

Pest Management Implementation Plan Framework:

Vision, policies, benefits, performance measures, results, strategies, statuses and priorities in Calgary’s pest management

Purpose

This document contains the framework for the implementation of The City of Calgary's Pest Management Policy. The strategies identified in this document give instructions and set out processes to implement the policy. They have been approved by the Director of Calgary Parks and may be revised from time to time. The implementation framework set out in this document must be developed, deployed, monitored and revised in accordance with the Policy.

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Vision

The City of Calgary uses science-based decision making to effectively manage pests when thresholds are reached, and in response to pests that pose unacceptable risks to humans, ecosystems or public infrastructure.

Description of implementation plan

Policy heading The policy statement which informs the foundation for results and strategies.				
Benefit What is gained and which individuals or organizations gain or profit either directly or indirectly, from the service, program, or process delivered.				
Headline performance measure A quantitative measure of "how much did we do," "how well did we do it" or "is anyone better off" of a program, process, initiative or department (or other organizational unit); connects to benefit.				
Result	Sub-result	Strategy	Status	Priority
The key goals of a program, service, process, or initiative.	The supporting goals of a program, service or process that support the result.	The actions required to meet the associated sub-result. Not adopted as policy.	An overview of the procedure’s status. Not adopted as policy.	Timeframe to initiate the procedure: High/Medium/Low (0-12 months; 12-24 months; >24 months). Not adopted as policy.

Pest management implementation plan

1. Prioritize human health and ecosystem health objectives Human health and safety is prioritized in all aspects of pest management. Conservation and resilience of biodiversity and healthy, functioning ecosystems are essential to human health, effective pest management, municipal service delivery, and risk reduction.				
Benefit				
WHAT: decreased exposure risks for citizens; local biodiversity is more resilient; decreased soil contamination; reduced impacts to water quality, conveyance, supply and storage; reduced threats and impacts to native species; reduced risks to municipal service delivery (e.g., providing physical protection to the city)				
WHO: citizens, ecosystems, Administration				
Headline performance measure				
Annual active ingredient report indicates pesticide use was limited to non-cosmetic, essential use for managing legislated pests, protecting City infrastructure and assets, and minimizing risk to human health and safety.				
Result	Sub-result	Strategy	Status	Priority
Health and safety Human health and safety impacts are minimized in all aspects of pest management.	Minimize human health risk There is the smallest possible degree of human health risk in pest management practices.	1) Develop and refine processes to limit human health risk (risk = toxicity x exposure) in pest control activities, which may include but not be limited to: <ul style="list-style-type: none">• Lowest risk, most effective suppression strategies• Reducing exposure to pesticides<ul style="list-style-type: none">○ Pesticide application setbacks (e.g., playgrounds, school sites, community gardens, waterbodies and reservoirs) and pesticide use restricted areas○ Pesticide application notification○ Pesticide-free park selection and dedication that involves community engagement○ Pesticide use restrictions based on source watershed protection goals○ Using certified applicators and authorized assistants only 2) Prioritize management of species that negatively impact human health and safety.	1) Existing, updates required: pesticide-free parks and playgrounds exist; website and signage notifications need updating; source watersheds in Calgary of concern have been identified. 2) Existing, updates required: mosquito control program has responded to increases of West Nile Virus vectors.	1) High 2) High

