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MAKING A GREAT PLACE

Metro

Site Management Plan

St. Johns Landfill

November 2013

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INTRODUCTION

The goal of the St. Johns Landfill Site Management Plan is to provide an internal tool for proactively managing post-closure care operations to ensure regulatory compliance, efficient implementation of projects prescribed by the Comprehensive Natural Resource Plan (CNRP) for the Smith and Bybee Wetlands Natural Area (SBNA), and cost-effective application of staffing and resources to those efforts. To this end, the plan includes recommendations for adaptive management of landfill operations and activities based on a comprehensive review of existing and anticipated conditions and circumstances.

Metro stopped accepting waste at St. Johns Landfill (SJL) in 1991, and since then has carried out closure and post-closure operations that have effectively protected environmental quality and public health and safety, and reclaimed the landscape to the point where the opportunity now exists to develop wildlife habitat and trails for public access, consistent with the CNRP.

Much of the historic Willamette Valley prairie has been lost to other uses and many of its associated plant and animal species are rare now. Although it is a "constructed" environment, the SJL site is already providing viable habitat for upland prairie species. With further restoration, this site will add important habitat to the SBNA and the region. Restoring the site to a more complex landscape of native plant communities that is integrated into the surrounding ecosystem will require more advance planning, research, and effort. Ultimately, the result can be economically advantageous and aesthetically rewarding through reduced maintenance costs, improved plant survival, enhanced wildlife habitat and attractive surroundings for trail users.

Effective long-term management requires that operations adapt efficiently to inevitable changes in applicable regulations, environmental conditions, and agency goals. Regulations may change as a result of new or amended rules, or site conditions that warrant modifications of currently held permits. Certain changes in environmental conditions, such as the gradually decreasing flow of landfill gas, provide opportunities to modify operations in ways that support current goals for the site, while maintaining regulatory compliance.

Managing the site in this way facilitates efficient planning, budgeting, and timely application of resources to operations and projects. This plan is intended to serve as a key instrument for implementing this approach, and will be updated as needed to ensure its continuing effectiveness for that purpose.

SITE HISTORY

The SJL site was originally a wetland like much of the present day SBNA. In 1939, the City of Portland built a bridge across the Columbia Slough for the purpose of landfilling 193 acres of this wetland immediately northeast of the bridge. Materials landfilled included residential and commercial/industrial wastes, and residuals from the City's waste incinerator, which operated at the current Chimney Park site. Incinerator residuals included ash and non-combustible material that had formerly been dumped in the area now referred to as Parcel A – the current location of Metro's maintenance facility supporting SJL post-closure operations. For years landfilling was largely unregulated, but by the 1970s the state imposed restrictions that generally followed the federal Solid Waste Disposal Act of 1965, at a minimum prohibiting open burning and uncovered waste, and requiring vector control. The passage of the Resource Conservation and Recovery Act in 1976 significantly expanded the federal role in managing waste disposal, and in 1979 the U.S. Environmental Protection Agency (EPA) developed further criteria for operating sanitary landfills. It was within this developing regulatory framework that SJL was expanded in the 1980s, from 193 to 248 acres. The expansion area included an under-drain system for collecting landfill leachate and discharging it to the municipal sanitary sewer.

Through separate agreements with the City of Portland, Metro assumed responsibility for landfill operations in 1980 and site ownership in 1990, at which time the Portland City Council and Metro Council jointly adopted the *Natural Resources Management Plan for Smith and Bybee Lakes.* This plan included SJL within a designated land use planning area under City zoning code, superseding the City's 1987 St. Johns Landfill End Use Plan, and establishing a trust fund for managing SBNA using monies reserved during the 1980s for implementing beneficial end uses at SJL. The plan incorporated the 1989 Revised Financial Assurance and Closure Plan for SJL, which had been submitted by Metro to the Oregon Department of Environmental Quality (DEQ), in conformance with a Solid Waste Disposal Site Closure Permit issued by DEQ in 1988.

Under the 1989 closure plan, Metro carried out the landfill cover construction project, from 1992 to 1996, which included a multilayer cover over the entire buried waste field, surface contouring for stormwater runoff, and a methane gas collection system. The main feature of the cover is a double barrier of compacted clayey soil capped with a polyethylene

membrane. A sand layer above facilitates stormwater drainage, and topsoil provides the growing substrate for cover vegetation. The estimated cost of the closure project was $36 million, the source of which was a SJL reserve fund established through ordinance by the Metro Council in 1983. The ordinance was amended in 1989 to further specify fund uses, including closure and post-closure activities, and mitigation of environmental impacts associated with the landfill, consistent with the 1989 closure plan. The fund received monies from solid waste disposal fees collected during the last few years of landfilling at the site. Fees were ramped up significantly in anticipation of the SJL closure project, and a new solid waste management system that would involve long-hauling municipal solid waste to the Columbia Ridge Landfill in eastern Oregon.

Since completion of the closure project in 1996, Metro has carried out post-closure operations and maintenance, and for this purpose the SJL *Operations and Maintenance Manual* was prepared in 1998, consistent with the site closure permit. The manual outlines the responsibilities and procedures to be followed during the 30-year post-closure care period defined by state solid waste rules. Post-closure operations have generally included maintenance of the cover system and perimeter levee, operation and maintenance of the leachate, stormwater, gas and condensate collection systems, environmental quality monitoring, and vegetation management.

In 1998, Metro signed a contract with the Ash Grove Cement Company (AGC), the terms of which included construction of a gas compressor at SJL and a two-mile underground pipeline from SJL to AGC's lime production plant in the Rivergate Industrial District. Since that time, AGC has been drawing gas from SJL as desired to meet its production needs. Gas not taken by AGC is combusted at high temperature in an on-site flare facility. As anticipated, the flow of gas from the landfill has gradually decreased. This, combined with a gradual drop in production at the AGC plant, has resulted in decreasing gas transfer.

In 2003, DEQ issued a consent order requiring a Remedial Investigation and Feasibility Study (RI-FS). The purpose of the RI-FS is to identify any remaining risks not eliminated or controlled by existing environmental protection systems. After several years of complex field investigations, Metro submitted a final RI Report to DEQ in 2012, which included risk assessments for human health and the environment. DEQ accepted the report, and Metro subsequently completed the FS, which evaluates alternative remedial measures for addressing the risks identified, and recommends a preferred alternative. DEQ approved the FS, including the preferred alternative, and is currently drafting a staff report. Metro is in discussion with DEQ regarding a prospective Record of Decision (ROD) and legal settlement.

In July 2012, Metro submitted a land use review application to the City of Portland for the 10-year CNRP. In May 2013, the CNRP was adopted through a City land use decision. It replaces the 1990 Natural Resources Management Plan, and fully integrates SJL into long-term land use planning for the SBNA. As such, the CNRP serves as an essential planning framework for ongoing post-closure operations, landscape and habitat restoration, and the eventual public use of the SJL site.

SITE REGULATION

Historically, there has been much regulatory scrutiny of the SJL site. This was particularly the case in the 1980s when the landfill was expanded and preparations were being made for its inevitable closure, in 1992-1996 during the cover construction project, and in the early years of post-closure operations following the cover project. Numerous environmental studies and investigations have been conducted over the years, and post-closure operations have been carried out in conformance with various permits, licenses and agreements.

Three permits currently provide the essential regulatory framework for post-closure operations. These include the *Solid Waste Disposal Site Closure Permit* and *Oregon Title V Operating Permit*, both issued by DEQ, and a *Discharge Authorization for Process Wastewater*, issued by the City of Portland Bureau of Environmental Services. The closure permit was originally issued in 1988 and is the primary regulatory mechanism for post-closure operations. When the permit was renewed in 2003, the RI-FS consent order was attached, with permit conditions directly referencing the RI-FS process and how results of that process would influence future permit conditions.

The Title V permit was originally issued in 2000 and regulates all air emissions from the site, ranging from road dust to flare stack emissions. It requires various types of monitoring, particularly related to the gas collection and management system. By extension of holding this permit, Metro is required to monitor and report greenhouse gas emissions under a separate regulatory process.

The wastewater discharge authorization was issued in 2011, replacing earlier wastewater regulations that included a conventional permit under which monitoring was required. The authorization requires only that landfill gas condensate be kept out of the wastewater (i.e. leachate) stream that discharges to the City sanitary sewer. Condensate is currently treated on site through an evaporation system.

Required reporting to DEQ under the closure permit includes an Annual *Environmental Monitoring Report* and *Annual Recertification of Financial Assurance.* Assorted notifications and approvals are also required, for example, as related to the planned construction of any

new on-site facilities. The annual monitoring report is focused on groundwater monitoring activities and results, although it is intended to provide a broad description of reporting-year activities. It also generally describes monitoring carried out under the Title V permit, including monitoring at gas wells, landfill surface emissions, and calculated emissions from the flare facility based on gas flow. An annual report required under the Title V permit covers these activities in greater detail.

Sources of information for preparing these reports include maintenance and monitoring records from field activities, analytical laboratory reports, and administrative documents.

RI-FS Quarterly Progress Reports are submitted to DEQ under the consent order. The culmination of the RI-FS process is the ROD, which will represent DEQ's formal recommendation for remedial actions to address risks identified in the RI. Alternative remedial actions evaluated in the FS will provide a basis for that recommendation. As specified in the closure permit, the ROD is expected to also include long-term monitoring requirements for SJL, which will serve as the basis for updating the 2001 *Environmental Monitoring Plan* for SJL, and negotiating with DEQ the conditions of a renewed closure permit.

The purpose of the annual financial report submitted to DEQ under the closure permit is to certify that Metro's financial mechanisms for funding SJL post-closure operations are intact and adaptable to developments that might result in unexpected expenditures. The report includes a projection of costs through the remainder of the post-closure care period, which is now 14 years.

The financial assurance mechanism implemented by Metro has two components: 1) Routine activities (e.g., operation of methane gas collection system; groundwater monitoring) are paid for through Metro's Solid Waste Fund, the source of revenues for which is charges for solid waste management services provided by Metro. Non-routine activities (e.g., RI-FS project, streambank restoration) are paid for through the SJL reserve fund (or Landfill Closure Account), the sources of revenue for which are interest accrued and the sale of methane gas to AGC. The remaining landfill post-closure liability and associated facts are included in the financial statements of Metro's *Comprehensive Annual Financial Report*, and are prepared in accordance with Government Accounting Standards Board (GASB) Statement 18 - *Accounting for Municipal Solid Waste Landfill Closure and Post-closure Care Costs*. Financial statements related to liability associated with the RI-FS project are prepared in accordance with GASB Statement 49 -*Accounting and Financial Reporting for Pollution Remediation Obligations*.

Some non-routine projects require certain temporary (or project-specific) permits, approvals and agreements. For example, such requirements for streambank restoration projects occasionally carried out on sections of the perimeter levee include, but are not limited to: Removal-Fill permit issued jointly by the U.S. Army Corps of Engineers and the Oregon Department of State Lands; Endangered Species Act consultation from the NOAA Fisheries Service (U.S. Department of Commerce); DEQ water quality certification; DEQ stormwater permit; City of Portland land use review and an associated development permit from the City. Depending on the location of this type of project, it could also require a land use approval from the Bonneville Power Administration and/or Portland General Electric, in conformance with separate long-standing easements granted to those entities for their respective electric power transmission lines that cross the northwest portion of the SJL site.

Hazardous waste regulations apply to two distinct activities, including the management of a sludge by-product from the operation of the condensate evaporator, and the storage of petroleum distillates and pressurized gases for use in site operations. The quantity of evaporator sludge collected in a given year is typically below the level that would require reporting to DEQ, and as such the site is considered a conditionally exempt generator of hazardous waste. The quantities of petroleum distillates and gases stored on site are reported annually to the Oregon State Fire Marshal under the state Community Right to Know law.

In 2002, Metro entered into a 20-year Intergovernmental Agreement with the City of Portland whereby the City leased 1.72 acres of Parcel A to Metro for purposes of constructing and using the present day maintenance facility, which was designed to support SJL post-closure operations. In exchange for this lease, Metro agreed to carry out post-closure operations at the Killingsworth Fast Disposal Landfill, and those operations are also supported by the maintenance facility. Assorted provisions in the agreement relate to Metro's responsibilities for maintaining and improving the subject facilities and property at Parcel A. Under the agreement, the City granted right-of-way and utilities easements to Metro for ingress and egress access to the maintenance facility and the SJL site, and sanitary sewer and water lines to benefit the facility and SJL operations.

Following is a set of policy statements pertaining to SJL that is included in the CNRP. The intent of these statements is to ensure that actions implemented to meet habitat and recreation goals of the CNRP are closely coordinated with SJL post-closure operations, to maintain or improve operational efficiency and ensure regulatory compliance.

Regulatory environment: Management of the St. Johns Landfill site shall be subject to the terms and conditions of any permit, license or agreement required for post-closure care operations, as issued and enforced by the U.S. Environmental Protection Agency, State of Oregon, City of Portland, or other agency responsible for regulating any aspect of such operations.

