WATER ON THE DEVELOPED LANDSCAPE

URBAN STORMWATER POLICY RECOMMENDATIONS

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AEPA Water Availability Engagement

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ALIDP

CONTENTS

INTRODUCTION

Who are we? The Alberta Low Impact Development Partnership (ALIDP) is a non-profit society working to remove barriers and equip Albertans to implement leading-edge urban stormwater management practices suitable for Alberta's conditions. The Society is made up of approximately 50 agencies across Alberta and includes professional practitioners in municipalities, industry, other non-profit organizations and academia. It is unique in its cross-disciplinary, cross-sectoral composition and approach.

Understanding of engagement purpose. Alberta Environment and Protected Areas (AEPA) is seeking through this 2024-25 engagement to explore opportunities to reduce red tape and better manage the province's water resources.

Urban stormwater management holds promise to enhance water availability in our communities as part of a re-imagined, integrated approach to water management. There is an opportunity to work with the province to overcome barriers, update policies and guidance, and create opportunities for better implementation, oversight and stewardship of the stormwater resource.

Organization of the document. ALIDP's policy positions are summarized first, followed by a summary of recommendations. The body of the document then provides background on concepts and terminology before providing more detailed, but not exhaustive, rationale for the policy positions. Policy topics covered in response to AEPA's survey include exemptions, permissible types of withdrawals from stormwater ponds, rainwater under the Water Act, net licensing, inter-basin transfers and some water supply/ water availability information and recommendations around green stormwater infrastructure (GSI). The rationale for GSI recommendations has not been fully documented due to time constraints but provides a basis for further exploration.

More information. Readers are encouraged to reach out to the ALIDP:

Leta van Duin, Executive Director
Alidp.org | leta@alidp.org | 403.617.8883

ALIDP POSITION SUMMARY

The difference between stormwater management and runoff mining. In our semi-arid region, about 95% of precipitation is evapotranspired. Land development hardens surfaces and converts about 30% of this amount that would naturally be vapourized into runoff, creating both stormwater management challenges and opportunities. Stormwater ponds are conventional flood-control infrastructure built to manage certain aspects of this excess runoff. While water taken from a pond may incidentally have a function (e.g., irrigation, dust suppression, process water), it does not necessarily mean it was withdrawn for that purpose. The likely purpose is rather stormwater management. **It is a misunderstanding of the urban water balance to govern these structures as natural water bodies.** AEPA should affirm the already existing status of drainage, flood control and erosion control as not being a diversion under the Water Act in Part 1 m (i). **Differentiating between withdrawals to achieve stormwater management runoff reduction and mining of natural runoff is essential.**

Absolute exemptions for withdrawals from stormwater ponds are inappropriate. Delta Water is a term that expresses the difference between pre- and post-development evapotranspiration. A Delta Water assessment quantifies the amount of runoff that is generated in excess of natural conditions and **is the only scientific basis for a quantity-based exemption** from a diversion license. **There will be unintended negative consequences in the absence of a Delta Water Assessment.**

Delta Water can be quantified at the Master Drainage Plan stage to ensure that withdrawals are appropriate and that withdrawals below Delta Water are flagged as requiring a diversion license.

Delta Water must be managed stringently to protect small streams. Significant runoff volume control is necessary to protect the integrity and function of small streams (tributaries) in an urbanizing context. The practice of irrigation from stormwater ponds began for this reason, as one method to keep some excess runoff from reaching and harming small streams. **Enforcement of mandatory runoff volume control targets is stalled in two watersheds in the Calgary area. As a result, streams are continuing to**

degrade and industry is reticent to implement practices to protect them for fear of shifting requirements from AEPA. In general, AEPA has not recognized the issue of small stream stability in urban environments. As owners of the bed and shore, AEPA is ultimately potentially liable for restoration works that may be required around the protection of small streams in this context if AEPA does not support the implementation of practices that aim to minimize the negative impacts of land development. **All watersheds in Alberta undergoing land development should have an assessment of safe runoff volumes to their receiving water bodies at the tributary level for long-term environmental protection, continued development viability, and protection of people and infrastructure.**

Permissible types of water withdrawals from stormwater ponds. AEPA should take an approach of *ruling out* prohibited activities for stormwater pond water withdrawals rather than exhaustively *ruling in* individual activities. The ALIDP Stormwater Reuse Working Group (STORMR) conducted a risk assessment related to water quantity and quality (i.e., not health-related) and did not identify any *types* of activities that should be restricted per se, notwithstanding the potential for Environmental Protection and Enhancement Act (EPEA) approval to ensure water quality needs are met. The assessment was shared with AEPA in early 2023.

