



Careers in Site Assessment and Reclamation

Current Job Trends and Future Growth

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Canada

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FOREWORD

In Canada, workers perform site assessments, remediation, restoration, and reclamation services for a variety of different development projects. Traditionally, most site assessment and reclamation work involved Phase 1 or Phase 2 Environmental Site Assessments (ESAs) to determine whether environmental contamination exists at a site and the extent of this contamination if present. After the assessment, workers may complete remediation services on the site to clean or remove contamination, followed by restoration services to return the site to its original condition and reclamation services to return the land to a natural or agricultural landscape.

New technology, more stringent environmental regulation, and public pressure drive demand for other site assessment and reclamation services, such as pre-disturbance environmental site assessments, environmental impact studies, plant and animal species inventories, ecological risk assessments, human risk assessments, environmental monitoring services, geomatic monitoring services, hydrogeological remediation and monitoring services, site assessments that support real estate transactions, and other services.

A multi-disciplinary labour force of engineers, scientists, and technical specialists work in the design and management of site assessment and reclamation. In addition, non-scientific workers, such as equipment operators, truck drivers, equipment service providers or vendors, and contracting supervisors perform site remediation activities and technical services, such as removing waste or drilling waste from oil and gas well sites.

This report focuses on a subset of approximately 30,200 workers in Canada that are *Core Site Assessment and Reclamation (SAR) workers*.¹ Core SAR workers include workers who perform tasks that require environmental competencies in one of four areas: (1) Environmental impact studies, (2) Phase 1 and Phase 2 site assessments, (3) Phase 3 remediation plans, or (4) Phase 3 reclamation plans. We identified core SAR workers as those who had at least one of these competencies in their job description.

In addition to the core SAR workers, there are workers who occasionally perform work that supports site assessments or reclamation activities, or work for firms who provide these services, but do not have one of the four main competency areas explicitly stated in their job description. According to ECO Canada's 2013 *Survey of Environmental Employers*, there were approximately 379,000 workers who perform some work activities related to site assessment and reclamation. These workers represent about 21% of Canada's 1.8 million environmental workers.²

Figure 1
Core Site Assessment and Reclamation Workers,
Jobs Requiring Site Assessment and
Reclamation Skills and Knowledge, and
Total Environmental Workers in Canada