Regulatory compliance: The implementation of any action established by this plan to support conservation target goals or public access objectives relevant to the St. Johns Landfill site shall give precedence to compliance with any in-force regulation of site post-closure care operations.

Land use definition: The primary use of the St. Johns Landfill site shall be upland prairie and riparian forest habitats, developed and managed consistent with this plan, with consideration of the surrounding wetland habitat, and of public access objectives. Public access to the site shall be limited to trail use, organized tours and educational events.

Land use review: New projects at the St. Johns Landfill site that are designed to meet post-closure care objectives are subject to land use review under City of Portland zoning code, for that purpose are pre-approved under this plan, and shall follow review procedures established by this plan prior to implementation.

Trail guidance: Trail development on the St. Johns Landfill site, consistent with this plan, shall include design features that minimize risks to public health and safety; are protective of site infrastructure; and allow landfill workers to carry out post-closure care operations efficiently and in compliance with all applicable regulations. Trail construction and maintenance at the site shall similarly abide by these guidelines.

Operations definition: Post-closure care operations at the St. Johns Landfill site shall be conducted in conformance with all applicable regulations and will include, but not necessarily be limited to: maintenance of the integrity of the landfill cover and perimeter banks; management of the landfill gas collection system; and environmental monitoring, environmental investigation and construction and management of remediation facilities stemming from such investigation.

Operations funding: Post-closure care operations at the St. Johns Landfill site shall be funded through a financial assurance mechanism approved by the Oregon Department of Environmental Quality under terms of the Solid Waste Disposal Site Closure Permit.

COMPREHENSIVE NATURAL RESOURCE PLAN

The goal of the CNRP is to establish a course of action that will protect and enhance the SBNA as an environmental and recreational resource for the region. Under the plan, the area is maintained and enhanced toward its original natural condition, to the extent possible. A functional link between the riparian and upland habitats of SJL and the wetlands will provide diversity that supports wildlife. In that context, plan objectives include the integration of upland prairie habitat management at SJL with wetland habitat management. Recreational uses of the SBNA will be compatible with the environmental objectives. The Smith unit and adjacent uplands will be the primary recreational area, while Bybee will remain less accessible and serve mainly as an environmental preserve. Surrounded on all sides by commercial and industrial development, the SBNA provides essential habitat for rare plants and a diversity of wildlife, from sensitive species such as the western painted turtle, bald eagle and migrating songbirds, to common species such as the great blue heron, waterfowl, raccoon, deer, coyote, river otter, beaver, mink and weasel.

Wildlife activity varies with changes in season and water level. During winter when water levels are high, the wetlands provide critical off-channel refuge for steelhead trout, Chinook and Coho salmon, including Evolutionarily Significant Units (ESUs) listed under the federal Endangered Species Act (ESA). During spring and summer, bald eagles and migrating songbirds nest and fledge their young. As water levels recede, wading birds and shorebirds such as egrets and yellowlegs utilize exposed mudflats. Peregrine falcons have been observed hunting these shorebirds. With the onset of winter rains, the lakes begin to fill and the cycle repeats.

The streaked horned lark is declining throughout its range, including the Portland metropolitan area. Experiments initiated in 2007 are aimed at creating breeding habitat at SJL. While pairs have yet to breed at the site, pairs have bred nearby in the Rivergate Industrial District, and have been observed scouting the experimental habitat at SJL. The streaked horned lark is a candidate for listing under the ESA, and is an Oregon Conservation Strategy species.

The CNRP establishes Metro as manager of the SBNA, including SJL, with responsibilities that include, but are not limited to: manage restoration and maintenance activities designed to achieve plan goals, provide community outreach and environmental education, develop regional trails in partnership with the City of Portland and the Port of Portland, and coordinate with the Smith and Bybee Wetlands Advisory Committee to implement these responsibilities consistent with the plan. Sources of funding for restoration work prescribed by the plan will largely be the Smith and Bybee Wetlands Fund, and grants.

Funding sources for trail development are expected to be various transportation grant programs.

The management framework for the SBNA as outlined in the CNRP is built on conservation targets. These targets are species, communities or ecosystems that, when conserved, ensure the conservation of all native biodiversity at a site. They reflect local and regional conservation goals and are viable or restorable. An example is upland prairie with diverse flowering plants providing food and habitat for pollinating insects. For each conservation target, the plan identifies key ecological attributes (attributes) that are used to measure a target's viability. Attributes are characteristics that, if missing or altered, would lead to the loss of that target over time. They include critical biological or ecological components that define the target, limit its distribution, or determine its variation over space and time. The targets and attributes are translated into specific indicators that can be measured. By evaluating and rating the indicators, a foundation is built for establishing restoration goals and actions, tracking progress through monitoring, and measuring success. The plan outlines and prioritizes strategic actions to be carried out at the SBNA over the next 10 years. Actions are based on the short- and long-term objectives for the conservation targets, and also for enhancing site visitor experience. Actions provide general courses to follow toward the objectives. Specific prescriptions will be developed by Metro staff with and other public landowners of property within SBNA (Port of Portland, City of Portland) to address site-specific conditions encountered in the targeted action areas.

The conservation target planning framework identifies certain threats to the established targets, including disruption to natural water regimes, invasive plants and animals, disruption in habitat connectivity, and human disturbance. Invasive species present a unique challenge in that they can appear and change quickly. More than 100 non-native plants and numerous non-native vertebrates inhabit the SBNA. As such, the management framework is designed to be flexible and adaptable. As knowledge and techniques for managing invasive species evolve, new methods will be applied.

The CNRP outlines goals and actions to enhance or develop the attributes of each conservation target in specified areas within the SBNA. Three conservation targets have been established for the SJL site, including riparian forest, upland prairie, and streaked horned lark. Goals and actions addressing the upland prairie and streaked horned lark targets have been prescribed for the SJL site. The riparian zone around SJL is actively managed by the City of Portland Watershed Revegetation Program, under an intergovernmental agreement with Metro, and as such the CNRP does not prescribe actions for SJL that are associated with the riparian forest target.

Goals and actions specific to upland prairie and streaked horned lark targets at SJL are outlined below.

Conservation Target: Upland Prairie

Short-term goal: In the first five years after adoption of the CNRP, restore 20 acres of degraded upland prairie to fair condition for native forb and graminoid cover and availability of natural perches attributes. Restore a total of 80 acres in this manner within the 10-year plan term.

Long-term goal: The desired future condition is 210 acres of contiguous upland prairie with all attributes functioning at good to very good levels, creating up to ten male western meadowlark territories and habitat suitable for other sensitive species such as grasshopper sparrow, Oregon vesper sparrow and western bluebird. Suitable conditions for nesting western painted turtles will be maintained along the perimeter.

Strategic actions: Implement aggressive site preparation using a variety of techniques to reduce non-native, rhizomatous grass cover and prepare a seedbed that will allow native grasses and forbs to be successfully established.

Monitoring: Existing point counts and photo points will be enhanced with periodic informal surveys to track the presence and general abundance of native plants and invasive species.

Conservation Target: Streaked Horned Lark

Short-term goal: Within the 10-year plan term, attract nesting pairs and successful fledging by creating and maintaining 10 acres of sparsely vegetated nesting habitat with attributes for graminoid height, woody vegetation cover, and rhizomatous grass dominance functioning at good to very good levels.

Long-term goal: The desired future condition is successful annual nesting by maintaining attributes for nesting and foraging that function at good to very good levels. The challenge presented by rhizomatous grass dominance is expected to be an ongoing challenge to developing these attributes.

Strategic actions: In the absence of a natural disturbance such as fire, cultural activities must be conducted to maintain attributes at good or very good condition. These actions may include importing soil, using chemical and/or mechanical methods to maintain bare ground, and experimenting with habitat configuration (shape and size).

Monitoring: Metro staff will coordinate with outside partners, primarily including the Streaked Horned Lark Working Group and the Center for Natural Lands Management

(CNLM). Both habitat and predator monitoring will be conducted on a schedule developed by Metro and CNLM. Standard techniques developed by the CNLM and Washington Department of Fish and Wildlife will be used so data can be compared with other projects and sites.

In addition to restoring native plant communities and habitat, a general goal of the CNRP is to improve public access to the SBNA, particularly in the form of trails for hiking, biking and wildlife viewing. This would primarily include improvements to the existing Interlakes Trail and its viewing platforms, and a proposed new trail aligned to fill a gap in the regional trail system and make a direct connection to the St. Johns neighborhood. As a segment of the 40-Mile Loop Trail and the North Portland Greenway, the proposed trail would link downtown Portland with the confluence of the Willamette and Columbia rivers at Kelly Point Park, along the way providing views of the SBNA that were previously unavailable. On a broader scale, it would become an important component of The Intertwine - the region's network of parks, trails and natural areas.

The proposed trail would involve construction of a bridge over North Slough, connecting the end of the existing paved trail on the north side to SJL on the south. Once on the landfill, the existing north and east perimeter maintenance roads would also serve as paved trail. A spur off the east segment would ascend Subarea 5 to a viewpoint. At condensate vacuum pump station T-2, located near the head of Blind Slough, the trail would leave the road and wind along Columbia Slough, passing behind the flare facility before crossing Landfill Bridge, Parcel A, and North Columbia Boulevard into Chimney Park. A bridge over railroad tracks between Chimney and Pier parks would make the neighborhood connection. A separate section of trail would branch off at the south end of Landfill Bridge, following the south bank of Columbia Slough to North Portland Road, where it would tie into the existing Peninsula Crossing Trail.

For security and safety, and to prevent interference with site operations, trail design would include fencing and signage intended to separate trail users from site infrastructure and facilities, while still offering meaningful views for users. The CNRP anticipates that, as gas collection continues to decrease, additional parts of SJL may be made accessible to the public, for example, by adding spur trails to other viewpoints. In this way, the proposed trail system would provide a means for effective community outreach and environmental education in support of plan goals, for example, by conveying information on the history and reclamation of SJL, and its assimilation back into the surrounding environment.

STAFFING AND RESOURCES

SJL currently is staffed with four full-time employees dedicated to site operations, monitoring and maintenance. One landfill and environmental specialist monitors the landfill gas system as well as surface and groundwater. A second specialist maintains and repairs site equipment and systems. A technician is responsible for enhancing and maintaining the vegetative cover. A program supervisor manages the three full-time employees, as well as any temporary employees who are hired for specific projects or to assist with seasonal work. In addition, a team of three engineers, assigned to a different business unit, are available to provide technical assistance to the SJL staff on an as-needed basis. The 4.0 FTE at SJL represents a decrease from 5.0 FTE in FY 10-11 due to attrition and the ability of the remaining employees to assume the job responsibilities of a former specialist position.

Located just south of the actual former landfill on the south side of Columbia Slough is the SJL maintenance facility. A building of approximately 3,600 square feet is equally divided between office space and a shop for maintenance activities and tool/equipment storage. Additional equipment storage is provided by two secured shipping containers. The building and shipping containers are all located within a fenced and locked compound. In addition, four pickup trucks are available for staff use, plus a water truck and a dump-bed truck. Other equipment includes a tractor, mini-excavator, backhoe, two ATVs and a trailer suitable for on-site use only.

The SJL personnel, materials and services budget for FY 12-13 is $1,051,000, a decrease of $13,000 from the previous year. In addition to the operating budget, a secondary landfill closure budget of $1,209,500 has been established for FY 12-13. These funds are dedicated to: remedial investigation, feasibility study, annual environmental review and non-routine remediation projects that are beyond the scope of regular maintenance activities.

In addition to SJL site operations staff, personnel in the Natural Areas Program perform habitat restoration, wildlife and plant monitoring and trail planning and development activities. They coordinate with working groups and other entities to ensure work at SJL is integrated with larger initiatives and to seek funding for habitat and trails work. These staff and projects are funded by the Smith and Bybee Lakes Fund, Metro's General Fund and external grants.

CURRENT CONDITIONS

Operations Infrastructure

The operations infrastructure of SJL consists of a multi-layered cover system, a landfill gas extraction and collection system and a condensate collection and treatment system. Protected from air and surface water intrusion by the cover system, the decaying refuse generates landfill gas at nearly 50% methane (CH_4). The gas is drawn from numerous vertical and horizontal extraction wells by axial vane gas blowers through a network of above-ground manifold pipes to the motor blower flare facility (MBFF) where it is burned in one of two standing column flares. As the warm, moist gas is drawn from the wells into the cooler surface manifold pipes, it condenses. Through a vacuum system consisting of vacuum valves, buried pipes and tanks, the condensate is collected and pumped to a condensate evaporator at the MBFF. Because this condensate contains hazardous substances, it must be treated onsite. The remaining sludge is managed as a hazardous waste.