	Responsible use of pesticides A transparent documentation process is followed for the acquisition, storage, preparation, transportation, application justification, notification, safe use and disposal of pesticides.	1) Further refine and document the pesticide chain of evidence process that aligns with internal and external auditing requirements for where, when, and why a pesticide is applied. The process may include: <ul style="list-style-type: none"> • roles and responsibilities • justification for purchasing (e.g., cost, efficacy, environmental, available treatment option) • inventory (e.g., pesticide registration expiry dates) • safe storage • safe handling, mixing, dilution, transportation • treatment prescriptions and application quantities • disposal of rinsate and pesticide containers • spill release reporting, and monitoring residues in environment 2) Regularly review Environmental code of Practice for Pesticides and revise internal procedures for compliance. 3) Revise pesticide application notification process (e.g., public signage, website notices, stakeholder notification, etc.). 4) Track purchases by City staff of pest control products available for sale at retail vendors (Schedule 4 pesticides as per the Alberta Pesticide (Ministerial) Regulation) and ensure their use is appropriately justified, monitored, and reported. 5) Adopt strategies to manage pesticide resistance.	1) Existing, updates required: improvements occur on an ongoing basis. 2) Existing 3) Existing, updates required 4) Not started 5) Not started	1) High 2) High 3) Medium 4) Low 5) Low
	Minimize the use of pesticides Pesticide application is limited to essential use.	1) Develop protocols to ensure that pesticides are only used for managing legislated pests, protecting City infrastructure and assets, and minimizing risk to human health and safety.	1) Existing, update required: Invasive Weeds Collector app tracks application justification.	1) High
Ecosystem health Pest impacts on ecosystem health are mitigated.	Conservation Exposure, risk and vulnerability of natural assets are minimized when selecting treatment options and pest management strategies.	1) Adopt or develop ecological health assessment protocols that incorporate pest damage evaluations and integrate into natural habitat assessments and management plans. 2) Include pest management as a component of open space management plans. 3) The retention of natural ecosystems considers design elements to optimize resilience (e.g. size, shape and configuration of open space) and minimize vulnerability to pests.	1) Existing, expansion of protocols required to better capture Habitat Condition Rating, Range and Riparian Health Assessments, General Management Observations App. Plant health inspections for Calgary Transit properties are currently in use. 2) In progress: natural area park management plan template includes weeds (mapped infestations, treatment areas, biocontrol releases), disease and pest species, and wildlife conflicts species as species of interest. 3) Not started	1) Medium 2) High 3) Medium

	Non-target impacts Non-target impacts of pest management practices to biotic (e.g., flora, fauna, horticultural assets) and abiotic (e.g., soils, source and storm water quality) are identified and mitigated.	1) Adopt and adapt monitoring protocols for non-target impacts related to pest management which may include: <ul style="list-style-type: none">• Identify easily measured non-target impacts associated with pest management treatments and collect data on those impacts.• Develop and implement strategies to reduce/eliminate non-target impacts and collect data on effectiveness of mitigating strategies.• Changes to water quality (e.g., The City's stormwater runoff water quality monitoring metrics).• Identify non-target impacts to wildlife and other species and develop mitigation measures to implement through standard operating procedures.	1) Not started	1) Low
	Plant health Vegetation and vegetation communities are healthy and resilient.	1) Reduce the establishment, spread of and susceptibility to pests through effective plant health care standards and practices (e.g., increased topsoil, watering, pruning, aeration, overseeding, mowing, mulching, fertilizing). 2) Utilize habitat management practices and support ecological restoration efforts that aim to prevent pests and mitigate pest damage where appropriate, and integrate pest management best practices into ecological restoration practices.	1) In progress: Soil specifications and planting standards are under development; plant health care practices are in use. 2) In progress: Habitat Restoration Project Framework considers invasive/exotic species and biocide application reports.	1) Medium 2) Low