Bringing Rainwater into the Water Act. Rainwater, as a definition, remains useful for characterizing water quality. **A Delta Water calculation includes rainwater, so there is no need for a distinction between rainwater and stormwater from a quantity-management perspective. Like stormwater, even if rainwater were regulated at the Water Act level, there is no absolute exemption quantity that would be appropriate or type of activity that should be excluded.** If AEPA wants to take a two-pronged approach, it could consider prohibiting commercial and industrial supplemental rainwater collection devices.

Moving to a One Water approach. Net licensing should be pursued with urgency. Co-mingling of treated wastewater, stormwater and rainwater into storage facilities for fit-for-purpose use is a plausible scenario, blurring the lines of stormwater use or reuse. It is not important to know the origin of a water droplet and which exact path it takes. **The sum of outfall discharges and return flows (as validated by agreed levels and types of**

monitoring) subtracted from natural withdrawals should satisfy AEPA's need for oversight and management of an integrated, One Water system and provide confidence that downstream needs are being met.

Inter-basin transfers. Tactics such as stormwater aquifer storage and recovery and other fit-for-purpose scenarios should be pursued long before any thought of inter-basin transfers. **Inter-basin transfers carry a level of risk and cost that is not warranted to pursue compared to fit-for-purpose use in the municipal context.**

Use of green stormwater infrastructure to restore the water balance. There are no less than 13 types of GSI for drainage management suitable for use in Alberta, featuring four ways to contribute to a restored water balance. These include soil/media/aggregate void space, temporary ponding, permanent wet pool, and a subsurface storage layer. **Distributed, natural buffering of soil moisture and restored recharge pathways achieved through these practices should be prioritized as part of a shift to supporting natural infrastructure and nature-based solutions that deliver a multitude of co-benefits and enhance water quality across the landscape.**

ALIDP RECOMMENDATION SUMMARY

Alleviate regulatory uncertainty around the implementation of leading-edge stormwater management practices

- Remove the need for a Water Act License for the management of drainage in any quantity
- Use Delta Water calculations to evaluate what runoff quantity constitutes drainage, rather than ANY absolute exemption
- Clarify procedures to account for Delta Water
- Streamline regulatory instruments governing stormwater management to account for both water quantity and quality (i.e., primarily the Water Act and EPEA)
- Work with the local authorities having jurisdiction to monitor and report in a simplified fashion in conjunction with moving to a net-licensing approach
- Participate in ALIDP's STORMR working group to explore discussion points arising from any proposed shifts

Support communities to move to resilient landscaping to reduce water use and better manage stormwater

- Regulate, or influence those who can regulate
  - Mandate deeper topsoil
  - Mandate elimination of conventional turf products meant to be irrigated from the residential market
  - Disallow potable water for landscape irrigation - this may be a longer-term fit-for-purpose-use goal and may be more applicable in the southern region where summer watering represents a large proportion of total annual potable demand.
- Educate and/or incentivize
  - Rain gardens
  - Rainwater harvesting for stormwater management purposes
  - Resilient landscaping (use of native and nativar plants, no or minimal mow, rainwater directed onto softscapes, shallow depressions)
  - Naturalization of municipally owned land
  - Support of a healthy urban forest using soil cells and tree trenches, adequate soil volumes, and passive watering using rainwater/stormwater

- Fund
  - Use wetland compensation monies to support the implementation of rain gardens as urban analogs of lower-class natural wetlands
  - Use Alberta Community Resiliency Program monies to fund GSI as a priority vs. end-of-pipe
  - Explore a funding transfer mechanism for health monies to be used for greening for wellness benefits

Optimize the urban water cycle

- Move to net-licensing as soon as possible
- Explore the feasibility of aquifer storage and recovery
- Support distributed landscape controls that better buffer soil moisture and recharge, can achieve water quality objectives and deliver co-benefits (GSI)

Support designers to protect watersheds

- Clarify that Delta Water calculations are the means to evaluate the excess runoff quantity to be managed for drainage purposes
- Mandate the establishment of runoff volume control targets (VCTs) for all receiving streams subject to land development influences through the watershed management planning process
- Update the provincial stormwater management guidelines (1999) and policies and procedures manual (2001) to account for the current state of practice and proposed direction
- Explore the applicability of a Code of Practice covering both the Water Act and EPEA

Engage

The ALIDP, with the enthusiasm of the University of Alberta School of Public Health, has established the STORMR working group as part of a Community of Practice for the forward progress of matters of urban water availability related to stormwater management and land development. AEPA is enthusiastically invited to participate in this working group to broaden understanding, improve dialogue, and breakdown silos between academia, municipal managers, industry leaders, and regulatory bodies.