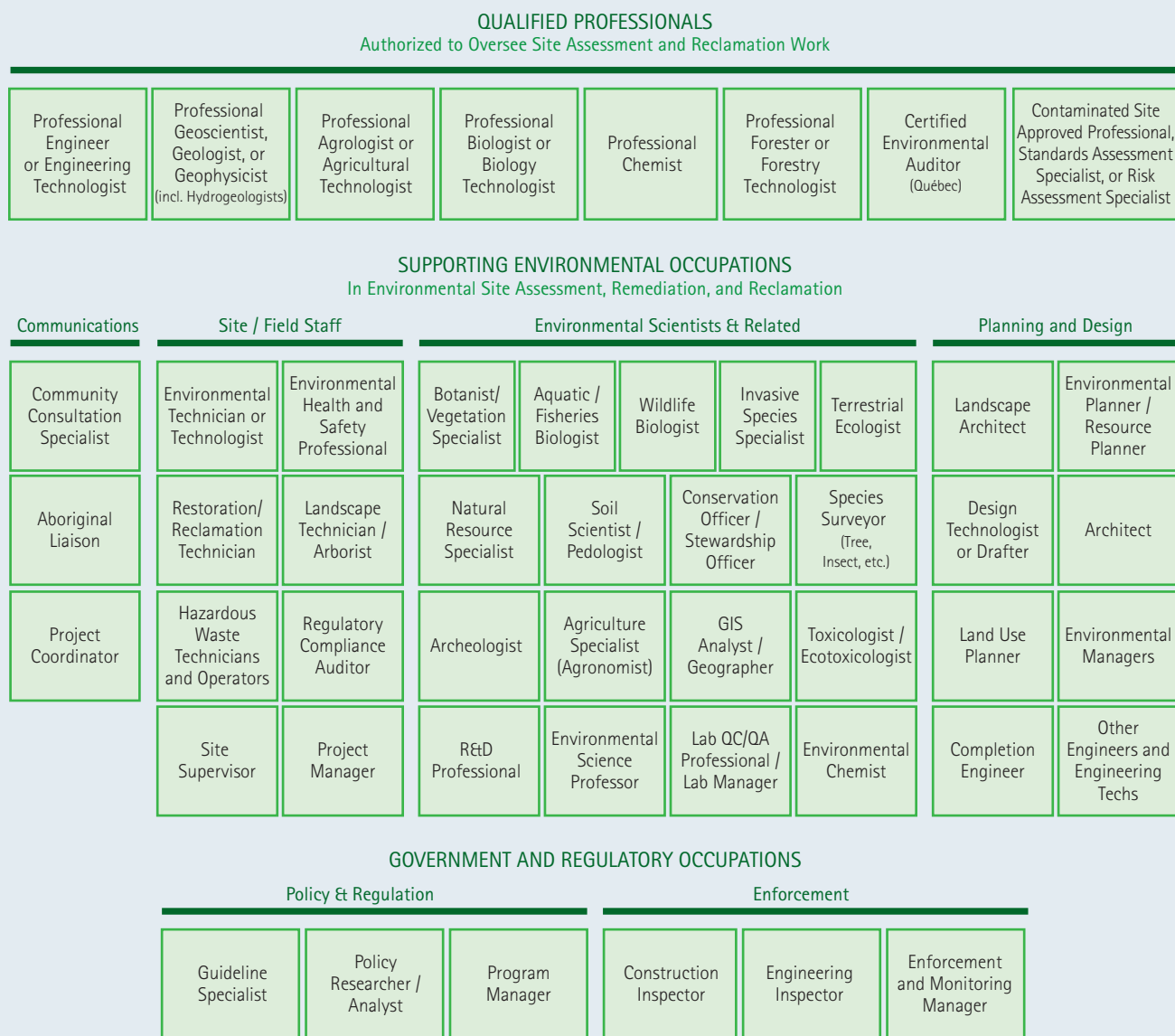
¹ Sources: Statistics Canada, *National Household Survey*, 2011, and analysis of job vacancy advertisements that require site assessment and reclamation (SAR) competencies in ECO Canada's *Environmental Job Vacancies Database*. Estimates by the author.

² Source: ECO Canada, *Survey of Environmental Employers*, 2013.

RESEARCH FINDINGS

Figure 2

Canada's Core Site Assessment and Reclamation (SAR) Labour Force



Note: Core occupations were determined through expert interviews (n=15) and an analysis of SAR job vacancy advertisements.

Canada's core site assessment and reclamation (SAR) labour force is comprised of three broad groups of workers:

1. **Qualified Professionals:** Authority to prepare, oversee, submit, or "sign-off" on environmental assessments, remediation, and reclamation activities according to provincial and federal legislation and regulations.
2. **Supporting Environmental Occupations:** A wide variety of environmental scientists, specialist engineers, planning and design professionals, field staff and practitioners in communications (e.g. community and Aboriginal liaisons and project coordinators).
3. **Government and Regulatory Occupations:** Workers in environmental policy and regulation as well as inspectors in enforcement and monitoring.

Qualified professionals include Professional Engineers, Engineering Technologists, Professional Geoscientists, Professional Geologists, Professional Agrologists, Professional Biologists, Professional Chemists, Professional Foresters, and other designated occupations approved through provincial regulation to oversee site assessments, remediation, and reclamation. The professionals designated to perform SAR work differ by province and type of work. In some cases, qualified professionals can include very specialized occupations such as Qualified Wetland Aquatic Environmental Specialists (QWAES) in Alberta who are authorized to perform wetlands assessments and designs.