Facility Maintenance

Cover System: From 1992 to 1996 a multilayer cover was constructed over all of the entire buried waste, including surface contouring for stormwater runoff and the methane gas collection system. The main feature of the cover is a double barrier of compacted clayey soil capped with a polyethylene liner. A sand layer above facilitates stormwater drainage, and topsoil provides the growing substrate for cover vegetation. The landfill surface is sloped to manage stormwater through the use of cutoff trenches, ditches, under-drains, detention ponds and outfalls.

Field staff have occasionally discovered and repaired tears or other defects in the polyethylene liner. Some of these were caused during initial construction of the cover system, some have occurred during maintenance operations, and others have been caused by differential settlement.

Motor Blower Flare Facility (MBFF): The MBFF consists of a control room, two condensate knockout tanks, two gas blowers, two operational flares, one non-operational flare, an oil/water separator, a condensate bulk tank, evaporator and an elevated sludge tank. There is also a supply air compressor station. The climate-conditioned control room houses the main electrical switchgear and the Programmable Logic Controller. This system monitors and operates most of the on-site gas transmission equipment. Also included in the control room is an oxygen monitor which will initiate a shutdown sequence if the oxygen level in the landfill gas approaches its lower flammable limit. Numerous data

collection, management and recording devices document system operations. When certain problems occur, an auto-dialer calls the field staff.

Gas Manifold: Collection pipes transport the landfill gas from the wells in the field to the MBFF as a result of the vacuum generated by the blower. The pipes, constructed of high density polyethylene (HDPE), range in size from four inches in diameter at the most remote collection points, up to 16" in diameter near the MBFF. The pipes are designed to expand and contract in length with changes in ambient temperature. Expansion loops are built into the system to accommodate some of this movement.

When warm gas enters the cooler pipeline, some of it condenses to a liquid. As a result, all pipes must slope back to either a well or a low point in the manifold called a drip leg, where the condensate will be removed through a collection system and eventually evaporated on-site.

Differential settlement on the landfill can alter the slope of the pipelines. At times pipelines must be lifted onto cribs or boards to maintain the desired slope. If condensate can't flow to the drip leg because of a low spot, a wave of condensate can build up and eventually block the flow of gas. Because the pipeline can move, it also means the well flex hoses can become detached if the pipeline moves near a well-head. This would introduce oxygen into the system. Elevated oxygen readings at the flare would alert staff to the problem. Occasionally, the pipes are re-routed to accommodate changing landfill conditions caused by settlement. This work, which requires rental of specialized equipment, is performed by landfill staff. Routine repairs of the pipeline system, involving specialized plastic welding methods, are also performed by field staff.

Flares: Two flares are currently operated to combust the landfill gas; a third flare is non-operational and will likely be removed from the site. Because the flares were sized for a higher volume of gas that was generated when the gas system was first constructed in the years immediately following closure, the flaring operation is not as efficient as it once was.

Motor blowers: To draw the gas from the landfill through the manifold system and push gas to the flares or Ash Grove, two motor blowers are available for use. Blower #1 is the older of the two and is used as a backup due to its large size and higher electrical consumption. Blower #2, installed in 2011, is the main unit in use at the MBFF.

Gas wells and trenches: Landfill gas is pulled into the manifold system through numerous vertical wells and horizontal trenches. These require routine operation, inspection, cleaning or repair. The larger producing wells are monitored and adjusted weekly based on gas composition. All wells are monitored and adjusted monthly to improve the landfill gas quality and checked for possible oxygen intrusion or underground fires. In addition,

the wells and associated gas lines are routinely inspected to identify problems caused from heat and cold stress, ultra-violet light damage, movement in the lines and landfill settlement. Some wells and trenches have been closed because they no longer generate sufficient gas. Most of these wells continue to require routine monthly monitoring although some could be decommissioned.

Vacuum pump stations: Two vacuum pump stations serve to draw the condensate from the vacuum valve stations to transfer tanks prior to being pumped to the condensate bulk tank at the MBFF. The stations are referred to as VS1 and VS2.

Condensate pump stations: The condensate transfer tanks contain the liquid condensate that is drawn from the gas manifold system through 30 vacuum valve stations. There are currently five condensate tanks in use, referred to as T1-5, in various locations around the landfill. The vacuum valve stations release condensate from the manifold drip legs, to be pulled by vacuum to the associated tank. Located within each transfer tank is a pump that transfers the condensate to the bulk tank at the MBFF.

Oil/Water Separator (OWS): The OWS is designed to treat condensate generated at the Ash Grove (AGC) compressor station and then piped back to the MBFF. This condensate is produced when the gas is chilled to remove 100% of the entrained moisture, but in the process picks up an oil phase that has a relatively high arsenic concentration. The OWS is designed to remove this oil before the liquid reaches manhole-1 (MH1) and the condensate evaporator system. It consists of a surge tank that moderates flow into the OWS, the OWS itself, and a separate oil storage tank. Floats within the OWS automatically pump the oil to the storage tank and the oil-free effluent to MH1.

Evaporator: Liquid condensate is pumped from a bulk tank into the evaporator, which is fueled by landfill gas and serves as a waste water disposal system. After every 1,200 hours, as recorded by an hourly run meter, the evaporator is emptied into an elevated sludge tank and cleaned. The sludge tank is decanted back into the evaporator and the remaining sludge (about 1.5 gallons per year) is managed as a hazardous waste.

Vacuum valve stations: Each of the 30 vacuum valve stations consist of a needle float valve plumbed into a drip leg. The valve allows condensate to be drawn by vacuum from a drip leg to a designated transfer tank. The vacuum valve stations are located in various low lying areas of the gas manifold piping throughout the landfill. On a monthly basis, these stations are inspected to ensure there are no vacuum or condensate leaks. In addition, filter screens are checked and cleaned. The proper functioning of the vacuum valve stations is vital in maintaining a vacuum greater than that created by the blower plus the

vacuum required to overcome any differences in elevation. If not, condensate can accumulate and back up in the gas manifold, effectively plugging the lines.

Leachate pump station: There is currently one leachate pump station (MH2) where leachate is collected from under-drains beneath the final closure areas of the landfill, in Subareas 4 and 5. To prevent this leachate from contaminating groundwater, it is pumped from the MH2, across the landfill bridge, to the City of Portland sanitary sewer. The volume of waste water discharged is monitored daily and a monthly report is submitted to the City's Bureau of Environmental Services. In 2012, a liquid level controlled pump system was installed allowing the adjustment of liquid levels in MH2 to remain lower than the level of surrounding surface water. This further limits the chance of leachate to enter the environment prior to treatment. The controller also contains a data logger to track the leachate levels.

Environmental Monitoring

Environmental monitoring and data collection at SJL is conducted in accordance with several permit requirements and additionally serves to assist with site operations and equipment maintenance.

Solid Waste Disposal Site Closure Permit: The closure permit issued by DEQ specifies requirements for groundwater and leachate monitoring, and seep inspections of the perimeter dike. Currently, groundwater is sampled semi-annually from 35 wells during two compliance periods (April-May and October-November), and analyzed at an independent laboratory for an extensive suite of chemical constituents, including indicators of landfill leachate. These constituents include metals, volatile and semi-volatile organic compounds, inorganic compounds, pesticides and herbicides, PCBs, as well as water quality parameters (e.g., temperature, pH, dissolved oxygen, and electrical conductivity) measured in the field at the time of sampling.

The groundwater wells are located either on the perimeter of SJL, or across Columbia Slough or its North Slough arm. Well depth ranges from relatively shallow (~25 feet), to fairly deep (~200 feet). This allows the detection of potential contamination in the near-surface zone affecting primarily adjacent water bodies (Columbia Slough; Smith and Bybee Lakes) and in deeper aquifers that could have a more regional effect.

Some of the wells are screened-in aquifers characterized by the presence of very fine silt. This has the effect of plugging the well screen, which makes the collection of a representative sample a time-intensive process. The recharge rate and depth-to-water on these wells is closely monitored and, as needed, they are re-developed to remove some of

these sediments to improve permeability and lengthen the lifespan of the well. This work was first done by a contractor, but has since been performed by the SJL staff.

There are also six screened wells within the solid waste that are intended for collection of leachate samples. They are subject to the same sampling requirements as the groundwater and analyzed for the same list of compounds. However, the functionality of these wells has become compromised. Three of the wells have either gone dry or are so fouled with tar as to make sampling impossible. Another two wells are nearly dry and the only one that is a consistently productive well was not originally intended to be a leachate well. K-5, near the terminus of Blind Slough, was planned to be a shallow aquifer monitoring well. During the drilling process, solid waste was encountered. It has since been considered a leachate well, but it functions more as a combination leachate – groundwater well.

Along with the closure permit, DEQ issued a consent order whereby Metro agreed to a risk assessment (RI) of potential hazards to human and ecological health caused by confirmed releases of hazardous compounds from the landfill, and a feasibility study (FS) of any potential corrective actions. Metro has contracted with CH2M Hill for this work, of which both the RI and FS have been completed and approved by DEQ. It is likely that some of the sampling requirements and/or locations will change as a result of the RI/FS, but at this point those potential changes are unknown.

Previously, Metro voluntarily carried out routine sampling and analysis of surface water and sediments for the purpose of characterizing changes and trends over time in the lower Columbia Slough system near SJL. These included both surface water and sediment sampling at multiple locations in sloughs and wetlands. In addition, continuous monitoring of surface water for standard water quality parameters was conducted in four locations with instruments that measure and record parameters at programmed intervals.

Oregon Title V Operating Permit: The Title V permit regulates all air emissions from the site, including monitoring requirements. Operational data related to landfill gas is collected on a continuous basis by an automated system of sensors and computers, and includes flow, gas temperature, oxygen content and flare temperature. On a daily basis, gas composition readings are collected with a portable gas analyzer from four locations in and around the flare facility. Data are reported to DEQ and are used to identify potential problems in the field that may require immediate attention. There are currently 107 vertical gas extraction wells and 86 shallow horizontal trench wells, of which all of the vertical wells and some of the horizontal wells are monitored for gas composition and flow, at least monthly. The 69 trench wells around the perimeter are monitored quarterly. This monitoring is expected to be required for the foreseeable future.

The Title V permit also requires quarterly surface emission monitoring to check for potential leaks in the landfill cover system. This involves walking across the landfill surface at 100 foot intervals with an instrument that will quickly detect the presence of methane at very low levels. Should a reading of greater than 500 parts per million be observed, the permit identifies specific required actions. If a leak is identified, immediate measures are taken to determine the source of the leak and what can be done to address it. For example, perforation of the liner requires excavation with heavy equipment and expertise in HDPE liner repair. That work is usually done by the SJL staff.

Over time gas flow has naturally decreased as the decomposition process in the buried waste progresses, with an annual decline of about 13 percent, by volume. This has allowed the removal of some of the pipeline infrastructure in areas where there is little to no gas generation, namely the Power Line Corridor and the perimeter trench wells around Subarea 1. There are no near-term plans to remove other parts of the pipeline, as there is likely to be some gas production in the rest of the landfill for some time to come. However, individual wells that are no longer productive could be decommissioned and removed, while ensuring that effective pressure in the gas well field is maintained. .

Discharge Authorization for Process Wastewater: Landfill leachate is collected through an under-drain system at the bottom of portions of Subareas 4 and 5 and directed to a sump (MH-2) where it is then pumped to the sanitary sewer. Originally, all condensate generated in the gas collection system was sent to MH-2 where it was combined with leachate prior to discharge to the sewer. Beginning around 1998, monitoring results began to show arsenic concentrations consistently above the City of Portland local discharge limit. A comprehensive investigation of the wastewater system revealed that condensate was the primary cause. To remedy the problem, the two liquid streams were separated, with the condensate treated on-site through an oil/water separator and an evaporator, and the leachate alone discharged to the sewer. After demonstrating the effectiveness of this system in meeting discharge limits for arsenic and other contaminants of concern, the City Bureau of Environmental Services terminated the long-standing site wastewater discharge permit and issued a discharge authorization for process wastewater. The authorization requires only that Metro follow best management practices in operating the wastewater system described above; no monitoring of wastewater is required.

NPDES Industrial Stormwater Discharge Permit: In 2012, DEQ terminated the SJL NPDES stormwater discharge permit based on the reasoning that: site stormwater does not come into contact with industrial activity or significant materials, as defined under the NPDES program; the site closure permit ensures groundcover and surface contours for efficient stormwater runoff; and land use is guided by comprehensive planning for the SBNA.

Consistent with the site closure permit, the stormwater management system will continue to be monitored for functionality; however, stormwater quality monitoring is no longer required.

O&M-Related Monitoring: Other data are collected to support landfill closure operations and maintenance. This includes run-time data for six condensate pumps, one leachate pump, two flares and the evaporator burner and blower. Flow data are collected for the oil/water separator, condensate flow to the evaporator and leachate flow to the sanitary sewer.