2. Engage citizens and stakeholders				
Delivering and collaborating on accessible information is necessary to secure support and positive actions for pest management.				
Benefit				
WHAT: increased awareness and understanding of pests, pest management, and legislation by citizens and stakeholders; increased public tolerance levels of where and when a pest occurs; increased actions taken by citizens and stakeholders in pest management; pest management information and tools readily available; greater collaboration and sharing best practices among stakeholders lead to more widespread pest management and alignment				
WHO: citizens, pest management staff; land owners, Administration				
Headline performance measure				
Number of citizens engaged on pest management topics.				
Result	Sub-result	Strategy	Status	Priority
Awareness Awareness and understanding of pests and positive actions for their prevention and management are improved.	Tolerance Citizens tolerate certain levels of pests, pest damage and pest populations.	1) Engage the public to gauge and improve their understanding of pests, the dynamic nature of pest populations, and action thresholds. 2) Develop consistent messaging to communicate pest dynamics to the public during outbreak cycles to improve tolerance expectations and acceptance levels. 3) Integrate tolerance levels into level of service expectations for asset management.	1) Existing, update required: existing webpages require revision. 2) Not started 3) Existing, update required: customer level of service for some park assets includes qualitative descriptions.	1) Medium 2) High 3) High
	Communication Pest management communication developed and executed.	1) Partner with existing effective pest management campaigns with a focus on influencing positive actions (e.g. Play Clean Go, Pull the Plug, Don't Let It Loose, Clean Drain Dry, Grow Me Instead, STOPDED, Clean Plants Certification Program) and develop new campaigns as needed. 2) Develop a plan for the purpose of communicating pest management, issues management, and sharing information (e.g., City website, story maps, committees, blogs, social media posts, online forums, newsletters, apps, pest hotlines, field days, and conferences) targeting various public and stakeholder audiences. 3) Measure effectiveness of communication through analysis of 311 data and media metrics.	1) Existing, updated required: Calgary Parks collaborating on STOPDED provincial monitoring programs. 2) In progress: City webpages include pests and pest management but needs updating; story maps have been published for Early Detection Rapid Response, biocontrol, and grazing; tree learning e-modules. 3) Not started	1) Low 2) Medium 3) Low
	Education Education programs related to the management and prevention of pests are developed, accessible, and effective.	1) Develop and implement pest management educational programs and materials targeting various public and stakeholder audiences as a method of pest risk mitigation. 2) Utilize enforcement activities to improve knowledge about pest legislation. 3) Measure effectiveness of education programs through knowledge increase.	1) Update required: the Integrated Pest Management Healthy Yards program was reprogrammed. 2) Existing, update required: Bylaw officers can provide citizens with education and enforcement of the Weed Control Act. 3) Not started: post-program surveys may be expanded upon for pest education programs.	1) High 2) High 3) Low
Collaboration The pest management program is strengthened through stakeholder collaboration and coordination on pest	Data sharing Data is shared among stakeholders to benefit regional pest management.	1) Put in place data sharing agreements and open data to benefit regional pest management.	1) In progress: open data related to pest management under development for release on City open data platform; regional data sharing agreements not yet in place.	1) High

locations, spread, impacts, management efforts, and management effectiveness.	Shared best practices Best practices are established and shared among stakeholders.	1) Develop and maintain a stakeholder list and share best practices with applicable stakeholders. 2) Develop and adopt inspection and quality standards for all infrastructure and assets where pest management occurs, including associated goods and services (e.g., gravel pits, storm ponds, railway, soil, seed, hay, mulch, plant orders, sports fields and sports areas, turf, trees, pathways, trails, play areas, water features).	1) In progress 2) In progress: gravel pit inspections, seed certificate of analysis (in Development Guidelines and Landscape Specifications, Calgary Parks Customer Level of Service and Asset Condition Rating inspections).	1) High 2) High
	Regional alignment Gaps and deficiencies in pest management policies and implementation strategies are identified and acted upon accordingly and collaboration opportunities are explored.	1) Periodically review alignment of pest management policies and practices with local, regional, provincial and federal jurisdictions to identify and minimize gaps.	1) On going	1) Low
	Initiatives Collaborative pest management initiatives are established with communities, government, industry, institutions, and non-profit organizations.	1) Collaborate with partners to minimize gaps and coordinate knowledge networks and action for priority pest initiatives across sectors. 2) Work with retailers to voluntarily eliminate the sale of target invasive species. 3) Involve community members in implementing pest management projects and strategies.	1) In progress: since inception of Integrated Pest Management program, many initiatives have occurred: e.g., STOPPED monitoring programs; Calgary Area Governmental Weed Committee has begun to identify gaps (e.g., regional Early Detection Rapid Response program); collaborative pest monitoring for Dutch Elm Disease and Emerald Ash Borer; Canada Food Inspection Agency monitoring on City lands. 2) Previously existed: A weed-free Garden Centre Certification program in 2009-2010 was unsuccessful and was cancelled. 3) Existing, update required: Calgary Parks offers volunteer weeding and beaver-wiring opportunities to the public.	1) High 2) Low 3) Medium

3. Be adaptable and accountable

The pest management program is implemented effectively and adaptable over time. It is accountable to the citizens of Calgary and considers economic, social, environmental, organizational and financial sustainability objectives. The program is aligned with best practices and research, and strives to meet or exceed all federal, provincial and municipal requirements.