BACKGROUND

Some background is provided here to frame the rationale of the urban stormwater management responses to the engagement questions.

Natural vs urban runoff is vastly different. In the White Zone of Alberta, under natural conditions, runoff would only have occurred for the largest storms, as approximately up to 95 percent of annual rainfall would simply evapotranspire rather than become runoff. This is a very high proportion compared to wetter climates. In developed conditions, hardened surfaces and associated loss of soil depth and natural vegetation generate enormous amounts of unnatural runoff volumes and create dangerous and destructive conditions, along with a difficult and costly management problem for municipalities. Traditionally, urban stormwater management focuses on ensuring public safety and protecting property and infrastructure from damage.

Delta Water. In 2015, WaterSmart published *Water Reuse in Alberta: Case Studies and Policy Development to Support Economic Development*. This report introduced the term "Delta Water" to denote the transformation of approximately 30 percent of natural evapotranspiration into extra runoff generated by developed conditions (i.e., the difference between pre- and post-development evapotranspiration). Delta Water creates both challenges and opportunities for stormwater management.

Low Impact Development (LID) is an approach to stormwater management that employs landscape-based features and processes in a distributed fashion to prevent and minimize the runoff impacts of land development. It seeks to match (or at least approach) pre-development conditions in terms of rate, volume and quality. The province does not presently require *any* management of runoff volume.

Green Stormwater Infrastructure (GSI) denotes the built components of an LID approach. GSI tools may be literally green (e.g., a rain garden) or functionally green (e.g., a cistern). It is not the materiality, rather the functionality that matters—although literal green practices should be prioritized for their vegetated co-benefits. Different tools or combinations of GSI tools can be employed to achieve different outcomes such as enhanced water supply,

drought resilience, source water protection, and reduced harmful algal blooms. Often, all these outcomes can be achieved simultaneously, along with co-benefits such as habitat, carbon sequestration, air quality improvement, heat mitigation, and social and wellness benefits.

Nature-based Solutions and Natural Infrastructure. Depending on the purpose and definition, GSI is generally seen as the constructed end of a Natural Infrastructure spectrum, with the conservation and restoration of natural assets at the opposite end of the continuum. An LID approach embraces the importance of natural assets, however, urbanized areas don't generally have adequate space or the correct relationship in position for natural assets to deliver the necessary infrastructure benefits. Nature-based Solutions is an even bigger umbrella. LID and GSI are older terms for the urban typologies encompassed by natural infrastructure and nature-based solutions.

Limitations of conventional stormwater management. Conventional stormwater management is made up of pipes, overland drainage networks, and dry or wet detention ponds. The focus is on runoff *rate* control for the mitigation of large flooding events and to a lesser extent on *quality*, with the total *amount* of runoff typically not considered and no or few features available to achieve co-benefits.

The problem of small streams in urbanizing catchments. In order to protect small streams, the total *amount* of runoff must also be managed. The short explanation for this is that more runoff has more energy and streams will downcut, enlarge and degrade in response to this increase in stream power. Infrastructure and buildings are put at risk, downstream flooding is exacerbated, with more development upstream making it progressively worse over time. This is an especially problematic phenomenon in our semi-arid region where the difference between natural and developed runoff frequency and quantity is so dramatic (e.g. Delta water). Repeated, small flows where none would occur under natural conditions break down the integrity of streambanks. If ponds were sized to capture the amount of runoff necessary to protect small streams, they would have a footprint about *three to five times* the size of ponds built for the traditional purpose of flood mitigation. These larger ponds are considered infeasible, given the cost of land. Note that recent advances in pond design combined with upland GSI have evolved such that pond footprints can be reduced, depending on the amount of GSI implemented. This is an

approach that combines the concept of runoff volume control and direct reduction of stream power through multi-stage flow control.

In general, AEPA has not recognized the issue of small stream stability. **All watersheds in Alberta undergoing land development should have an assessment of their receiving water bodies at the tributary level for safe runoff volumes to ensure the long-term viability of development and protection of people and infrastructure.** As owners of the bed and shore, AEPA's failure to act on this matter may be a future liability.

