2017a), although this is a generic value – not one based on site-specific data. The source document for this total unit weight (Caterpillar, 2017) attributes this value to loose, wet sand. The corresponding value for loose, dry sand is 2,400 lb/cy. Assuming the same dry density for both the dry and wet soil conditions implies each cubic yard of dredged sediment would contain 700 lb of water, equivalent to 583 lb of

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[19] "Excess water" is water that initially drains from the dredged sediment by gravity when the sediment is removed from the water and placed on a barge. It is distinct from pore water that remains in the sediment. This initial drainage is distinct from any water reduction from subsequent dewatering or solidification processes.

water per ton of dry soil. The optimum water content for soil compaction is typically less than 10% for sand (200 lb/ton of dry soil), so drainage and dewatering operations at the St. Helens landfill could release 383 lb of water (46 gal) per ton of soil. Assuming a final soil density in the landfill of 3,600 lb/cy, a disposal volume of 2.635 million cubic yards, a 4 month/year dredging season, and a disposal period of 15 years, the landfill facility would need to treat about 0.10 MGD of drained pore water in addition to annual precipitation falling on the 48 acre site of 0.14 MGD. The average dry weather flow at the current WWTP is 1.0 MGD (MSA, 2017).

Water Management

The design of the landfill should include a discussion of water management throughout the operational life of the landfill and for the steady-state conditions following landfill closure. The studies should consider the volume of water that would arrive with the dredged sediments, water recirculation between the unloading facility and the landfill required for hydraulic unloading, handling water that immediately drains from the sediments when placed on the landfill, and longer term releases from the placed fill as it consolidates.

Specific studies should also estimate potential landfill liner leakage rates, evaluate the potential for liner leakage on groundwater quality, discuss managing spills or releases at the offloading facility, and predict the flow rate and characteristics of the landfill effluent destined for the WWTP.

The discussion of water management should include an analysis of the existing groundwater flow from the elevated areas west of the landfill to the river and how this flow would change due to the placement of the fill material. The analysis will need to account for the presence of the landfill's geomembrane liner along the bottom and sides of the landfill.

The analysis of long term water management would need to consider how infiltration from precipitation on the landfill surface would affect the groundwater conditions within the landfill and how the infiltration would be managed by the leachate collection system and the landfill final cover.

Closing the Existing Lagoon

The lagoon area comprises two separate lagoons – a 2 acre primary lagoon holding 7.1 million gallons and a 36.5 acre secondary lagoon holding 214 million gallons. Based on a reported lagoon surface elevation of 27 feet, the bottom of the secondary lagoon must be below elevation 9 feet which is below both the river level and the likely groundwater level. Work below the groundwater level could require substantial pumping during lagoon removal, landfill construction, and early landfill operation as well as design details or operational procedures to prevent uplift of the landfill's geomembrane liner.

Early in the construction process, the first portion of the existing lagoon will need to be drained and closed, with its contents and materials removed and properly disposed of. The landfill would most likely be constructed in multiple cells.

According to as-built drawings, the lagoon has a partial geomembrane liner covering the perimeter berm and a portion of the lagoon bottom, although the condition is unknown. Removal of the lagoon will entail discharging or removing lagoon fluid, as well as removing and disposing of any accumulated sludge and the liner. The lagoon sludge and liner would be disposed of in one of the early landfill cells.

Landfill Effluent Treatment

For dredge sediments that arrive by barge, one of the major treatment requirements would be to reduce the total suspended solids (TSS) content to the permitted discharge criterion. The current treatment system achieves this objective using the existing lagoon system. It is expected that any modifications to or replacement of the treatment system would incorporate technologies to control TSS.