Benefit

WHAT: a pest management program that is versatile, flexible and able to respond to change; has high adaptability to successfully execute the program in a changing environment; is responsible and answerable to citizen expectations and needs; is responsible and responsive to operational outcomes

WHO: citizens, stakeholders, applicable staff

Headline performance measure

A pest management report is produced every budget cycle illustrating alignment with The Pest Management Policy.

Result	Sub-result	Strategy	Status	Priority
Transparency and accountability Pest management priorities, plans, and management actions are defensible and reported in a transparent manner.	Reporting Reports of the pest management program are publically available.	1) Develop City-wide standard protocols for compiling and analyzing pesticide use and pest management activities, and internal and public reports.	1) In progress, updates required: corporate pesticide active ingredient reports have been produced annually since 2002; individual applications are recorded through paper and electronic biocides; public pesticide use report piloted in 2017.	1) Medium
	Program justification Rationale is provided for pest management decision making and actions.	1) Define, describe, and adapt method of control rationale. 2) Assign corporate accountability structure for pest management.	1) Existing, needs updating: current rationale used by Calgary Parks needs to be modified and adopted across the corporation. 2) Existing, needs updating: structure needs to be formalized.	1) High 2) Medium
	Performance measurement Performance measurement for the pest management program is in place to monitor efficacy and inform reporting and adaptive management.	1) Develop performance measures for pest management. 2) Include adaptive management strategies and corporate resilience goals in implementing the pest management program.	1) In progress 2) In progress: resilience framework applied to policy revision.	1) High 2) Low
	Evaluation Pest management policy and related programs are periodically audited and amended accordingly.	1) Develop and implement a standard internal process to audit and update the pest management policy and pest management programs.	1) In progress: protocols in place to correct data entry errors in the Weed App; policy audits not yet developed.	1) Low
Economic resilience The pest management program is fiscally resilient and efficient.	Cost effectiveness Cost-benefit analyses are conducted to inform budgetary considerations of pest management, as a component of prioritized decision making.	1) Conduct cost-benefit analyses of pest treatments completed and those being researched as pest treatment options. 2) Determine program capacity for effective pest management based on budget scenarios; use budget cycles to develop multi-year work plans (e.g., determination of staffing levels, the purchase of pest management products and contracting services).	1) Existing, needs to be expanded to other programs. 2) Existing, needs updating: current budget and capacity information requires review and projections.	1) High 2) Medium
	Funding Funding is sufficient for program delivery.	1) Pursue multiple funding sources to improve program resourcing to diversify budget sources (e.g., Agricultural Service Board funds). 2) Ensure budget allocation includes contingency to meet pest management regulatory requirements.	1) Not started 2) Existing: annual pest management work plan budget includes contingencies.	1) High 2) High