Runoff volume control targets (VCTs) are set by municipalities seeking to manage the impacts from increased runoff, especially for the case of small streams in urbanizing catchments, but also for other drivers. Controlling runoff volume is also the first step in a sequence of steps for the protection and enhancement of runoff quality.

Irrigation from stormwater ponds is a response to the problem of small streams. Methods to control runoff volume are varied. Irrigation from stormwater ponds is one method that has been popular in the Calgary region, followed by the implementation of deeper topsoil in new (greenfield) development. Irrigation is a GSI practice for drawing off excess runoff, having nothing to do with landscape irrigation for the sake of the landscape. Irrigation (or other pond withdrawals) is similar to a bioswale or rain garden or tree trench or other type of GSI that uses the excesses of runoff (i.e., Delta Water) created by hardened landscapes.

Luxuriant irrigation. Landscapes should not be designed to require irrigation; they should always be drought tolerant. The type of irrigation to meet runoff VCTs can be thought of as a practice that happens when too much runoff water is available. Under drought conditions, watering would (at a certain point) cease.

The first example of irrigation used to achieve runoff VCTs in Alberta: The Nose Creek Watershed

The Nose Creek Watershed Partnership (NCWP) was formed in 1998 to undertake planning to address concerns regarding the future condition of Nose Creek and West Nose Creek, two small streams in an area of intense urbanization on the north side of the greater Calgary area.

Instream Flow Needs. An Instream Flow Needs Assessment was undertaken by the NCWP in 2005. As one would expect, it considered low flows but also looked at the impacts of intermediate and high flows. The Government of Alberta participated directly in oversight of this assessment, in support of the NCWP. The findings were later reflected in the 2008 Nose Creek Watershed Water Management Plan. This type of Instream Flow Needs Assessment, that considers the full spectrum of flows, can and should be part of watershed plans for all receiving streams in Alberta.

Achieving Intermediate and High Instream Flow Needs through GSI. In response to the development of the plan, the City of Calgary LID Subdivision Study (2011) demonstrated how VCTs could practically be met. Central to achieving these targets—amoung other GSI measures—is the practice of irrigation from stormwater ponds, which can address runoff that has not been dealt with by other forms of drainage management further up in the catchment by other forms of GSI.

Implementing VCTs in the Nose Creek Watershed. A sliding timescale of increasingly stringent VCTs in the plan was designed to allow industry time to adapt and optimize implementation. Unfortunately, implementation has still not been able to effectively proceed past 2010 levels due to uncertainty around AEPA's policy direction with respect to irrigation from stormwater ponds.

In the intervening decade since the VCTs were first implemented, updated VCTs based on additional weather and flow data and the potential incorporation of a low-energy release control-approach were investigated. A low-energy release approach allows for ponds to be sized and designed to empty more slowly. This has resulted in the proposal of a new implementation scenario where the post-development runoff can be about double pre-development runoff when appropriate low-energy release controls are co-implemented. The Approvals Group of the Calgary Regional Office of AEPA has been integral to discussions establishing updated VCTs and how to meet them. In the absence of low-energy release controls on ponds, post-development runoff still needs to fundamentally match pre-development runoff.

VCTs cannot be made more stringent until AEPA's policy direction moves beyond Interim status. In the meantime, the creek continues to degrade and land development options narrow and become more costly with each passing day.

TOPICAL RESPONSES

Exemptions

Stormwater ponds are the tail-end of the drainage network, not natural water bodies that should be subject to withdrawal regulation. To envision this, consider future scenarios where GSI will be implemented in a distributed fashion further up in the catchment. For argument's sake—and potentially in reality—the amount of runoff that will make it to a stormwater pond at the bottom of the catchment could be drastically reduced or even eliminated. There may be nothing to take out. There may not even *be* a pond.