Supporting environmental occupations in site assessment and reclamation contribute to site assessment and related work, but typically under the supervision of a qualified professional. Supporting environmental occupations include:

- **Environmental scientists:** Life sciences professionals and technicians (biologists, specialist soil scientists, botanists, limnologists, etc.), physical and earth sciences practitioners (chemists, physicists, toxicologists, etc.) and other scientists and technicians (geographers, archeologists, and other specialists).
- **Planning and design professionals:** Environmental managers, environmental planners, engineers, architects, landscape architects, drafters, engineering technicians, and land use planners.
- **Field staff:** Environmental technicians, on-site environmental health and safety workers, reclamation technicians, or project managers who spend a significant portion of their site work duties under evaluation.
- **Communications and engagement professionals:** Aboriginal liaisons and community consultation specialists.

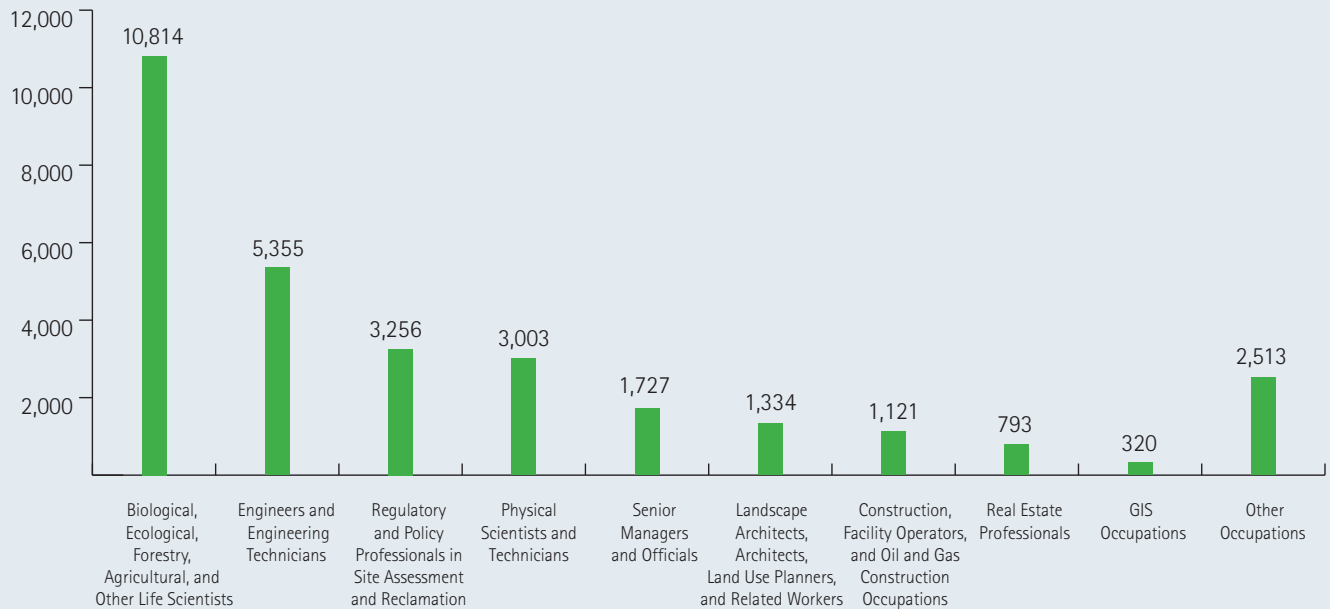
The SAR Labour Force

An estimated 30,200 core SAR workers in Canada have site assessment competencies as part of their job description.³

- **Life scientists and related technicians represent the largest component of the core SAR workforce, with over 10,800 workers.** Biologists, ecologists, botanists, wildlife biologists, aquatic and wetlands biologists, toxicologists, and related scientists (NOC 2121), represent a labour force of 8,200 life science SAR workers. Nearly 40% of job openings for biologists in NOC 2121 state requirements for site assessment and reclamation skills. This segment of the core SAR labour force also includes nearly 1,000 biological technicians, over 400 agricultural consultants (agrologists and agronomists), approximately 300 conservation and fishery officers, over 200 foresters, approximately 500 forestry technologists, and other professionals in life sciences.