Compliance Pest management activities comply and align with all applicable federal, provincial, and municipal legislation and strategies.	Legislative compliance and authority Ensure regulatory compliance for pest management and protection of the environment or species.	1) Periodically review legislation pertaining to pest management to ensure The City is appropriately compliant. 2) Update protocols and agreements for City-owned and City-stewarded lands (e.g., Enhanced Landscape Maintenance communities) to ensure legal risks and liabilities associated with applicable legislation are identified and mitigated. 3) Periodically review and revise City Bylaws that may have an impact on pests, pest attractants (e.g., compost bins, mulch, etc.) or pest management. 4) Ensure that local authorities for pest legislation are in place. 5) Track and report detected pests to appropriate authority as applicable. 6) Develop a working group with applicable cross-corporate members to implement applicable aspects of the Pest Management Policy in order to ensure compliance and distribution of best practices across the Corporation.	1) In progress 2) Existing, needs updating 3) In progress 4) Existing, needs updating 5) In progress 6) Not started	1) Medium 2) High 3) Medium 4) High 5) High 6) High
	Enforcement Enabling legislation is utilized to enforce legal compliance.	1) Determine appropriate City staff to enforce pest-related Acts where municipal officers may be appointed by the Minister or local authority such as: <ul style="list-style-type: none"> • Municipal Inspector (Alberta Weed Control Act), • Wildlife Officer or Wildlife Guardian (Alberta Wildlife Act) • Fishery Officers or Fishery Guardians (Alberta Fisheries Act) 2) Clarify and address gaps in roles and responsibilities for pest species (e.g. monitoring, management) between The City, the Province and the Federal government.	1) Existing, needs updating: Bylaw officers enforce Weed Control Act, gaps exist for other Acts. 2) In progress: underway for conflict wildlife species.	1) Medium 2) Medium
	Corporate strategic alignment Pest management aligns with or complements Corporate strategic programs, policies and standards.	1) Review, align and integrate pest management with other City programs (e.g., resilience, biodiversity, cumulative effects, climate change, sports field strategy, City Charter, City-wide planning, tree protection, source water protection, etc.) and standards (e.g., specification manuals, inspection processes, etc.) and amend affected programs as needed.	1) In progress: occurring through the policy update and forthcoming development of an implementation plan.	1) Medium
Research and development Emerging pests and treatment options are investigated and findings are applied and shared.	Pilot projects Pest management pilot projects are conducted and shared as case studies to improve knowledge and practices associated with pest management.	1) Evaluate operational and economic feasibility, as well as control efficacy for novel pest management strategies through scientific pilot projects. 2) Develop and coordinate a pilot project program that carefully assesses pest management needs and opportunities, implements successful initiatives and shares program results.	1) In progress: since inception of Integrated Pest Management program, many scientific studies and pilot projects have occurred (e.g., European elm scale). 2) In progress	1) Medium 2) Medium
	Emerging and long-standing needs Emerging and long-standing challenges for local and regional pest management are identified and addressed.	1) Identify local and regional stakeholders and programs (e.g., pest management operations, contractors, academia, and citizen scientists) to address emerging and long-standing pest management challenges (e.g., increase in green roofs, community gardens, etc.).	1) Existing, needs updating: regional governments participate in the Calgary Area Governmental Weed Committee; Integrated Pest Management liaises with applicable City business units.	1) High
Capacity building Staff are well-trained and well-resourced within an effective organizational structure that prepares for and manages pest infestations.	Trained staff Staff are trained as required on pest management policy and protocols.	1) Review the existing training manuals and information materials and regularly update to reflect current pest management protocols. 2) Develop and amend training programs for applicable staff (e.g., enforcement, operations, technical, and asset owners). Track employee training records and requirements.	1) Existing: Integrated Pest Management training manual is reviewed and updated annually. Needs to be expanded corporately. 2) Existing: train the trainer model has been adopted for some programs (e.g., Weed App, Weed ID School); Calgary area weed school; in-house pesticide credit training. Needs to be expanded corporately.	1) High 2) High

	Human resourcing The pest management workforce is well-trained, well-staffed and resourced appropriately.	1) Review human resourcing needs, hiring strategies and constraints to identify gaps and explore possible solutions. 2) Redundancy is in place to ensure spare capacity is purposefully created within pest management program so that it can accommodate disruption, extreme pressures or surges in demand. Unnecessary redundancies are identified and reduced. 3) Build relationships with external organizations to leverage volunteers, citizen scientists, etc.	1) In progress 2) Not started 3) In progress	1) Medium 2) Medium 3) Medium
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4. Make science-based decisions and actions

Prediction, prevention, preparedness, response and recovery are the foundational components of pest management decision making and action.

Benefit

WHAT: budget (reducing future pest management costs); asset sustainability and protection; better ability to develop short and long term plans; improved response time, costs and increased efficacy in pest response; strategic deployment of human resources, citizen satisfaction, correct use of pest control products; knowing when and where to apply pest treatment; program planning and implementation efficacy and effectiveness; management effectiveness and defensibility; value of technique for the cost; pest management activities are easier to plan and explain to the public; reduced risks to ecosystems and assets; responsible pesticide use

WHO: citizens, pest management staff; land owners, Administration

Headline performance measure

Controlled invasive species mapped by patch indicates infestation area, density and/or distribution decrease over time.