Absolute exemptions from stormwater ponds are problematic for several reasons. Firstly, the runoff that AEPA is concerned about regulating as a withdrawal from a storm drainage storage facility is the same runoff that could be buffering soil moisture, returning to natural flowpaths, improving quality, and delivering co-benefits further up in the catchment. The amount of water in stormwater ponds and what that amount represents relative to pre-development conditions will vary as a function of the size and characteristics of our watersheds. Currently, with the implementation of GSI like deeper topsoil (as is practiced in Calgary, Edmonton, Okotoks, etc.) all runoff isn't necessarily destined for stormwater ponds. Secondly, **even the largest proposed exemption amount of 11,000 m^3 would only be enough to irrigate about 2.2 ha (@ 500 mm/year). This is about a third of the Delta Water volume that is necessary for drainage management purposes per quarter section in southern Alberta.** Thirdly, making a comparison between stormwater ponds and dugouts is not a parallel case: dugouts intercept, divert and reduce *natural* flows while stormwater ponds are engineered flood-control devices for *excess* flows. Fourth, if an even larger exemption volume were proposed to meet drainage needs (i.e., more than 11,000 m^3), it could be *too much* for a small catchment. Finally, if a per-pond absolute exemption were implemented, designers would inevitably be enticed to increase the number of ponds to achieve the necessary VCTs for watershed protection, which AEPA said in the 2022 engagement would not be allowed. However, who is to say what the 'original' pond count or size was going to be and what part would constitute the 'added' number or size? This approach would only serve to create more bureaucratic headaches and uncertainty.

Interim Irrigation Exemption Letter is Superfluous. Since 2011, the Interim Accepted Practice Letter has exempted irrigation from storm drainage storage facilities from licensing as long as these 'withdrawals' are applied to the landscape within the same catchment and evapotranspiration amounts are not increased over pre-development conditions. This was understood to be a stop-gap measure until permanent clarification was made. It was expected that the 2022-23 survey and engagement by AEPA would address this given that this topic had been extensively discussed, but instead, the Interim Accepted Practice letter was rescinded and replaced with an inadequate absolute exemption. A hasty reinstatement of the Interim Letter followed in August 2023, with a promise from AEPA to the ALIDP for closer discussion going forward. Unfortunately, no discussions have occurred to date and now another survey proposes a bigger absolute exemption.

The signal to industry should be the removal of the extra layer of unnecessary red tape around drainage facility withdrawals that reflects an incomplete understanding of the urban water cycle and its management. AEPA should affirm the already existing status of drainage, flood control and erosion control as not being a diversion under the Water Act in Part 1 m (i).

There seems to be a belief that just because water taken from a pond may incidentally have a function (e.g., irrigation, dust suppression, process water), that it means it was withdrawn for that purpose, which is not the case, and which the Interim Accepted Practice Letter actually affirms for the case of irrigation. **Stormwater managers are implementing measures to reduce runoff to prevent environmental harm and damage to people, property or infrastructure, while supporting development. Novel stormwater management practices should not be penalized as withdrawals just because they happen to provide secondary benefits in addition to their drainage, flood control and erosion control purposes, as already exempted in the Water Act.**

Pre- and Post-development runoff calculations. While removal of stormwater from storm drainage storage facilities to achieve drainage, flood control and erosion control objectives is not considered a diversion under the Water Act**, the volume to achieve these objectives must be determined on a case-by-case basis.** Fortunately, a post- vs. pre-development rate-based calculation already occurs as part of existing processes at the

Master Drainage Plan (MDP) level, which are subject to Water Act approval, and a Delta Water calculation for volume could easily be incorporated. **A Water Act license should not be required if it is demonstrated that the volume** that could be removed from a storm drainage facility **is within Delta Water. The regulatory oversight of AEPA should be met at this point as long as the water does not leave the watershed or the water cycle, and the resulting drainage system also meets Environmental Protection and Enhancement Act (EPEA) requirements.**

Concerns with respect to established communities. Provincial guidance is typically focused on greenfield development, which would be covered under Master Drainage Plans. In the case of re-development or other activities in established, older communities, a **One-Water approach consisting of net-licensing considering the sum of outfall discharges and return flows (as validated by agreed levels and types of monitoring) subtracted from natural withdrawals should satisfy AEPA's need for oversight and management,** for instance as part of a License-to-Operate or equivalent**.**

Is there a danger of mining runoff by going below predevelopment conditions? The pre- and post-development runoff volume (Delta Water) calculation safeguards instream flow needs and protects downstream users. **The Delta Water calculation considers the whole system, including GSI, not just water that is in the storm drainage storage facility.** To capture a full picture, as a safeguard, the pre- and post-development runoff calculation, along with outfall monitoring for validation, would demonstrate that mining conditions are not being created. If drainage is to be removed **below pre-development amounts, approvals should be required.**

Should other uses besides irrigation be allowed from stormwater ponds?

AEPA should take an approach of *ruling out* prohibited activities that should *not* take water out of stormwater ponds rather than exhaustively *ruling in* individual activities. Through STORMR, the ALIDP held several meetings to discuss and evaluate quantity and

non-health-related quality risks and communicated these consensus opinions to the AEPA policy group in 2023.