³ Sources: Labour force numbers extrapolated from our analysis of 7,027 SAR job vacancies and Statistics Canada's 2011 *National Household Survey*. Analysis by the author.

Figure 3
Site Assessment and Reclamation (SAR) Labour Force by Occupation Category, 2011



Sources: Labour force numbers extrapolated from our analysis of 7,027 SAR job vacancies and Statistics Canada's 2011 *National Household Survey*. Analysis by the author.

- **Engineers and engineering technicians represent the second largest category, with approximately 5,350 engineering workers.** This includes approximately 3,170 engineering managers, civil engineers, geological engineers, mining engineers, and other engineers, approximately 1,000 civil engineering technologists and technicians, and nearly 800 drafting technologists and technicians.
- **Regulatory inspectors and policy professionals represent the third largest component of the site assessment labour force with an estimated 3,250 workers.** This category of workers includes approximately 1,500 policy researchers, consultants and program officers, and nearly 1,800 different inspectors including construction inspectors, engineering inspectors, and inspectors in public and environmental health and occupational health and safety.
- **Around 3,000 physical scientists require site assessment and reclamation competencies.** This includes about 1,200 geoscientists, 700 chemical technologists, nearly 400 chemists, and other practitioners such as physicists, geological technologists, mineral technologists, and soil chemistry specialists.
- **Approximately 1,300 planning and design professionals,** including landscape architects, landscape technicians, architectural technologists, architects, land use planners, and contractors in landscaping who require site assessment and reclamation competencies.
- About 1,100 construction managers, renovation managers, facility operations managers, oil and gas drilling contractors, and water well drillers use SAR skills.
- Roughly 800 workers in real estate occupations require site assessment competencies, including credit managers, appraisers, and valuers.
- Approximately 1,700 additional managers and senior managers perform work in site assessment. Other SAR workers are in specialized positions such as GIS/geomatics professionals, software developers, and equipment sales and service workers.

Site Assessment and Reclamation Practice Areas

Figure 4
Six Practice Areas for Site Assessment and Reclamation

	Pre-Disturbance Environmental Impact Assessments	Phase I Environmental Site Assessments (ESAs)	Phase II Environmental Site Assessments (ESAs)	Phase III ESAs: Remediation, Risk Assessment and Risk Management	Reclamation	Post Reclamation Site Assessment & Monitoring
Typical Activities	<ul style="list-style-type: none"> • Collect a baseline inventory of environmental quality of soils, landforms, plants, wildlife, and other environmental factors at a site prior to any construction or development. • Identify sensitive sites and conditions. • Inform project planning, environmental monitoring, and eventual remediation and reclamation plans. 	<ul style="list-style-type: none"> • Use non-intrusive methods to review a site's history and determine the types of possible contamination. • Document adjacent land use including identifying potential sources of contamination, potential receptors, evidence of contamination, and assessment of potential contamination risks on-site. • Determine whether a Phase II ESA is necessary. 	<ul style="list-style-type: none"> • Apply intrusive sampling and testing of materials, air, soil, surface water, and groundwater to identify or confirm the presence or absence of adverse environmental impact. • Interpret site conditions, results of chemical analyses, and fate and transport of chemicals. • Perform risk and receptor analysis to determine potential on-site and off-site effects of contamination. 	<ul style="list-style-type: none"> • Explore remedial options on the basis of timeline and costs, considering physical and chemical limitations, construction requirements, environmental health and safety implications, regulatory approvals, and public perception. • Develop a hazard assessment, perform exposure modeling and risk assessment. • Carry out remediation and verify the success of remediation through sampling and monitoring. 	<ul style="list-style-type: none"> • Identify final intended land use and stakeholder concerns. • Design and implement biological processes to achieve recovery of biodiversity and ecological processes, revegetation in riparian and terrestrial ecosystems, rehabilitation of aquatic ecosystems, and structure of landscape. • Supervise implementation of reclamation activities (landscape, tree planting, revegetation, habitat recovery, etc.). 	<ul style="list-style-type: none"> • Develop an appropriate sampling plan and conduct systems to record sampling for monitoring purposes related to ongoing risks. • Evaluate site results and interpret them against objectives, regulations, and policies. • Determine if land use and stakeholder concerns are addressed.
Work is performed by a multi-disciplinary team of professionals who collectively possess the competencies required for site assessment and reclamation.						