Result	Sub-result	Strategies	Statuses	Priority
Prediction Potential pest species, key pest introduction pathways, including when and where pests could arrive and become established are identified.	Pest pathways Predictive and analytical tools are utilized to predict where and how pests may be introduced, and to assess factors that influence pest establishment and spread under a range of environmental conditions and climate change scenarios.	1) Develop, utilize, or amend existing models that reliably identify pest invasion pathways and establishment conditions (e.g. use resources and information available from Provincial and Federal agencies; i.e., Alberta Agriculture and Agri-Food Canada). Models should inform preparedness for change (e.g., climate change, seasonal/annual changes in temperature and precipitation), regional pest threats, etc. 2) Develop, utilize, or amend standard sampling protocols to monitor known and predicted pest introduction pathways to help validate predictive models and identify new infestations.	1) Update required: current basic degree day models for applicable pest emergence and treatment timing. 2) In progress: data collection protocols (e.g., IPM Invasive Weeds Collector app) can inform predictive models.	1) Low 2) Low
Prevention and exclusion Processes are in place to prevent the introduction and establishment of pests.	Preventing introduction The intentional and unintentional introduction of pests through anthropogenic and natural pathways is mitigated through implementation of proactive measures.	1) Identify, amend, and implement land use and landscape design policies and practices related to the introduction, spread, transportation, and mitigation of pests (e.g., standard list of desirable and pest resistant species). 2) Create municipal protocols for regulatory and enforcement instruments that require the prevention of pest introduction to be mitigated (e.g., Clean Plant Certification Program standards for material purchased by The City, stripping and grading permits, etc.). 3) Develop protocols for community planning, construction and maintenance that limit pest introductions (e.g., setbacks for trees from roadways, a no plant species list, an acceptable species list, and planting location/configuration).	1) In progress: ongoing improvements to design standards based on maintenance implications. 2) In progress: Clean Plant Certification Program is being implemented by Urban Forestry. 3) In progress: seed mix guidelines provide guidance on species selection in different habitats. Landscape construction guidelines need to consider how landscape design (location and configuration) impacts long term maintenance.	1) Medium 2) Medium 3) Medium
	Preventing establishment Conditions conducive to pest establishment are altered to exclude pests and mitigate pest establishment.	1) Develop practices and mitigation measures to prevent or change conditions favourable for establishment and survival of pests of key concern (e.g., avoid planting tree species that are hosts to priority pests). 2) Design and construct communities and develop land use objectives that support healthy plant communities for all land use types to optimize long-term plant health and minimize the attraction, establishment, and spread of pests. 3) Employ strategies to make assets less likely to be impacted by pests (e.g. control species colonization, limit disturbance size and severity). 4) Minimize the planting of monocultures of species known to be susceptible to pests and encourage vegetation community species diversity, function, and structure.	1) In progress 2) Not started 3) Needs updating, turf assessment surveys exist. 4) In progress: seed mix guidelines exist.	1) Medium 2) Medium 3) High 4) High