The dredge sediments will contain contaminants of concern (COCs) at some concentration. At the Portland Harbor Superfund Site, there are 64 COCs including polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), polychlorinated dibenzo-p-dioxins and furans (dioxins and furans), pesticides such as dichlorodiphenyltrichloroethane (DDT), cyanide, and volatile organic compounds (VOCs). Some of these COCs may be present in the landfill effluent, either in the dissolved phase or attached to fine soil particles. The design of the modified or replacement WWTP must consider the concentration and quantity of theses COCs and ensure that the treatment process addresses them appropriately.

Implications of Using Dewatering Agents

The Portland Harbor Superfund Site FS (EPA, 2016) says “contaminated materials designated for off-site disposal at ... a Subtitle D facility are assumed to be managed through pre-treatment (dewatering and/or amendment with diatomaceous earth) to assist in ability to transport and to pass the paint filter test if required”.

Materials destined for a Subtitle D non-MSW landfill are not required to pass the paint filter test, so the addition of diatomaceous earth to dredged sediment may not be necessary. Omitting pretreatment with diatomaceous earth would eliminate the costs to purchase the diatomaceous earth, transport it to the site, and mix it into the dredged sediment and would reduce the total volume of material requiring disposal. Being able to reduce or eliminate these costs would enhance the competitive cost advantage of the St. Helens landfill.

Before deciding whether or not diatomaceous earth needs to be mixed into the dredged sediment, the project design engineers should carefully investigate the following issues:

- How much would the addition of diatomaceous earth affect the available airspace in the landfill? The Portland Harbor Superfund Site Feasibility Study calculates that adding 5% diatomaceous earth increases the dredged sediment volume by about 30%. Although compaction and consolidation in the landfill would be expected to reduce the volume, the implication is that adding diatomaceous earth could consume valuable landfill capacity.
- How would the addition of diatomaceous earth inhibit dewatering through natural drainage of the landfilled soils? The addition of fine-grained materials such as diatomaceous earth to soils generally increases the water holding capacity of the soils. In fact, that is the precise purpose discussed in the FS. Higher water content may alter the engineering properties of the fill material.
- How would the addition of diatomaceous earth affect the final in-place density? Soils amended with diatomaceous earth may be more difficult to compact because of the higher water content. In addition to the possible airspace consumption discussed above, lower density in-place soils

may affect the ability of loaded trucks or earthmoving equipment to maneuver on the active landfill surface.

- How would the addition of diatomaceous earth affect the consolidation and total settlement of the landfill? The material placed in the landfill would be expected to receive light compaction, but not the degree of compaction generally performed for structural fills. As new layers of material are added to previously placed fill, their weight will further increase the density of the underlying layers through compression and consolidation. The time for full consolidation is primarily a function of the drainage characteristics of the soil and the thickness of the consolidating material, with fine-grained materials generally taking longer to fully consolidate. The total amount of settlement after the landfill reaches its final design height may also be affected by the addition of diatomaceous earth.
- How would the addition of diatomaceous earth affect the properties of leachate draining from the landfill? The fine grained diatomaceous earth may help filter the leachate and retard the migration of contaminants from the dredged sediment. The predicted leachate quality may have implications in the design of the WWTP.

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APPENDIX A: CASE STUDIES

Astoria Athletic Complex

Former Municipal Landfill – Astoria, Oregon

Site Background

The City of Astoria, Oregon operated a 12-acre municipal landfill, accepting general household waste and select commercial and industrial wastes from 1965 to 1985. However, the City was unable to meet all the requirements to officially complete the landfill closure after operations ceased in 1985. In 2012, the City was awarded $100,000 in Solid Waste Orphan Account funds from the Oregon Department of Environmental Quality (ODEQ) to conduct an environmental investigation of the site.