Sources: ECO Canada, *Expert interviews, Survey of Site Assessment and Reclamation Employers, and Environmental Job Vacancies Database*, 2013.
Analysis by the author.

Workers perform most SAR activities on a project basis to meet regulatory requirements. Because site conditions and requirements vary from project to project, no two assignments are exactly alike, but most SAR projects fall into six broad practice areas⁴ including:

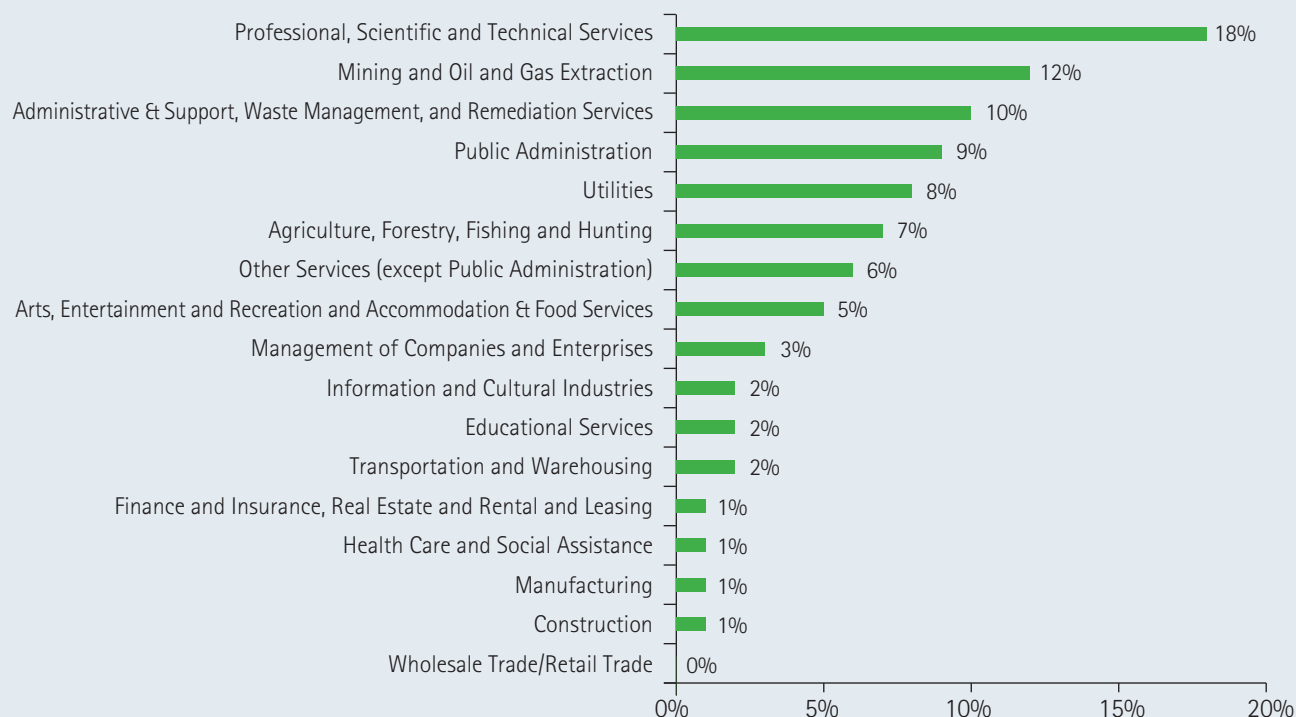
- (1) Pre-disturbance environmental impact assessments prior to development activity,
- (2) Phase 1 Environmental Site Assessments (ESAs), non-intrusive investigations of sites to determine whether contamination is likely,