Vegetation Management

In addition to anchoring the final cover soil and preventing erosion, the purpose of the vegetative cover is to provide habitat for a diversity of pollinators and other wildlife. As the final cover was constructed using only non-native grasses, test plots of various native grasses and shrubs have been planted around the landfill during the post-closure period, with mixed results. Plots developed in Subarea 1 during the past decade to test grasses, forbs, shrubs and trees have achieved relatively good success, providing a reasonable indication of which species will adapt to the site's unique soil environment. As established in the CNRP, the site goal for habitat restoration is largely a functional upland prairie, with perimeter bottomland and riparian forest habitats transitioning to the surrounding wetlands. Work is under way on Phase 1 of upland prairie habitat restoration, which is designed to minimize invasive non-native grasses and introduce native grass and forb (wildflower) species within 17 acres of Subarea 1.

Most or all of the landfill was previously mowed annually. This provided weed control and facilitated access for maintenance and monitoring operations, however, mowing often occurred during the height of nesting for grassland birds. In 2003, rotational and operational mowing was introduced, with approximately 30 to 50 acres mowed or grazed annually in late summer after the offspring of ground-nesting birds have fledged. This provides greater diversity of vegetation structure within the prairie, although many weeds are more evident now. Staff and contractors manage the weeds via manual, mechanical and chemical methods as appropriate. With reduced mowing, native grasses seeded in the late 1990s in what was thought to be a failed experiment are now growing and thriving.

By limiting mowing, a variety of structure with different grass heights is encouraged. Additionally, it allows both grasses and forbs to reach maturity and produce seed. Many ground nesting birds, such as the western meadowlark, require taller grass to nest and forage. Other birds may also have preferences for the additional cover that taller grass offers. Some are attracted to thick grass and others, like the streaked horned lark (STHL),

prefer mostly bare ground. In addition, forbs attract pollinators such as bees and butterflies.

In 2007, due to concerns about regional habitat loss for the STHL, Metro voluntarily created a five-acre experiment habitat plot in Subarea 4 by importing dredge materials (sand) from West Hayden Island. Metro staff worked in cooperation with the U.S. Fish and Wildlife Service, Center for Natural Lands Management (CNLM), Washington Department of Fish and Wildlife, Oregon State University and the Port of Portland in an effort to attract the STHL to nest on the constructed plot. A monitoring and maintenance protocol for the habitat plot was established. The first sighting of STHLs at this plot was in February 2010. As of 2013, STHLs have been seen during winter and breeding season, but to date no nesting behavior has been observed.

In 2011, a second five-acre STHL plot was developed in Subarea 3 to serve as control habitat for a conspecific attraction study conducted by the CNLM. The study employs audio (bird song) and visual (bird decoys) attraction techniques on the original plot. Unlike the original plot, no fill material (e.g., sand or soil) was used to develop the control plot. Rather, vegetation was removed to expose the soil in place, establishing sparsely-vegetated ground conducive to STHL nesting. As of early 2013, no STHLs have been sighted on this second plot.

An inter-governmental agreement between Metro and the City of Portland Bureau of Environmental Services, Watershed Revegetation Program (WRP), guides the planting and maintenance of perimeter vegetation along Columbia and North sloughs. Metro staff meets with representatives from WRP annually to review conditions and develop a plan for the following year.

ANTICIPATED DEVELOPMENTS AND EFFECTS

Purpose

In the next 10 years several key actions, influences and planning efforts are likely to have significant impact on operations at SJL. These include regulatory changes, changes in site and environmental conditions, and the implementation of the CNRP. The following section identifies these anticipated developments, their effects on the site and operations, key considerations, and alternatives for addressing effects.

Regulation

Record of Decision (ROD): The prospective ROD represents the regulatory endpoint of the RI-FS process. It will include DEQ recommendations for long-term environmental

protection, including a remedy for reducing current risks, and environmental monitoring requirements going forward. The FS identifies limited ecological risks posed by a few contaminants in the west mudflat sediments, and a preferred approach involving broadcasting activated carbon onto sediments to increase contaminant-binding capacity. DEQ has accepted that approach. Overall reduction in the groundwater monitoring well network is anticipated.

There will likely be a reduction in environmental sampling and analysis resulting from anticipated modifications of monitoring requirements, although until the ROD is issued and the closure permit is renewed, those requirements will be uncertain. Staff will modify sampling activities as needed to conform to new requirements.

Permit Modifications: The current closure permit includes conditions wherein the ROD will trigger changes in the permit, including, for example, new concentration limits for groundwater contaminants, specified actions for addressing exceedences and revised requirements for annual reporting.

Renewal of the permit will present the opportunity to request other modifications such as revisions in cover management requirements for the purpose of providing greater flexibility for habitat projects and gas system downsizing and reconfiguration.

Site Conditions

Decrease in Gas Generation: Gas flow will continue to decrease at a predictable rate, roughly 65% every five years. Current estimates indicate gas flow will decrease to about 170 standard cubic feet per minute (SCFM) by 2019 and 60 SCFM by 2024. General options for accommodating this reduced flow could include continued flaring of the gas or processing it through a static carbon filter system. Whatever options are exercised, a continued staff presence will be required to operate and maintain any future gas/condensate systems.

As gas flow decreases, several infrastructure changes will be required. These include downsizing the flares and blowers, decreasing the manifold pipe size, redirecting manifold pipes due to differential settlement and to more efficiently collect the landfill gas and condensate, removal of unused sections from decommissioned wells and decommissioning vacuum valve stations and additional non-productive gas wells. A protocol will be established to determine when a gas well falls below a productive level. Several wells per year could qualify.

As landfill gas generation decreases, there will be a corresponding decrease in the production of condensate. The current condensate evaporator will be due for a complete overhaul, primarily the replacement of the flue piping system, in three to five years. The service life of the evaporator, including one replacement of the flue piping system, is 20 years. When this system reaches the end of its service life, options will exist to redirect the condensate and inject it into a flare, or to treat it and re-connect it to the wastewater discharge stream. This would require modifications to the existing wastewater discharge authorization and Title V permit.

End of Ash Grove Program: Gas flow will eventually reach a point at which it can no longer serve the production needs of AGC. AGC has not drawn landfill gas since the contract expired in April 2012, and prior to that time, gas consumption was highly sporadic and tapering off. Current gas flow is 50 SCFM less than when AGC last took gas.

Understanding that contract termination will include decommissioning and eventual removal of the compressor station, the existing cover and concrete pad at the station could be repurposed for site equipment storage needs.

The end of the ACG program will likely necessitate changes in operation of the MBFF and gas well field. The flares and blowers, and possibly the manifold pipeline system, will need to be reconfigured to operate on the anticipated gas flow. These changes will also impact the management of condensate.

Differential Settlement: Waste decomposition and related changes in the subsurface will cause occasional settling of the landfill surface and potential damage to the geo-membrane. Staff estimates have determined that 10,000 tons of CH_4 and CO_2 are removed from the landfill every month. As that occurs, the resulting vacated space generates settlement at different rates. The need to fill depressed areas will continue, although the volume and frequency will continue to decline. A fault line exists along the top eastern side of Subarea 5. The liner has been stretched past its breaking point in places, requiring repair. At some point, the entire top of slope may need to be repaired. Some repair work is also likely in Subarea 4, where the Blind Slough once meandered across the landfill property prior to being filled as part of landfill expansion in the 1980s. The unconfined silts in this area will continue to settle, and it is reasonable to assume that another major landscape restoration project will be required here.

Occasionally, there is a need to import soil to fill areas that have settled or where ponding of stormwater has occurred. Fill material is located and samples collected and tested for contamination. The results are sent to DEQ for approval as clean fill. Excess soil from

Metro's cemeteries is occasionally hauled to SJL for use in filling low spots. The testing protocol is waived for these soils.

Subsurface Fires: Oxygen intrusion into the gas extraction system can cause subsurface combustion. Maintaining the integrity of the liner will continue to be essential in keeping oxygen out. During regular monitoring activities, the site is inspected for signs of subsurface fires. In the event they are discovered, they are immediately suppressed. There have been no underground landfill fires since 2003; future incidents are likely to be minimal as long as regular gas monitoring continues.

Environmental Conditions

Streambank Erosion: Natural hydrologic cycles will cause ongoing erosion and slope instability and potential failure in some sections of the perimeter levee. The areas most susceptible to the effects of erosion are sections of the "natural" levee that have not been reinforced or reconstructed. The levee is checked for erosion during quarterly inspections for bank seepage.

Groundwater Table Fluctuation: Natural fluctuations in the groundwater table will influence the volume of liquid in the leachate wet well. Leachate will continue to develop in the refuse unless measures are taken to reduce the infiltration of surface water along the perimeter.

Leachate sampling wells have experienced diminishing liquid levels, with several of them going dry. Should DEQ wish to have more complete analytical data sets from the leachate, new wells, or the designation of gas wells to serve as collection points, will be necessary.

There are several systems available to lower the permeability of the perimeter dikes. Previously, 1,000 feet of cement/bentonite (CB) wall was installed using a ditching process. The cost was about $500 per lineal foot in 2000. There is nearly 9,000 lineal feet of native perimeter dike remaining to be modified. There are other construction techniques to install the same type of wall including drilling and pressure grouting. These may be less expensive but include slope stability drawbacks. A vertical HDPE liner can be included or used alone in a trenching operation to further reduce permeability. A perforated pipe is usually installed with this type of construction to collect the leachate at the wall base and remove it for treatment.

High Water Conditions: Surface water elevation is variable and seasonal high water or flooding can occur in any given year. High water conditions sometimes cause standing water on sections of the perimeter road on the north side of Subarea 1 and the south side of Subarea 3, but generally cause no permanent damage to landfill facilities. While it is

occasionally a minor impediment to staff, it is likely to impact users of the recreational trail once it is developed and open to the public, unless trail construction involves re-grading that section of perimeter road.

Cold Weather Conditions: Cold weather can cause shutdown of automated equipment. Condensate can freeze in the manifold or in the vacuum valve stations. HDPE manifold pipes contract in cold weather. This can lead to oxygen leaks when a joint opens up or a flex hose is detached as the manifold moves. Leaks are diagnosed by daily gas composition readings and analysis of the oxygen analyzer data. As soon as a determination has been made that a leak is present, staff proceed into the field with portable monitoring equipment until the leak is located. The leak repair process then begins. Each fall, potentially affected systems are weatherized to prepare for the possibility of extreme cold temperatures. Electric trace heating is used to protect some equipment such as pneumatic pumps, exposed pipes, the oil/water separator and outdoor sampling equipment.

Comprehensive Natural Resource Plan Implementation

The CNRP identifies goals and actions for upland prairie habitat restoration, including continued development of streaked horned lark habitat, and for construction of public trail. Current challenges for restoration include the relatively poor quality of the current upland prairie habitat and the fact that streaked horned larks, while observed at SJL, have not yet been known to nest at the site. The upland prairie conservation target includes other wildlife and plants that will occur on the site consistently. Trail construction will require prior assessment of site facilities that may be relatively more vulnerable to vandalism or tampering, and measures to improve security of such facilities.

Upland Prairie: Within five years of the plan adoption, 20 acres of degraded habitat will be restored to fair condition for native forbs, grass cover and bird perches. Within 10 years, 60 additional acres will be restored. The longer-term goal is to establish 210 acres of upland prairie functioning at good to very good levels for species such as the western meadowlark, grasshopper sparrow, Oregon vesper sparrow and western bluebird. Conditions for nesting western painted turtles will be maintained along the perimeter of the site. Site preparation will include techniques to reduce the non-native grass cover and prepare a seedbed that allows native grasses and forbs to become established.

Streaked Horned Lark: The 10-year goal is to develop nesting and fledging functioning at good to very good levels by maintaining 10 acres of sparsely-vegetated nesting habitat with key attributes for grass height, woody vegetation cover and rhizomatous grass dominance. Management techniques will include importing soil, chemical and/or mechanical methods to maintain bare ground and experimenting with habitat configuration (shape and size).

Trail Construction: A trail for hiking, biking and wildlife viewing is proposed for the site, to include a new paved trail that is aligned to fill a gap in the regional trail system and connect to the St. Johns neighborhood. This trail will include a bridge over the North Slough to connect to an existing trail that continues from the site to the northwest. The north and east sections of the perimeter road will serve as trail segments, with a spur trail to come off the east segment and ascend Subarea 5 to a viewpoint. At condensate station T-2, the trail will leave the road and wind along Columbia Slough behind the flare facility before crossing Landfill Bridge and Parcel A. Changes to Landfill Bridge will include a five foot extension of existing sidewalk with a rolled curb, a reduction of the vehicle lane to 15 feet and moving the gate to the landfill side of the bridge. A combination of post/cable and chain-link fencing will be used (with signage) on the landfill side of the trail to discourage trail users from wandering onto the site. Six fence gates will provide access for staff to selected areas. Over time, as allowed by gas system downsizing, spurs to other viewpoints will be considered.

As currently designed, the new trail will affect staff access to the site. Nearly 60% of once easily accessible perimeter road will be restricted, requiring that staff utilize several gates to enter restricted areas from the service road that will also serve as trail. Further, staff will have regular contact with trail users, and as such could benefit from training in interaction with the public.