Preparedness Processes are in place to be prepared for pests.	Critical pest response plans A response process for candidate critical pest species is implemented.	1) Work with other levels of government to define and identify critical pests and develop response plans for them that include the four phases of emergency management: mitigation, preparedness, response, recovery.	1) Existing, expansion needed. Memorandum of Understanding for Critical Plant Pest Infestation Response in Alberta exists and includes a role for local authority/local government.	1) High
	Pest identification A process has been established for pest identification for when an organism is suspected of being a pest, and when there is uncertainty regarding its identity.	1) Develop protocols and processes for pest species identification and taxonomic confirmation that leverage existing internal and external resources. Include criteria and instructions for pest photography, specimen collection and preparation, qualifications and selection of taxonomic verifiers and development of reference collections. 2) Integrate pest identification protocols into pest management training. 3) Develop and maintain a current list of target pests including information on local presence (e.g., known presence, absence, unknown or uncertain) and those determined to be critical pests. 4) Define pest, pest categories and risks applicable to this policy. 5) Acquire and/or develop reference materials for pest identification (e.g., field guides, taxonomic keys, posters, reference library) and ensure they are accessible.	1) Ongoing: (e.g., University of Calgary online herbarium, City of Calgary herbarium samples, university insect collections, Alberta Invasive Species Council Fact Sheets). 2) Existing, update needed: IPM Weed Identification Sessions offer annual training for internal staff and external contractors, and can be expanded to include identification protocols. 3) In progress: preliminary target pest list has been developed for this policy. 4) In progress: pest has been defined for this policy. Pest categories are under development. 5) Ongoing: weed posters, field guides exist.	1) Low 2) High 3) High 4) High 5) Medium
Response Targeted pests are managed as required by legislation and unregulated pests are managed in proportion to the assessed level of impact.	Inventorying and monitoring Pests and pest impacts are inventoried and monitored and this data is used to inform decisions about current and future pest management activities.	1) Establish measurement standards and processes to inventory and monitor priority pests. This may include tracking pest populations, control success, and impacts to people, infrastructure and assets. 2) Monitor invasion pathways and pest infestations for changes in pest impacts or threats to municipal assets. 3) Monitor the threat of pests in the region being introduced into Calgary and integrate regional monitoring programs into City programs and predictive models.	1) Existing, update needed: protocols exist for IPM Invasive Weeds Collector app, IPM Insect Monitoring app, mosquito surveillance, and Dutch Elm Disease. 2) Ongoing: monitoring invasion pathways near important transportation routes or other invasion pathways (e.g., Industrial areas, wood processing facilities, landfills). 3) Ongoing: many pests are monitored (e.g. Early Detection Rapid Response, IPM Invasive Weeds Collector app, Dutch Elm Disease traps, Emerald Ash Borer monitoring).	1) High 2) High 3) High

	Prioritized decision making Multiple factors are considered for if, when, and what priority pest management strategies and actions are taken.	1) Develop a process to prioritize which pests are managed that could consider but is not limited to the following factors: <ul style="list-style-type: none"> Legislative requirements Risks to the environment/human health and safety Risks to infrastructure and assets Public opinion/perception Ecosystem services that the pest provides or hinders (e.g., reducing habitat quality/connectivity) Invasive potential of a given species within the habitat context it has appeared in Budget 2) Develop a pest management prioritization process to determine where and when pest management efforts are needed and how pest management actions are carried out, which could include but is not limited to the following factors: <ul style="list-style-type: none"> Location Invasive potential of a given species within the infested location Severity of potential future infestations Budget Human resourcing Asset condition rating and replacement cost, quality (e.g., functional quality based on purpose), susceptibility/protection requirements (e.g., heritage value) and specific maintenance standards (e.g., Natural Environment Parks, habitat types, open space types, infrastructure needs, private properties) Customer level of service and public opinion/perception Life stage and biology of pest Availability of control strategies (legislative approval, efficacy, cost and product label instructions) Seasonality (outbreak phase), etc. 3) Develop a process to evaluate pest management actions.	1) In progress: preliminary pest list developed to identify all legislated species, known presence of species in Calgary or the region, and existing City-wide business unit management and monitoring programs to inform pest prioritization. 2) In progress, update required: plant health inspections occur on select City infrastructure and horticultural assets. 3) Existing, update required: current post-treatment evaluation process requires revision.	1) High 2) High 3) High
	Containment Infestations of pests are contained when required to reduce impacts and meet legal obligations.	1) Develop and use best practices for the disposal of pests in ways that significantly reduce or eliminate further spread. 2) Require evidence from vendors that compost and mulch are pest-free. 3) Conduct spatial analyses of priority pests to better understand where containment efforts are best suited.	1) In progress: Waste and Recycling business unit posts information to the public website about how to dispose of diseased plant material. Bins for regulated weed are in use; further optimization required. 2) Not started 3) Not started	1) High 2) Low 3) Low
	Suppression and eradication Pest populations are maintained below specified asset injury levels and/or levels of occurrence and in accordance with legal requirements.	1) Establish and use pest action thresholds that consider human and ecosystem health and asset protection. They should evolve over time and be based on evaluative criteria using data on pest populations and damage. 2) Implement integrated pest management suppression tactics for when action thresholds for pests are exceeded. 3) Audit and evaluate cost, effectiveness and environmental performance of treatment options for pests. Develop a process to periodically review and determine what treatment options are used and implement appropriately.	1) Existing, update required 2) Existing, update required 3) Existing, procedures required	1) High 2) High 3) High