- (3) Phase 2 ESAs using invasive methods to determine whether environmental contamination is present, and the types and extent of the contamination,
- (4) Remediation activities performed in Phase 3 ESA,
- (5) Reclamation activities, and
- (6) Post-reclamation assessment and monitoring.

In addition, SAR services encompass special studies such as ecological risk assessments and human health risk assessments.

Site Assessment and Reclamation Employers

Figure 5
Percentage of Employers with Site Assessment and Reclamation Workers, 2013



Source: ECO Canada, *Survey of Environmental Employers*, n=3,492, 2013.

⁴ Practice areas were identified through a combination of expert interviews, analysis of the *Survey of Site Assessment and Reclamation Employers*, and analysis of ECO Canada's *Environmental Job Vacancies Database*.

The industries most likely to employ core SAR workers include consulting companies, resource industries, utilities, governments, and regulatory bodies.

- **Consulting Companies:** Approximately 18% of employers in the professional, scientific, and technical services industry hire workers for SAR activities.⁵ These employers include environmental consulting companies, engineering firms, geoenvironmental labs, and independent individual consultants, such as Professional Agronomists or Vegetation Specialists.

Consulting companies typically perform SAR work in two categories: (1) analytical services to assess a problem and recommend next steps, or (2) technical services that meet specific, previously established needs for the client. Analytical services include environmental impact assessments, Phase 1 and Phase 2 ESAs, reclamation planning services, environmental risk management services, and monitoring.

Technical services include groundwater monitoring, geo-environmental laboratory services, plant and animal inventories, rare species inventories, commercial building remediation services (e.g. removing asbestos or lead paint), emergency response (e.g. spill remediation), in-situ remediation services (e.g. applying chemical or biological agents to break down a contaminant), and ex-situ remediation services, such as "dig and dump" services in which contaminated soil is removed from a site and placed in a landfill, or oil well drilling waste is assessed, diluted to non-toxic levels, and sprayed in low concentrations over agricultural lands.

- **Resource Industries and Utilities Companies:** About 12% of mining and oil and gas companies and 8% of utilities companies hire SAR workers.⁶ These workers perform services similar to those performed by consultants, or they manage consultants to perform SAR activities. Most job vacancies at resource companies and utility employers are for project managers with prior work experience.
- **Governments and Regulatory Bodies:** These employers hire workers to perform reviews of permits and approvals, inspect sites, enforce compliance, develop or implement policy, and manage related SAR programs. Provincial and federal ministries and branches that hire SAR workers include environmental and natural resources ministries, transportation ministries, agricultural ministries, energy ministries, ministries

managing crown lands, forestry ministries, and industry ministries such as ministries of mines. Cities and counties also employ site assessment professionals to perform reviews of construction applications or assess the impacts of disturbances and developments on rural or agricultural lands.

SAR workers may also be employed in real estate by developers, construction companies, or engineering firms, non-profit organizations such as advocacy NGOs and conservation authorities, and research and development organizations, creating new technologies to prevent or clean up contamination.

Common Job Duties and Competencies

Site assessment and reclamation work is multi-disciplinary, with considerable overlap in job duties and skills requirements. Cross-training across different roles contributes to a multi-skilled workforce that possesses many of the same competencies.