The types of uses considered included irrigation for all purposes, toilet and urinal flushing, process water, vehicle washing, cooling, deep injection, dust control, street sweeping, fire suppression, and wetland supplementation.

The risks evaluated related to the Water Act and included low-flow instream flow needs not being met, water leaving the watershed, and water leaving the water cycle permanently.

Overall STORMR findings. There are already provisions within EPEA for water-quality-related concerns, and there are already provisions through Master Drainage Plans and Pond Reports for the risk of low-flow instream flow needs not being met and water leaving the watershed.

The risk of water leaving the water cycle through deep injection is of concern to STORMR, as there is no pathway for this water to come back into the water cycle. However, regulatory provisions exist for this type of activity. **Deep injection *is* mining of runoff and is a truly permanent, consumptive use of the resource.**

Activities that keep water in the water cycle should be welcomed for their ability to reduce withdrawals from natural water bodies and reduce potable water demand while meeting stormwater runoff-reduction needs. From a Water Act perspective, STORMR did not identify *any* types of activities that need to be ruled out except for the concern around deep injection.

Two items of note that STORMR explored:

Dust suppression and street sweeping are relatively small, seasonal, recurring activities that can be credited to meet stormwater runoff VCTs and should be encouraged so long as they, like any other activity, do not reduce discharges below pre-development conditions and do not remove water from the watershed. There remains a question of at what scale of 'watershed' such removal activities would be deemed inappropriate. These activities can be incorporated in an overall OneWater accounting.

Permanence of activities. STORMR noted that only permanent or seasonally recurring activities should be credited to meet stormwater runoff VCTs. This is not a question of regulatory permissibility, but rather of the reliability of the activity to meet stormwater management objectives or the ability of stormwater management facilities to support the activity. For example, firefighting is not a predictable activity to reduce runoff volume, and ponds may not be adequately sized to have water available for this purpose. Schedule 3 of the Water (Ministerial) Regulation exempts firefighting, but this is as a withdrawal from natural water bodies. There is no issue with firefighting also being exempt as an activity taking water from stormwater ponds as an opportunistic, occasional event; but the water can't be relied on to be available or credited at the design stage for stormwater management purposes.

Should rainwater become regulated as stormwater?

Rainwater as a term will continue to have a high value for communicating the source and composition of this type of runoff. In terms of 'stormwater management', there is no distinction between rainwater and stormwater from a quantity perspective, because both rainwater and stormwater are accounted for and managed as part of an overall system. From a quality perspective, both Alberta Health Services and Alberta Municipal Affairs make their own stipulations on the definition and allowable uses of rainwater for health protection. Understanding that rainwater comes from a roof (i.e., is intercepted before it touches the earth) is a useful distinction and the term should persist.

The risk of too much rainwater being 'taken' due to lack of regulation. In terms of exemption, there is SO MUCH excess runoff and the cost of land, construction, transportation and overflow management in times of flooding so high, it is difficult to imagine a scenario in which anything but the encouragement of rainwater harvesting would make sense for the foreseeable future. In addition to the well-known conservation of potable water value of rainwater harvesting, an LID approach welcomes rainwater harvesting for the cost savings realized from potential downsizing of conveyance and pond infrastructure, potential for added climate resiliency, and the enhancement of the

performance of water-quality-improving source-control treatment facilities such as bioretention. Discussion of these benefits is beyond the scope of this document. **Because rainwater contributions are intrinsically part of pre- vs. post-development runoff calculations, the risk from a quantity standpoint is already accounted for at the MDP stage and through asset management at a finer level of granularity. The risk of water leaving the watershed can be similarly addressed and managed.**

Absolute exemptions and alternatives if rainwater would be brought into the Water Act. Like stormwater, **even if rainwater were regulated at the Water Act level, there is no absolute exemption amount that would be appropriate or type of activity that should be excluded.** AEPA could consider excluding commercial and industrial supplemental rainwater collection devices from exemption. These collection devices, for example, could be roof areas without another purpose or aerial devices. The question of what constitutes a *supplemental device* would need to be defined.

Net withdrawals and one water

Is that use or reuse or…? Tracking of sources and whether they are termed "use" or "reuse" has no practical significance from a water quantity management perspective. Co-mingling of treated wastewater, stormwater and rainwater in storage facilities for fit-for-purpose use is a plausible scenario. **It is not important to know the origin of each water droplet and what path it takes; it matters what is withdrawn from natural water bodies and what volume and quality of water returns to natural water bodies in the aggregate.** AEPA is encouraged to urgently move to a One Water, net withdrawal approach.