To protect trail users and secure wells, pipes, and facilities, staff will assume some responsibility for patrolling the site and keeping the public away from gas and condensate systems. Some equipment like the condensate pump stations will require the installation of hardened enclosures to protect against tampering, theft and vandalism. This could include fencing, bars, walls, etc. Securing gas wells will be more challenging, as locking and securing them will be difficult, and any measures used must allow for reasonable access for monitoring and maintenance at the wells. Increased monitoring once public access is allowed will be essential.

The landfill vegetation becomes very dry from summer through early fall. The area between the trail and the landfill is particularly susceptible to ignition due to a discarded cigarette, firework, etc. A fire across the landfill could result in damage to the gas collection system. Additionally, several wells generate dangerous levels of hydrogen sulfide (H_2S), and these should be protected from tampering.

RECOMMENDATIONS

1. Document current procedures for operating all site equipment. Identify equipment and systems, and describe inspection protocol, including: scope, frequency, tracking (e.g., hours, SCFM), and recordkeeping.

2. Conduct a technical evaluation of the existing gas management system for the purpose of recommending modifications to the system, including equipment function and system design changes offering long-term efficiency and stability.

3. Initiate a process to evaluate and decommission non-producing gas wells and interior trenches; perimeter trenches should remain to detect fugitive methane.

4. Evaluate the efficiency of the leachate management system, including but not limited to pumping mechanisms and cycles at Manhole 2. Prepare and implement a plan for system monitoring and/or modifications, as necessary to achieve efficient discharge from the manhole to the sanitary sewer.

5. Develop protocol for evaluating the quality of any fill material under consideration for use at the site, including criteria for acceptance of such material, and procedures and locations for storing accepted material.

6. Identify and outline feasible modifications in site operations that would support CNRP conservation targets, primarily including upland prairie, streaked horned lark habitat, and riparian forest; as well as shrub and emergent wetlands.

7. Develop a plan for adapting facilities and activities to the proposed public trail, including: 1) securing gas and condensate facilities, and other infrastructure, in areas where vulnerability to vandalism will likely be high; 2) procedures for using security gates, staff access to the site, and addressing the threat of fire; 3) interaction with trail users; 4) managing public access.

8. Outline desired modifications to the site closure permit, in preparation for negotiating a renewed permit with DEQ after the ROD is issued.

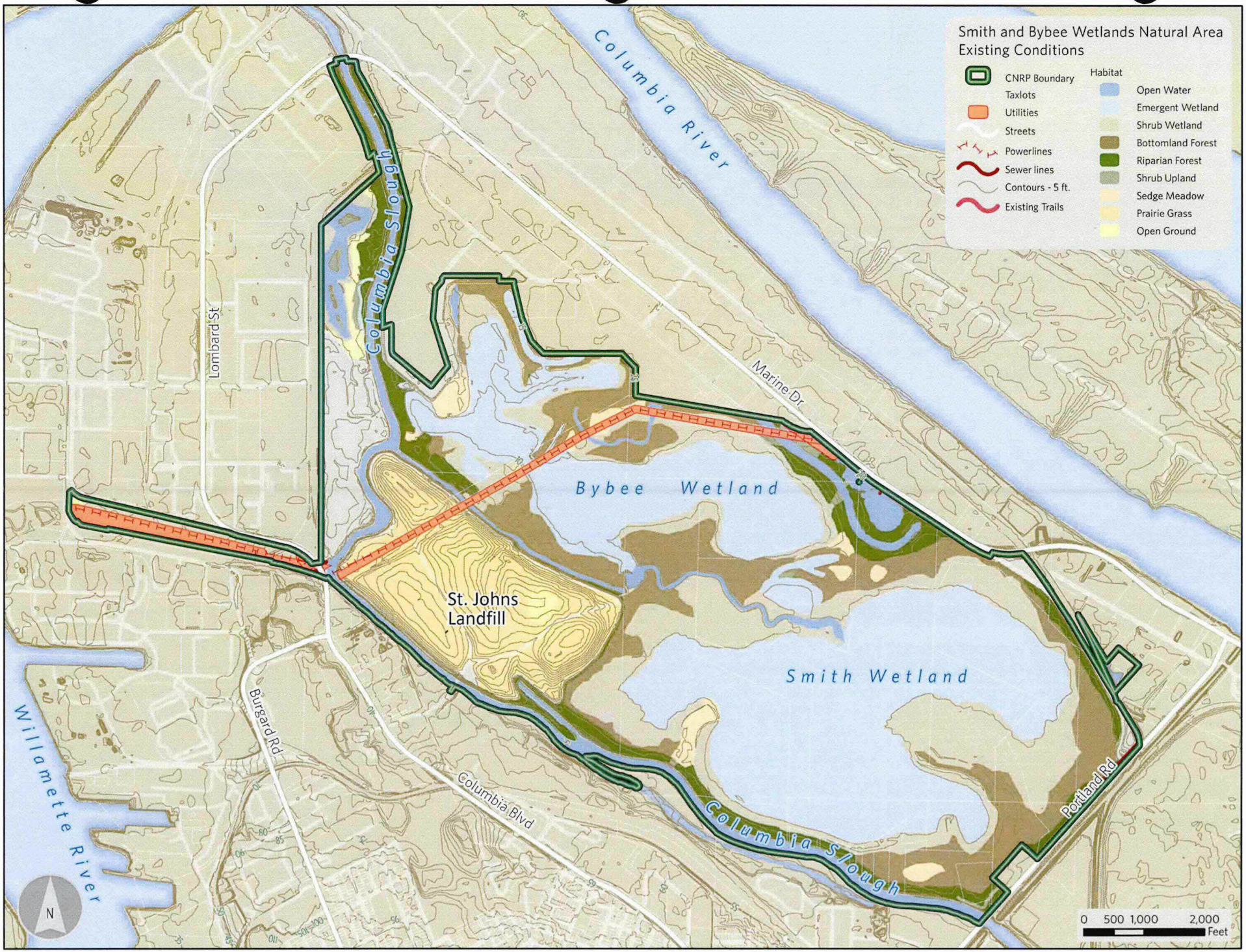
9. Outline a plan for decommissioning groundwater and leachate monitoring wells, the total number and location of which will be determined by the renewed closure permit. Groundwater wells to be decommissioned should include abandoned wells along the northeast and southeast perimeter.

10. Outline consulting services that may be needed to carry out actions described or implied in the recommendations above.

11. Maintain the current level of staffing and resources, in order to provide a depth and range of experience and specialized service needed to effectively adapt to anticipated developments described in this plan.

APPENDIX

Figures


Smith and Bybee Wetlands Natural Area
Existing Conditions
CNRP Boundary
Taxlots
Utilities
Streets
Powerlines
Sewer lines
Contours - 5 ft.
Existing Trails
Habitat
Open Water
Emergent Wetland
Shrub Wetland
Bottomland Forest
Riparian Forest
Shrub Upland
Sedge Meadow
Prairie Grass
Open Ground
Columbia River
Columbia Slough
Lombard St
Marine Dr
Bybee Wetland
St. Johns Landfill
Smith Wetland
Burgard Rd
Columbia Blvd
Portland Rd
Willamette River
N
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Feet

Regulations
St. Johns Landfill

Regulatory Mechanism	Agency	Regulated or Required Activity
Solid Waste Site Closure Permit No. 116	OR DEQ	Regulates site operations - environmental monitoring – remedial actions
Order on Consent LQSW-NWR-02-14	OR DEQ	Requires remedial investigation and feasibility study leading to Record of Decision
Oregon Title V Operating Permit 26-3310	USEPA / OR DEQ	Regulates air emissions from site
Greenhouse Gas Emissions Report Rules	USEPA / DEQ	Requires annual report of greenhouse gas generation and emissions from site
Discharge Authorization for Process Wastewater DA-2011-012	City of Portland	Specifies best management practices to control quality of wastewater discharged to sanitary sewer
Hazardous Waste Generation Reporting Rules	OR DEQ	Requires annual report of hazardous waste generation unless conditionally exempt
Hazardous Substances Reporting Rules	OR Fire Marshal	Requires annual report of hazardous substance quantities stored on site
Electric Power Transmission Line Easement	Bonneville Power Administration	Limits land use within a defined power line corridor crossing the site
Electric Power Transmission Line Easement	Portland Gas and Electric	Limits land use within a defined power line corridor crossing the site
Access and Use Agreement	City of Portland	Allows access to / use of monitoring wells on City property within SBWNA
State-Owned Submerged and Submersible Land Use Registration	OR DSL	Requires registration for certain projects carried out along site perimeter below line of ordinary high water
Open Space Code	City of Portland	Specifies allowed uses on property zoned as open space
Archaeological resources	OR Historic Preservation Ofc	Current state cultural resources laws and regulations
Land Use Review	City of Portland	Regulates projects conducted within environmental overlay zone – Specifies allowed uses
Removal-Fill Permit	USACE / OR DSL	Regulates projects below the line of ordinary high water
Metro Functional Plan, Title 13, Nature in Neighborhoods	Metro	Riparian protection including class I and II habitat, exempt uses and conditioned activities


Zoning Designations
St Johns Landfill
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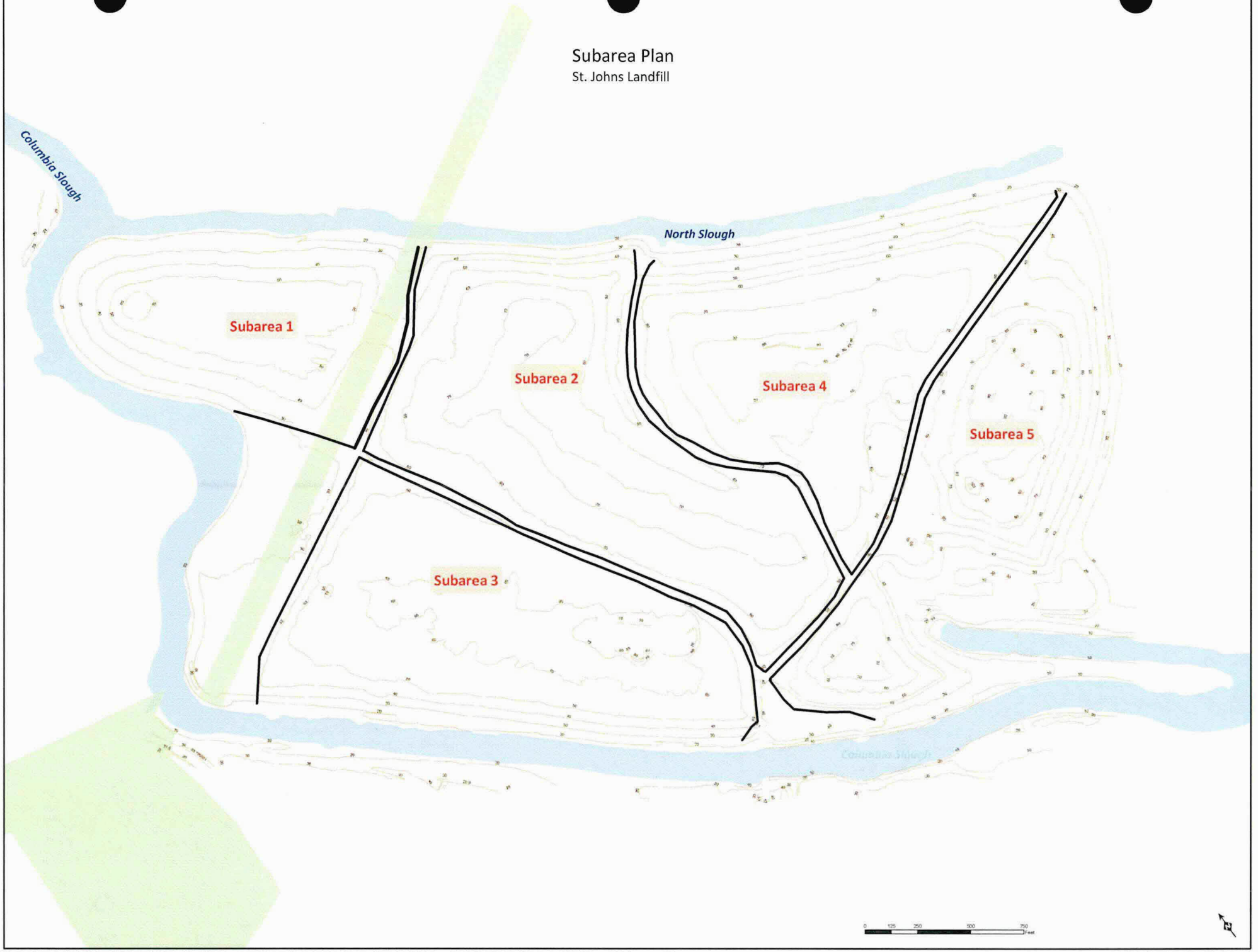
Subarea Plan