There are four main categories of site assessment and reclamation competencies. Essentially, all jobs in site assessment and reclamation require workers to have skills in one of these four areas:

- Conducting Phase 1 and Phase 2 Environmental Site Assessments (required for 73% of SAR job vacancies⁷),
- Developing or implementing Phase 3 site remediation plans (26% of SAR job vacancies),
- Developing or implementing Phase 3 site restoration or reclamation plans (14% of SAR job vacancies), and
- Performing environmental impact assessments (9% of SAR job vacancies).

Other environmental competencies are also important for SAR workers, including natural resource planning and management competencies (required for 47% of SAR jobs), corporate environmental program planning and implementation (40% of jobs), and environmental sampling and analytical work (30% of jobs).

Between 20 and 30% of jobs in the SAR sector require competencies in at least one of the following other areas:

- Regulatory & Enforcement
- Environmental Communications & Public Awareness
- Environmental Business, Technology & Product Development
- Environmental Health & Safety
- Environmental Education & Training
- Water Quality Management

⁵ Source: ECO Canada, *Survey of Environmental Employers*, 2013.

⁶ *Survey of Environmental Employers*, 2013.

⁷ Note: total percentages do not add up to 100% as more than one competency could be listed in a job vacancy.

Competencies for Specific Occupations

Workers in each SAR occupation tend to share many similar job duties and competencies, but greater emphasis is placed on certain environmental competencies according to the worker's background and area of expertise. Standardized approaches may be sufficient for most sites, but when non-conventional approaches are required, employers need the specialized expertise of particular SAR professionals or subject matter experts.⁸

- **Project engineer jobs** are more likely to require a broader scope of environmental competencies compared to other occupations, and place a stronger emphasis on corporate environmental program planning and implementation, environmental impact assessment, and competencies related to climate change.
- **Hydrogeologists and geoenvironmental engineers** have more requirements for water quality management competencies.
- **Jobs for environmental engineers and geoenvironmental engineers** are more likely to require competencies for remediation plans.
- **Environmental scientists** are more likely to require competencies in the following categories:
 - Water Quality Management
 - Developing/Implementing Site Restoration/Reclamation (Phase 3) Plans
 - Regulatory and Enforcement
 - Environmental Health & Safety
 - Environmental Communications & Public Awareness
 - Environmental Education & Training

- **Agrologists and soil scientist jobs** place a strong emphasis on restoration and reclamation plans, natural resource management and planning, regulatory and enforcement skills, and Phase 1 and Phase 2 ESAs.
- **Biologists and ecologists** are less likely to require competencies for Phase 1 and Phase 2 ESAs (required for about 31% of job openings), but do require skills in remediation, restoration, and reclamation plans. Biologists and ecologists are also more likely to require competencies in environmental impact assessments, environmental sampling and analytical work, corporate environmental program planning and implementation, and natural resources planning and management.
- **Environmental technologists and technicians** need competencies in environmental sampling and analytical work, as well as environmental education and training.

The Job Market and Career Pathways in Site Assessment and Reclamation

- **There is stable expected demand for SAR professionals in the near term.**
 - Between 2011 and 2013, 56% of site assessment and reclamation employers had job openings.
 - Over the next two years (2013-2015), approximately 68% of all SAR employers expect to increase staffing levels.
- **Career opportunities depend on location.** Site assessment and reclamation professionals work in all provinces, with demand that reflects the size of each province's total labour force. However, site assessment workers are in higher demand in Western Canada, especially in Alberta.⁹

⁸ ECO Canada, *Expert interviews and Environmental Job Vacancies Database*, 2013. Analysis by the author.

⁹ *Expert interviews and Environmental Job Vacancies Database*, 2013. Analysis by the author.