Management can be achieved without the need for scrutiny of individual activities by AEPA. This should be confirmed through discussion of necessary Monitoring and Reporting to achieve adequate oversight of an integrated One Water system. That said, a simple management approach eliminates the need for an unnecessary layer of red tape, thereby addressing concerns that AEPA simply does not have the resources to effectively and timely review and approve individual activities.

Requirements under the Water Act, EPEA, and possibly other regulatory instruments should be harmonized so that water quantity and water quality are considered together.

Monitoring and reporting

Quantity. At the highest level, **AEPA should be interested in withdrawals from natural water bodies, return flows and outfall contributions**. Delta Water-type calculations should be employed as part of the urban land development process, tied to MDPs, Pond Reports and Outfall Approvals. APEA is encouraged to manage water in a way consistent with a One Water system, where the sum of return flows and outfall discharges are subtracted from natural water body withdrawals.

Quality. EPEA approvals already seem to be able to provide the necessary assurances that the quality of discharges is being met. At the very least, discussions to confirm that this alignment is in place are needed.

Adjusted monitoring and reporting requirements for a One Water approach. AEPA should engage in discussions to ensure that the right type and level of detail is in place to **move to integrated, net-licensing as fast as possible. Modelling and enhanced monitoring can help to support the One Water approach.**

Inter-basin transfers

There are many risks to inter-basin transfers. Fit-for-purpose use of existing water supplies and local aquifer storage and recovery should be explored and matured before inter-basin transfers are supported.

GSI for water supply/ availability

The AEPA survey mentions some types of GSI specifically for the purpose of enhancing water supply. This is certainly a benefit that can be achieved. **However, benefits should be prioritized in the context of broader neighbourhood, community, and regional systems and goals to achieve integrated solutions to questions of disaster mitigation, resiliency, adaptation and wellness.** It is beyond the scope of this document to provide a quick, brief and reasoned answer about which practices will yield the desired result that AEPA has in mind. However, it can be generalized that **there are no less than 13 types of GSI for drainage management suitable for use in Alberta, featuring four ways to contribute to water supply.** These include void space, temporary ponding, permanent wet pool, and a storage layer.

Void space in soil/ media/ granular layers. All landscape-based GSI practices store precipitation and runoff in the void spaces of their soil, growth media or open granular layers. This type of storage provides local, distributed moisture buffering, resulting in flood and drought mitigation and healthier landscapes with little to no need for supplemental watering of vegetation (where applicable).

Temporary surface ponding or chamber. Ponding is designed to be in the range of hours to a few days. **Basin-type retention is particularly important in Alberta's flashy storm context**, as rainfall that would otherwise be absorbed by surfaces in less intense events is not able to infiltrate fast enough in high-intensity events, resulting in runoff. Basins, on the other hand, do not diminish in performance with higher rainfall intensity.

Chambers associated with rainwater harvesting need to be emptied to provide a stormwater management benefit in the wet season, not merely stored for conservation purposes in the dry season. Chambers can be designed to do both, but they require active management (which can be automated), whereas rain gardens and other infiltration practices are self-emptying.

Permanent wet pools are associated with larger, more well-known infrastructure including ponds and wetlands. Some constructed wetlands (mini-wetlands) may be implemented as

alternatives to rain gardens and bioretention (which only have temporary surface ponding). Constructed wetlands are not generally preferred at the lot or street scale due to perceptions around drowning risk and mosquito habitat.

Subsurface storage layers are placed under a variety of practices to provide enhanced flood and drought mitigation and to contribute to healthier landscapes. Some practices incorporate perforated pipes in a drain-rock reservoir. This provides a controlled submerged, anoxic zone for denitrification, with drainage generally tied directly to the storm sewer. This can be an important feature for water quality (although management of phosphorus and emerging contaminants may be more critical than nitrogen, depending on the context). Most practices—everything from green roofs to permeable pavement— can have a storage layer geared to flood management and drought mitigation without the need for a perforated pipe or sewer tie-in. **At least eight of the thirteen types of practices can be designed to incorporate a storage reservoir. Six of these reservoir-type practices are already happening in Alberta, some fairly extensively (e.g. soil cells/ tree trenches).**

The table below identifies the applicability of all 13 practices by their landscape context, the type(s) of water storage they feature, and the land use context.