Project Description

At the same time the City was working to assess and close the former landfill, several other entities were planning potential moves within the city limits. The regional medical care provider, Columbia Memorial Hospital, was searching for nearby space to expand their facilities to support a new cancer treatment center but was struggling to find available vacant land close to the hospital. The Astoria School District owned the land adjacent to Columbia Memorial Hospital, which housed the high school's football fields. However, the field's location made parking and transportation difficult and the sports field needed costly upgrades. The fourth entity involved was the county's solid waste disposal company, Recology Western Oregon, who was located adjacent to the landfill property but was in need of expensive utility upgrades to be successful in their location. After discussions were facilitated among the four players, a 4-Party Agreement to redevelop the landfill into a sports complex was negotiated.[20]

Outcomes

In 2014, redevelopment of the landfill was completed and the Astoria Athletic Complex opened. The City, working alongside their consultants, overcame several environmental and logistical obstacles managing a complex project such as addressing landfill gas concerns, fulfilling all ODEQ requirements for closure of the landfill, and minimizing creation of future leachate from the facility.[21] In completing a land swap between the City, School District, and the Hospital, the Complex was able to be built on the landfill and the Hospital received land adjacent to their facility to expand services. In addition, Recology Western Oregon benefited from the utility upgrades necessary for the Complex on the landfill site. The successful redevelopment of the Astoria Athletic Complex illustrates the opportunities for partnerships to complete a project and the fulfillment of community needs through redevelopment.

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[20] http://www.oregon4biz.com/Brownfields-Conference-2016/Award-Astoria.php
[21] http://www.maulfoster.com/news/astoria-municipal-landfill-redevelopment-wins-brownfield-phoenix-award/

Figure 7. Completed Astoria Athletic Complex on former landfill. (Credit: Maul Foster & Alongi, Inc.)

West Covina Sportsplex

Former BKK Corporation Landfill – West Covina, California

Site Background

The City of West Covina, California has been home to the 583-acre BKK Landfill site for almost 40 years. The RCRA hazardous waste facility includes a leachate treatment plant, a Class I landfill, a Class III landfill, and a waste disposal area. The 190-acre Class I landfill received over 3.4 million tons of liquid and solid hazardous waste between 1972 and 1984. In addition, the 175-acre Class III landfill accepted nonhazardous municipal waste until 1996.[22] Remediation of the overall site is ongoing through multiple consent decree orders between the State, U.S. EPA, and the BKK Corporation.

Project Description

Between 1999 and 2002, the City conducted significant community outreach efforts to understand community health and safety concerns and learn about the residents' visions for the landfill space, once parcels of the site were remediated to levels acceptable for redevelopment. The City held multiple community meetings and circulated a questionnaire to over 2,500 nearby residents and businesses to gather input on the future use of the site. In 2003, the City acquired 231 acres of the BKK site and lobbied for an amendment on the consent decree between the BKK Corporation and EPA that had previously placed institutional controls on the site to block recreational land uses on the site. West Covina also established a Prospective Purchaser Agreement with EPA and California Department of Toxic Substances Control to protect the City from environmental liability. Agreements on the sale of the property to the City hinged on BKK Corporation completing the site remediation on the select parcels of the site. However, when the company became insolvent, the City had to look for alternative methods to site closure. Using a combination of tax incremental funds (TIF) and grant funding from the California Integrated Waste Management Board, the City was able to bring sections of site to remediation complete.[23]

Outcomes

The City of West Covina successfully transformed portions of the landfill site alongside additional City-owned property into a 315-acre development to provide vibrant commercial and recreational space to the region. The Sportsplex is comprised of the Commercial District, the Big League Dreams Sports Park, an 18-hole public golf course, and a 47-acre natural habitat preserve with walking trails.[24] The Commercial District houses both national chain stores and local small businesses and the Sports Park provides life-sized replicas of Major League baseball stadiums from around the country such as Yankee Stadium and Fenway Park. The redevelopment of the site has resulted in over 1,000 new jobs, improved property values, and resulted in $74 million in economic benefits across the region.[25]

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[22] http://dtsc.ca.gov/HazardousWaste/Projects/upload/BKK_ENF_CO.pdf
[23] http://www.westerncity.com/Western-City/July-2010/West-Covina-Transforms-Landfill-to-Landmark/
[24] http://www.westcovina.org/departments/community-and-economic-development/economic-development-/west-covina-commercial-centers/sportsplex-projects-overview
[25] http://www.helenputnam.org/winners_2009.php