- Over the long-term, demand for SAR professionals may fluctuate from cyclical factors related to economic growth, the nation-wide resolution of certain types of contamination (e.g. most underground storage contamination in Canada has been remediated), and fluctuations in government funding for cleaning up contaminated sites. Growth in demand will be stabilized, however, by regulatory requirements for annual permits, the increasing stringency of environmental legislation, and the need to hire new workers to replace experienced workers who retire.¹⁰
- Demand for SAR project managers is high. Between March 2012 and August 2013, approximately 38% of all job vacancies for site assessment and reclamation occupations required project management competencies.¹¹ Occupations that are most likely to require project management competencies include reclamation managers, remediation managers, mining closure and rehabilitation specialists, environmental project managers, contaminated sites professionals, geoenvironmental engineers, permitting specialists, and hydrogeologists.
- The most common entry level jobs in site assessment are for environmental advisors (35% of positions are entry level), environmental consultants (20% of positions), environmental scientists (20% of positions) and environmental technicians and technologists (25% of positions).¹²
- Employers place a high value on practitioners who have the regulatory authority to oversee site assessment work. Individuals planning their SAR career should consider an educational path that leads toward a professional designation such as Professional Engineer, Professional Geoscientist, Professional Agrologist, according to their province's requirements.
- Employers also look for workers who can contribute to a team's scope of expertise with specialized knowledge in a discipline related to site assessment, such as ecotoxicology, terrestrial ecology, aquatic biology, or other environmental science fields.
- On-the-job training is an important component of career and skill development, helping workers gain exposure to a variety of technical approaches for different sites. Junior workers are typically mentored by workers with more experience. Most practitioners with a university degree, including Engineers in Training and biologists, chemists, and agrologists, begin their career gaining hands-on experience performing field work similar to the work performed by a technician.
- SAR employers have broad needs for ongoing training. More than three quarters of employers report that their workers need skills training related to the following:
 - Regulatory & Enforcement
 - Environmental Health & Safety
 - Pollution Prevention, Abatement, & Control
 - Environmental Impact Assessment
 - Water Quality Management
 - Climate Change

¹⁰ Expert interviews, 2013.

¹¹ Environmental Job Vacancies Database, 2013

¹² Survey of Site Assessment and Reclamation Employers, 2013.

Earnings for Site Assessment and Reclamation Professionals

Annual wages can vary considerably for SAR workers, but in all cases, workers with five years of experience earn significantly more.

Table 1
Average Starting Salaries and Salaries for Workers
with Five Years of Experience, by Occupation, 2013

	STARTING SALARY			AFTER 5 YEARS		
BY MANAGEMENT ROLE	LOW	MEAN	MAX	LOW	MEAN	MAX
Manager / Director	\$25,000	\$72,875	\$150,000	\$35,000	\$112,500	\$180,000
Project Manager	\$30,000	\$61,621	\$85,000	\$80,000	\$104,808	\$150,000
Coordinator	\$20,000	\$40,500	\$55,000	\$35,000	\$59,000	\$75,000
Environmental Consultant	\$40,000	\$59,000	\$80,000	\$70,000	\$103,000	\$135,000
Environmental Advisor	\$35,000	\$46,000	\$58,000	\$45,000	\$57,000	\$68,000
SELECTED OCCUPATIONS						
Environmental Engineer	\$40,000	\$57,325	\$92,000	\$55,000	\$94,526	\$200,000
Agrologist / Soil Scientist / Agronomist / Pedologist	\$39,000	\$47,200	\$55,000	\$70,000	\$97,200	\$150,000
Hydrogeologist	\$40,000	\$64,333	\$90,000	\$80,000	\$114,667	\$160,000
Natural Resource Specialist / Biologist / Aquatic or Wildlife Biologist	\$26,000	\$47,405	\$75,000	\$48,000	\$74,050	\$100,000
Environmental Scientist (Unspecified)	\$45,000	\$57,875	\$100,000	\$55,000	\$85,000	\$120,000
Environmental Technologist/Technician	\$30,000	\$45,810	\$76,000	\$45,000	\$66,722	\$120,000

Source: ECO Canada, *Survey of Site Assessment and Reclamation Employers*, n=100, 2013.



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The opinions and interpretations in this publication are the author's and do not
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