St. Johns Landfill



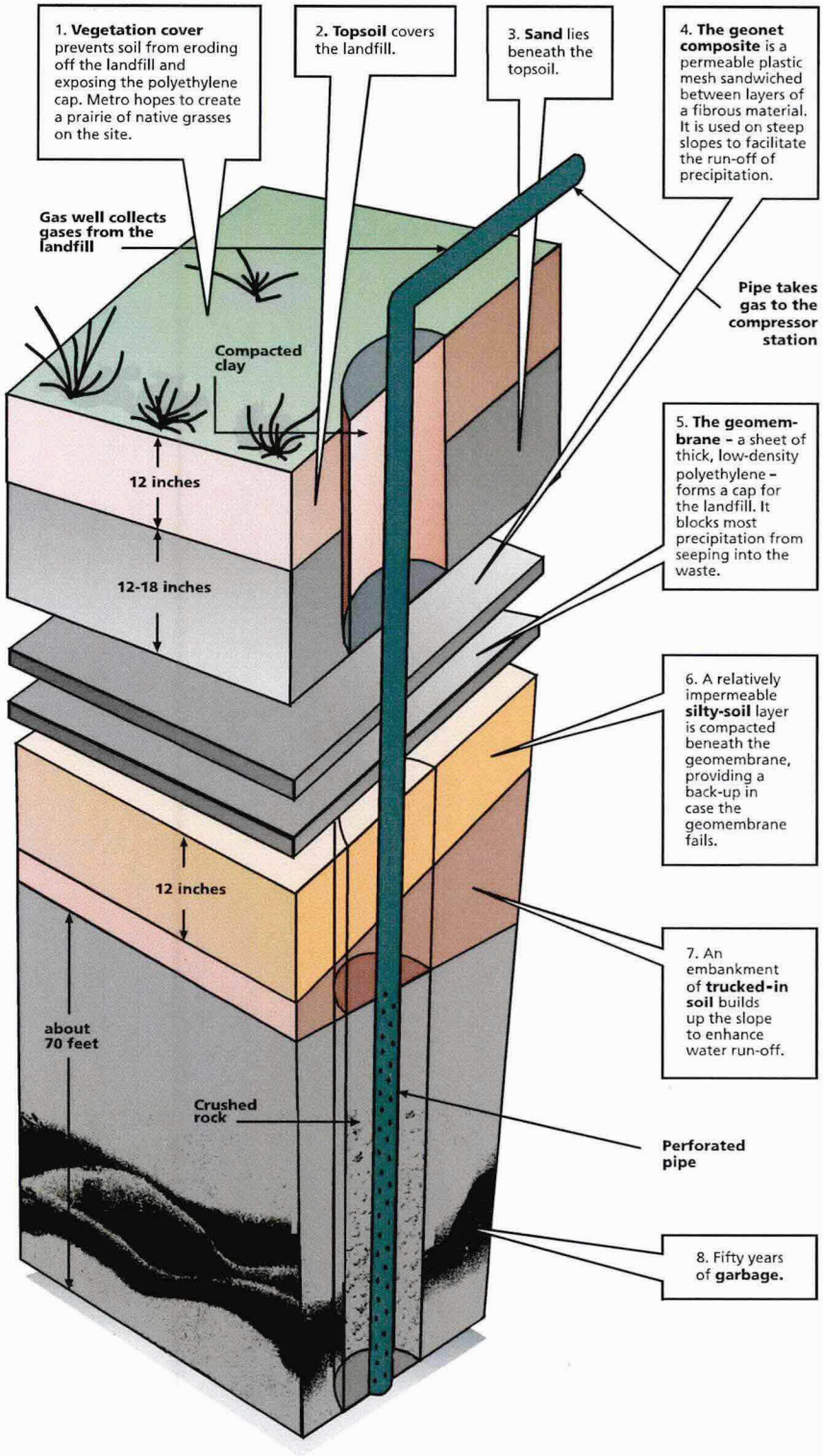
Anatomy of the Landfill

St. Johns Landfill cover and well system

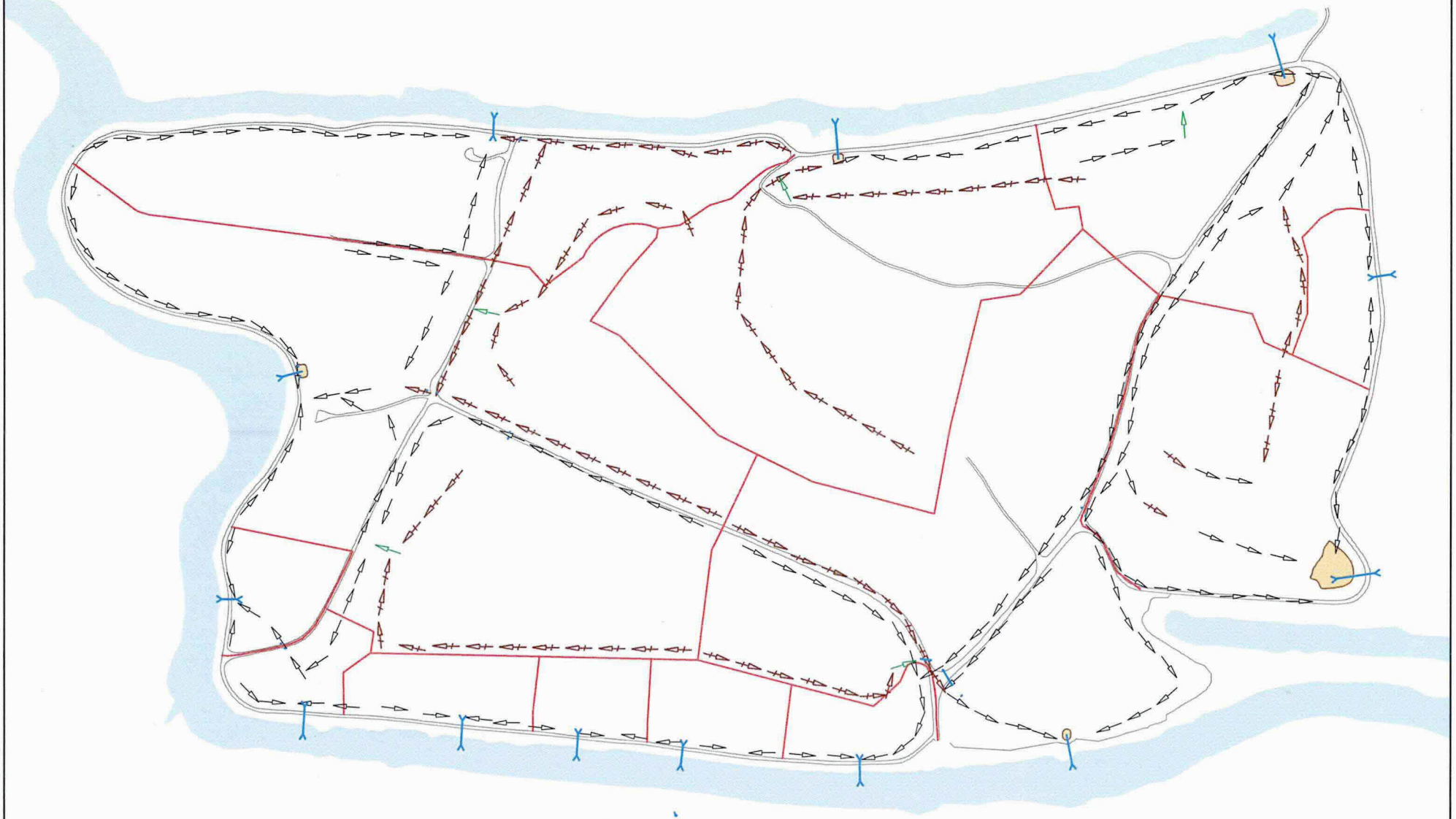
The decomposing waste at the St. Johns Landfill has been covered with soil, sand and a plastic membrane. Much of the cover material used was recycled from the existing landfill cover or dredged from the Columbia River. A network of wells drilled into the waste collects the methane produced by the decomposing garbage.

Materials used in cover:

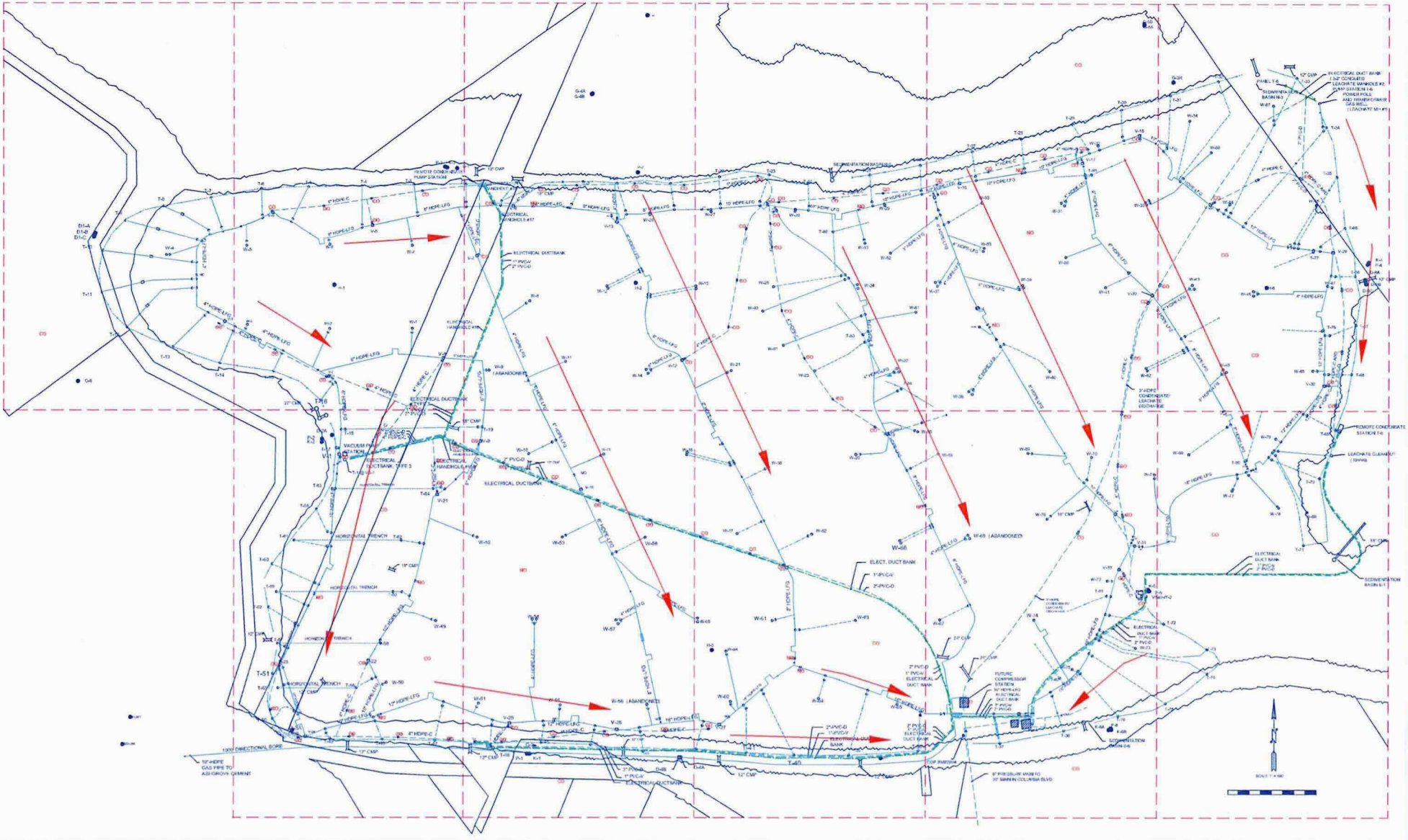
- Top soil: 391,848 cubic yards
- Percent of topsoil recycled from old landfill cover: 45%
- Sand: 533,659 cubic yards
- Percent of sand dredged from the Columbia River: 57%
- Total amount of membrane: 1,087,082 square yards (170 football fields)
- Total amount of geonet composite: 367,090 square yards
- Total amount of compacted silt: 350,721 square yards
- Percent of silt recycled from old landfill cover: 16%