Figure 8. Site Map of West Covina Sportsplex after construction complete. (Credit: West Covina, CA)

Cully Park

Former KFD Landfill – Portland, Oregon

Site Background

The KFD Landfill was originally mined for sand and gravel materials until the 1980s, when the site was depleted of resources and began accepting construction, industrial, and inorganic wastes. The owner of KFD filed for bankruptcy in 1994, and the ODEQ received monies to conduct post-closure activities in the bankruptcy settlement, including operation and maintenance of a landfill gas collection system. In 2000, the City of Portland Parks and Recreation acquired the 25-acre landfill and designated the area as open greenspace. The current methane control system is now managed by the City Parks and Recreation office with help with the Metro Regional Government and ODEQ. [26]

Project Description

The former landfill site is situated in the disadvantaged Cully neighborhood. The neighborhood was lacking in available recreational opportunities and open space and the City of Portland did not have the necessary funding to complete the park's development. In response to the growing needs of the Cully neighborhood, a local non-profit launched a community engagement campaign and entered into a private-public partnership with the City to develop Cully Park. During the community engagement campaign, six local non-profit organizations conducted over 225 surveys to understand nearby residents' visions and hopes were for the park space. The survey responses helped guide and inform the design, construction, and educational activities of Cully Park.

Outcomes

Today, the park features a community garden, a habitat restoration area, an innovative "greenstreet", play area, and native gathering gardens. Several of the Park's amenities were identified by residents during the engagement campaign and acted upon during the design phase. Additionally, the lead non-profit in the area continues to conduct community outreach activities, including youth outreach surveys, to continue the legacy of community engagement and create an inclusive space within the neighborhood. The strong support from local residents and non-profits helped to make this project a success, despite governmental funding deficiencies.

[26] http://letusbuildcullypark.org/our-story/

Figure 9. Native Gathering Gardens during construction. (Credit: Let Us Build Cully Park)

Figure 10. Completed "greenstreet" along NE 72nd Avenue.

Bridgeport Village

Former Durham Quarry – Tualatin, Oregon

Site Background

Washington County, Oregon has owned the Durham Pit Landfill in Tualatin, Oregon since 1939. The County mined the site for gravel production until the 1970s, when it was backfilled. Although the County requested inert material be used as backfill, some solid wastes were included, leading to hazardous landfill gases and underground substances as remaining issues after closure of the site. The County entered into the Oregon Voluntary Cleanup Program in 2003 and completed methane mitigation measures in October 2005 to bring the site to ready for redevelopment status.[27]

Project Description

When Phase I and Phase II Environmental Site Assessments indicated high levels of methane gas from organic materials and wood waste used to backfill the landfill, the County had to reassess the amount of remediation needed for the site. In the end, the County invested about $100 million to remediate the property. Additionally, the instability in backfill material presented the developers interested in the site with complex geotechnical hurdles that could have derailed the project. Instead, the developer's contracted engineering firm designed reinforced soil cement pads and soil cement using recycled materials to stabilize the site for construction. [28]

Figure 11. Bridgeport Village Development after construction complete. (Credit: The Opus Group)

Outcomes

Today, Bridgeport Village is a 465,000 square-foot open-air shopping destination that provides retail space, entertainment options, and restaurants for the neighborhood. In addition, the investment in the Bridgeport Village development has leveraged $8.5 million in off-site improvements. The project represents a successful private-public partnership that despite several unique geotechnical challenges, has been incredibly successful in generating revenue for the County and attracting subsequent development in the area.

[27] http://www.deq.state.or.us/lq/ECSI/ecsidetail.asp?seqnbr=3791
[28] http://cement.org/pavements/Brownfield%20News%20Sept_Oct04%20article.pdf