	Recovery Restore biodiversity and bolster resilience of native systems to prevent reinvasions.	1) Introduce early successional species into areas where pests were treated to encourage vegetation community species diversity, function, and structure. 2) Utilize habitat management practices and support ecological restoration efforts that mitigate pest damage, and integrate pest management best practices into ecological restoration practices.	1) Existing: included in restoration projects and cultural practices. Needs to be expanded City-wide. 2) In progress	1) Low 2) Medium
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Glossary

Action threshold – The number of pests, level of pest damage, or set of conditions required to take action to reduce pests or pest infestation to tolerable levels, which may vary by pest, location, or season (modified from: <https://articles.extension.org/pages/20415/school-integrated-pest-management-thresholds>).

Asset - An item, thing or entity that has potential or actual value to an organization. The value can be tangible or intangible, financial or non-financial and includes consideration of risks and liabilities (source: Asset Management Policy GN-001).

Critical pest – Pests where an infestation would be considered critical due to the threat to Calgary’s environment or economy and has the potential to cause serious damage (modified from: http://www.aema.alberta.ca/documents/Critical_Plant_Pest_Infestation_MOU_-_EMA.pdf).

Critical pest infestation – A situation created by a combination of severity of the infestation and the time frame for preventing or limiting damage (modified from: http://www.aema.alberta.ca/documents/Critical_Plant_Pest_Infestation_MOU_-_EMA.pdf).

Integrated pest management – A combination of control methods (cultural, biological, chemical and mechanical) in a program that is both economically and environmentally sound, and considers the overall management of a pest species (modified from: [https://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/agdex9350](https://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex9350)).

Invasive species – A type of pest that includes plants, animals, pathogens and other organisms that cause economic or environmental harm or adversely affect human health. In particular, they impact adversely upon biodiversity, including decline or elimination of native species - through competition, predation, or transmission of pathogens—and the disruption of local ecosystems and ecosystem functions (modified from: <https://www.cbd.int/ldb/2009/about/what/>).

Harm – Damage, injury or destruction caused by a pest as determined by evidence-based injury and/or threshold levels that consider whether potential negative consequences outweigh potential benefits and how they change over time. The damage, injury or destruction of a pest caused by a pest control product.

Pest – An organism or organic function of an organism whose presence, introduction, establishment or spread in a particular time and place is causing or has the potential to cause ecological, economic, legal, aesthetic or social harm, or harm to human health and safety, if left unmanaged, including but not limited to invasive species.

Pest management – The collection and combination of proactive and reactive activities that aim to reduce the damage caused by pests and pest infestations.

Pest control product – Means

- a) a product, an organism or a substance, including a product, an organism or a substance derived through biotechnology, that consists of its active ingredient, formulants and contaminants, and that is manufactured, represented, distributed or used as a means for directly or indirectly controlling, destroying, attracting or repelling a pest or for mitigating or preventing its injurious, noxious or troublesome effects;
- b) an active ingredient that is used to manufacture anything described in paragraph (a); or
- c) any other thing that is prescribed to be a pest control product (source: Pest Control Products Act).

Pesticide – a pest control product used to kill pests.

Priority pest – Pests that are considered by The City of Calgary to be a priority for management due to impacts of known or predicted significance to warrant pest management.

Target pest – Pests that are the subject of pest management activities such as monitoring, inventory, containment, suppression, or eradication.

Toxicity – The ability of a pesticide to cause short-term or long-term harm to an organism.