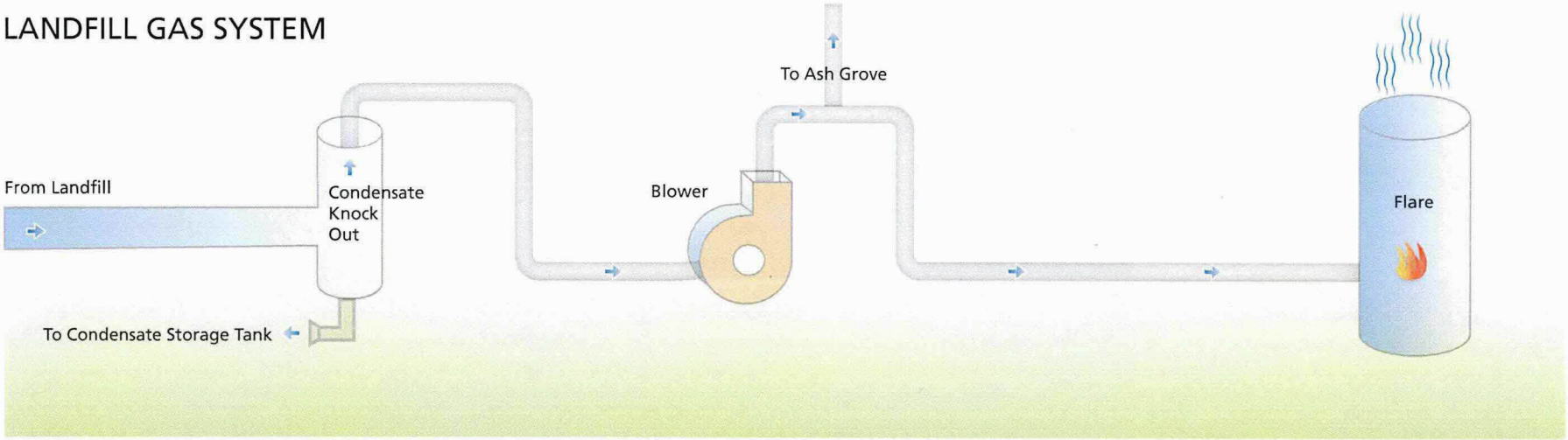
Stormwater
Drainage Basin Boundaries
and Outfall Locations



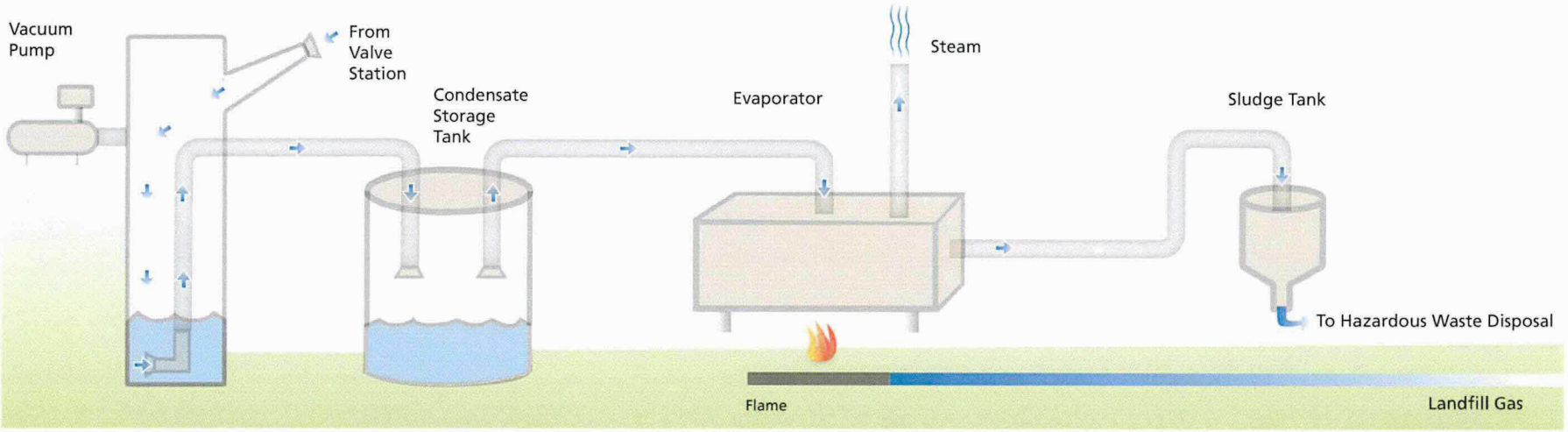
PROCESS FLOW: ST. JOHNS LANDFILL GAS COLLECTION SYSTEM



LANDFILL GAS SYSTEM



CONDENSATE SYSTEM



10.28.13 Metro Job# 14035

Metro

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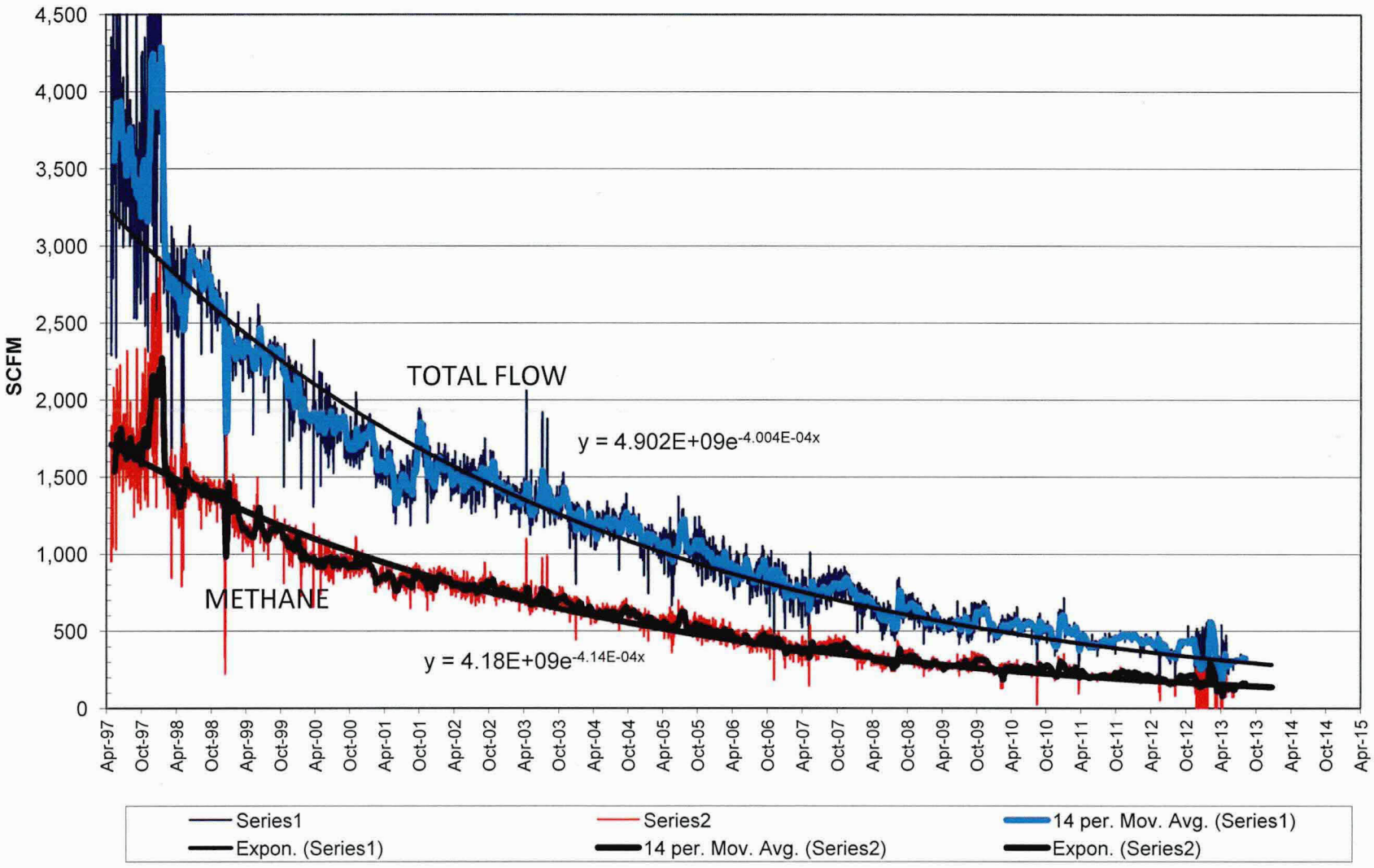
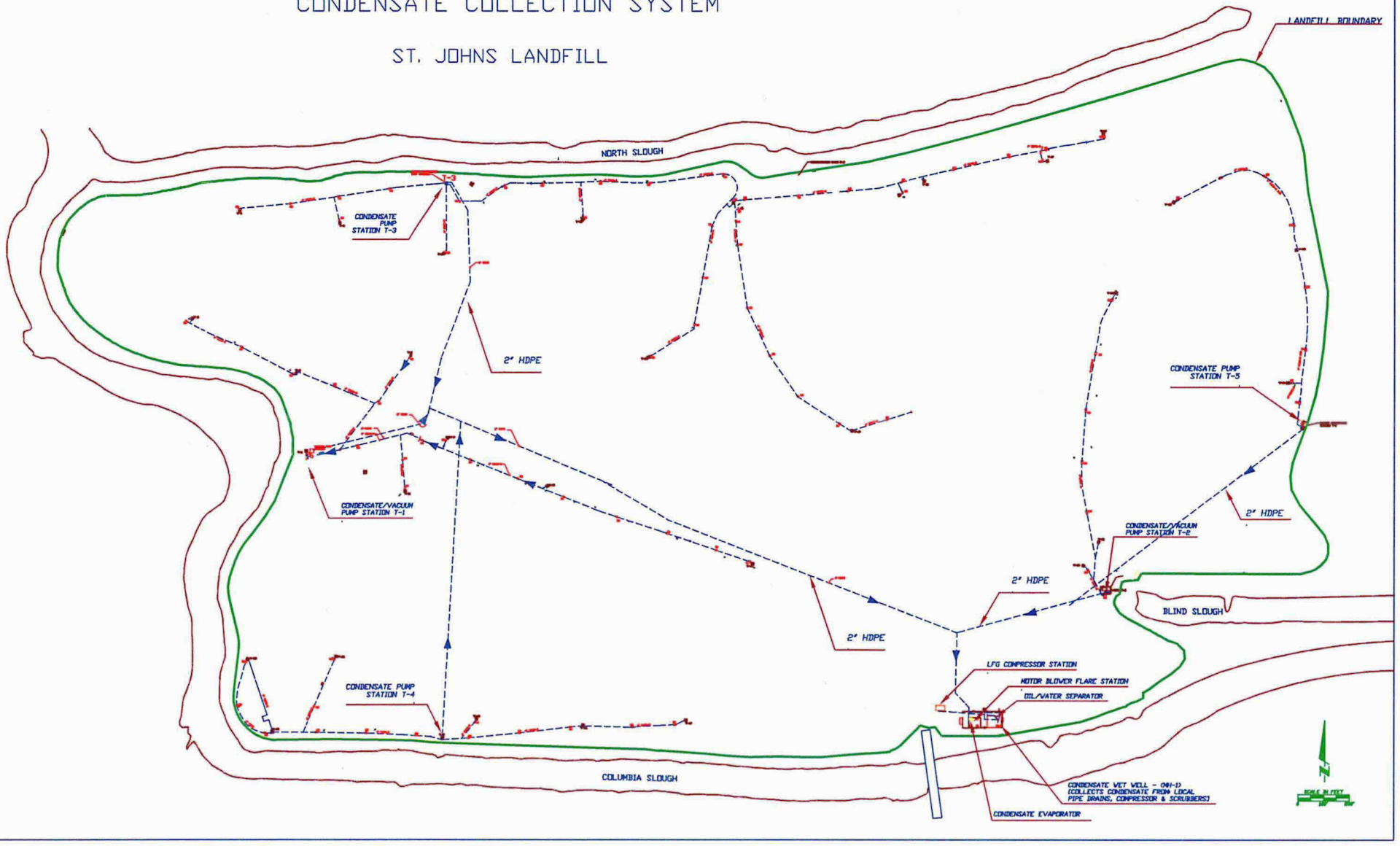
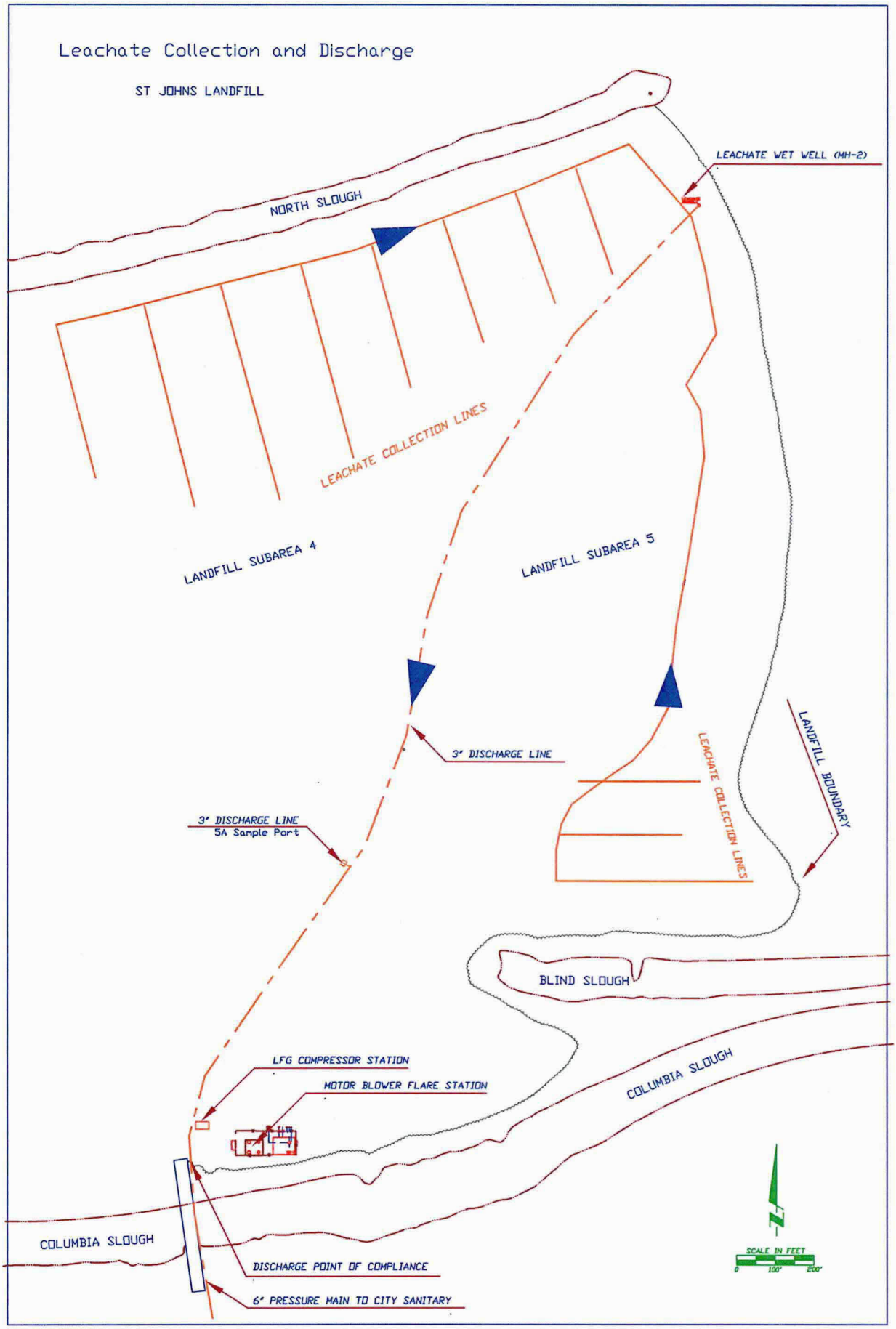
Gas Flow (1997-2013)
St. Johns Landfill



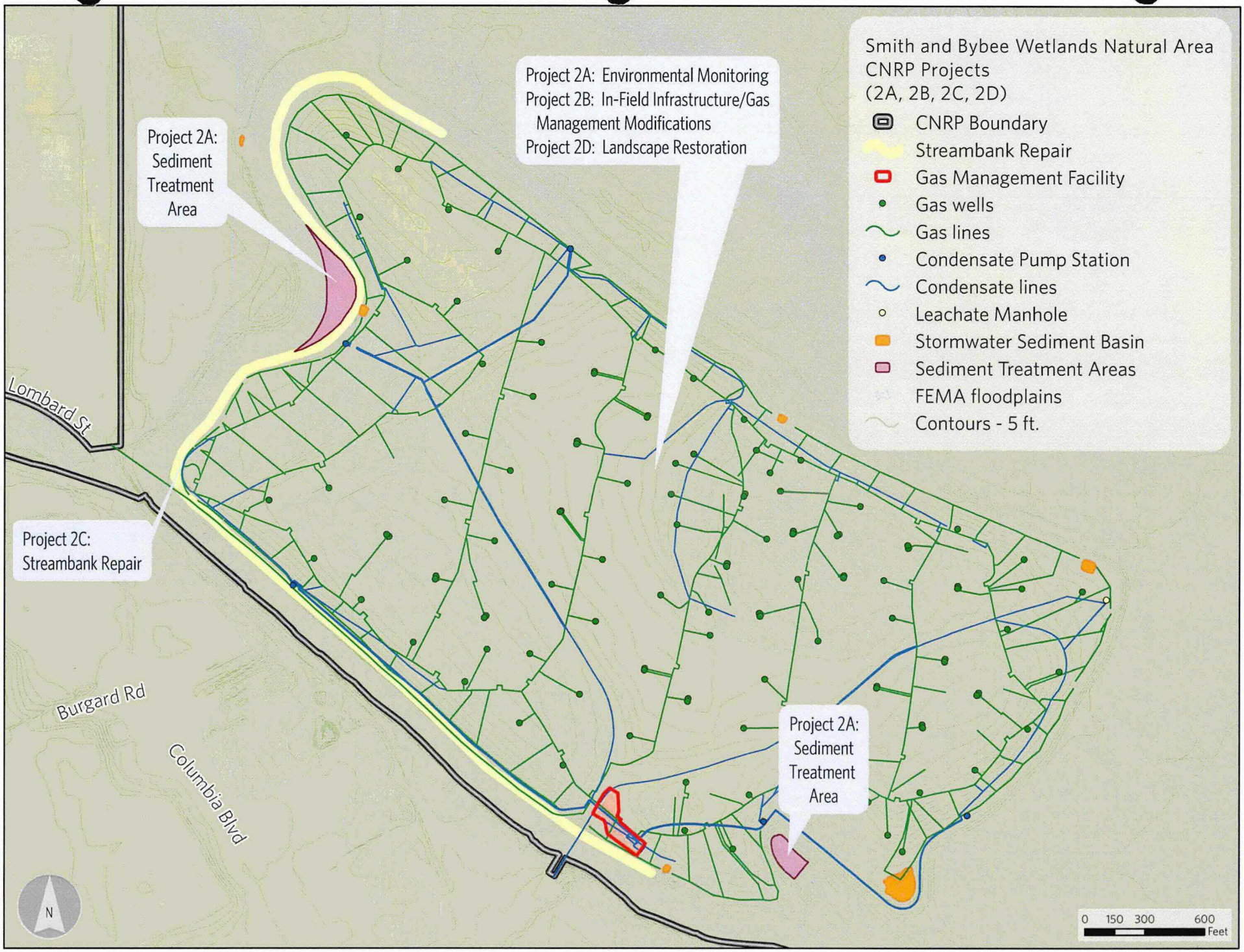
CONDENSATE COLLECTION SYSTEM

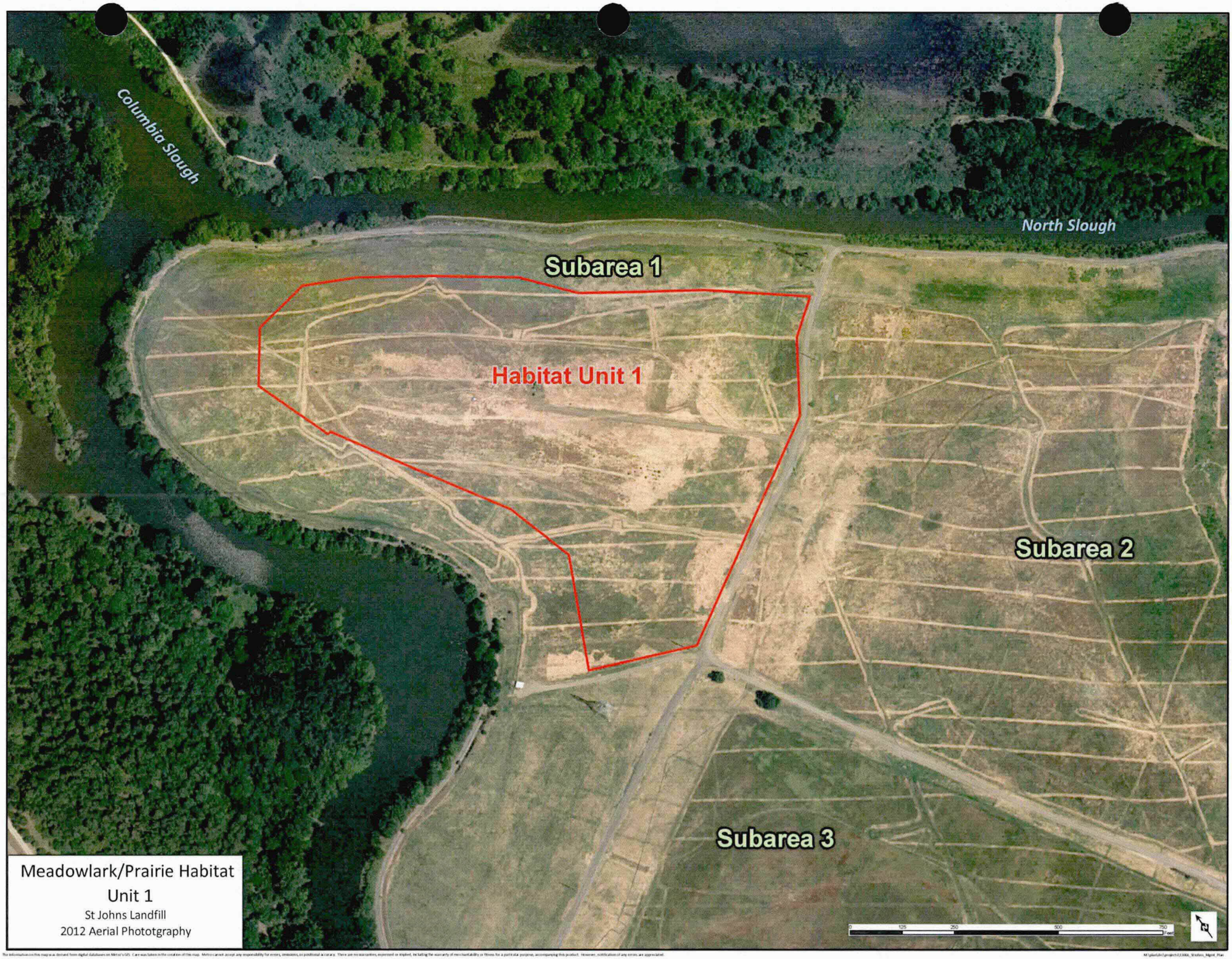
ST. JOHNS LANDFILL




Leachate Collection and Discharge
ST JOHNS LANDFILL
NORTH SLOUGH
LEACHATE WET WELL (MH-2)
LEACHATE COLLECTION LINES
LANDFILL SUBAREA 4
LANDFILL SUBAREA 5
3" DISCHARGE LINE
3" DISCHARGE LINE
5A Sample Port
LEACHATE COLLECTION LINES
LANDFILL BOUNDARY
BLIND SLOUGH
LFG COMPRESSOR STATION
MOTOR BLOWER FLARE STATION
COLUMBIA SLOUGH
COLUMBIA SLOUGH
DISCHARGE POINT OF COMPLIANCE
6" PRESSURE MAIN TO CITY SANITARY
SCALE IN FEET
0
100'
200'


Groundwater Monitoring Wells
St Johns Landfill
2012 Aerial Photo
Bybee Wetland
Columbia Slough
North Slough
Smith Wetland
Columbia Slough
Bybee Lake Gauge
G-5A
G-5B
G-4B
G-4A
G-3R
Q-3A
Q-3B
K-3
G-7
D-1B
D-1A
D-1C
H-1
H-2
H-4
H-5
F-1
K-4
D-6C
D-6A
D-6B
G-6
Q-2
K-2
D-2A
K-5
H-3
D-3A
D-3B
Q-1A
Q-1B
K-1
G-2
D-4A
D-4B
G-1
K-6A
K-6B
G-8A
G-8C
G-8B
2012 Aerial Photography
Monitoring Well Locations
Upper Overbank Silt
Middle Overbank Silt
Lower Overbank Silt
Columbia River Sand and Pleistocene Gravel
Leachate
Surface Water Station
Note: Surface water station for Coumbia Slough (USGS Station 14211820) is located 0.25 mile from mouth of slough (not shown)


Smith and Bybee Wetlands Natural Area
CNRP Projects
(2A, 2B, 2C, 2D)
CNRP Boundary
Streambank Repair
Gas Management Facility
Gas wells
Gas lines
Condensate Pump Station
Condensate lines
Leachate Manhole
Stormwater Sediment Basin
Sediment Treatment Areas
FEMA floodplains
Contours - 5 ft.
Project 2A: Environmental Monitoring
Project 2B: In-Field Infrastructure/Gas Management Modifications
Project 2D: Landscape Restoration
Project 2A: Sediment Treatment Area
Project 2C: Streambank Repair
Project 2A: Sediment Treatment Area
Lombard St
Burgard Rd
Columbia Blvd
N
0 150 300 600
Feet


Columbia Slough
North Slough
Subarea 1
Habitat Unit 1
Subarea 2
Subarea 3
Meadowlark/Prairie Habitat
Unit 1
St Johns Landfill
2012 Aerial Phototgraphy
0
125
250
500
750
Feet


Bybee Wetland
Columbia Slough
North Slough
Smith
Wetland
Columbia Slough
Planned Trails
St Johns Landfill
2012 Aerial Phototgraphy