Stormwater Management Practice Applicability in Alberta and Water Storage Features

Practice	Landscape Context						Water Storage Type				Land Use Context		
	General Site Landscaping	Lower Density Building Runoff	Higher Density Building Runoff	Streetscapes and Plazas	Parks and Open Spaces	Large Landscape Scale	Soil, Media, etc. Void Space	Temporary Surface Ponding or Chamber	Permanent Wet Pool	Subsurface Storage Layer	Retrofit	New Development	Redevelopment
Naturalization (grassland)		N/A	N/A					N/A	N/A	N/A			
Afforestation (parkland)		N/A	N/A					N/A	N/A	N/A			
Deeper Topsoil		N/A	N/A					N/A	N/A	N/A			
Deeper Topsoil + DD	N/A			N/A	N/A	N/A		N/A	N/A	N/A			
Absorbent Landscaping		N/A	N/A						N/A	N/A			
Rain Garden	N/A								N/A				
Rainwater Harvesting	N/A			N/A	N/A	N/A	N/A		N/A	N/A			
Blue Roof	N/A			N/A	N/A	N/A	N/A		N/A	N/A			
Green Roof	N/A			N/A	N/A	N/A			N/A				
Bioswale								N/A	N/A				
Bioretention	N/A								N/A				
Soil Cell / Tree Trench	N/A								N/A				
Permeable Pavement									N/A				
Dry Pond									N/A				
Wet Pond								N/A					
Constructed Wetland													
Natural Wetland											N/A		

1. Darker values are typical implementations, medium values are lesser seen, white are technically possible but uncommon, and N/A is not applicable by definition.
2. Darker outlines in the Land Use Context column indicate the most favoured GSI practices for the context.

Preferred practices. **Vegetated practices are preferable to unvegetated practices** for their co-benefits to e.g., habitat, carbon sequestration, air quality, heat mitigation, and wellness. Space constraints are the main reason to choose other GSI practices. **Basins are favoured** for their ability to function regardless of rainfall intensity. **Rain gardens are more suited to retrofit situations** where there is both more available space and high benefit due to the lack of existing grey infrastructure, e.g., pipes, or the ability to find space to retrofit it e.g., dry ponds. **Deeper topsoil and deeper topsoil + DD (downspout direction) can be effective in new development** where a pond-type feature is present and rain gardens are difficult to fit in due to limited on-lot green space (related to higher densities).

Please refer to the **Alberta Clean Runoff Action Guide** for more information about practices that are suitable for the residential property context.
https://resilientlandscaping.ca/crag/

Benefits of distributed controls. Placing small, distributed GSI throughout communities reduces requirements for conveyance (pipes) and end-of-pipe management (stormwater ponds and constructed wetlands), saving costs. For existing communities, GSI improves performance without having to up-size pipes and can be implemented incrementally to keep pace with infill development. Natural recharge pathways are enhanced and restored at myriad locations throughout the catchment with a GSI approach, in contrast to merely happening at an outfall or within the footprint of the conventional stormwater management facility. More greening throughout communities increases wellness and reduces health costs. GSI contributes to both climate change mitigation and adaptation in ways that conventional infrastructure cannot.

Creating resilient landscapes. **Landscapes should not require supplemental watering to survive.** Shallow soils and conventional turf should be eschewed in favour of biodiverse, more appropriate landscaping choices. These include deeper topsoil, native and adapted plants, reduced mowing, and increased naturalization. Numerous jurisdictions in arid regions are moving to incentivize or require these approaches.

Roof runoff should be directed to landscapes rather than to streets to facilitate natural recharge and evapotranspiration. Rain gardens should be used wherever feasible for their

ability to passively retain runoff during intense storms and naturally dissipate it after rainfall ends.

Street runoff should be directed to bioretention facilities, soil cells and tree trenches to support biodiverse plantings and the urban forest. In fact, recent years with dry conditions have already provided ample evidence that **the urban forest's main chance of survival during extended periods of drought is when it is associated to GSI features** that provide enhanced soil volume in combination with rainwater and stormwater flows directed through them.

Woody plants (trees and shrubs) are susceptible to dieback from *weather whiplash* (rapidly fluctuating temperature conditions) which seems to be becoming a more frequent occurrence in Alberta. **Therefore, a shift to more emphasis on herbaceous material** (grasses and flowering plants) in the Prairie Ecozone (grasslands and aspen parkland) will help adapt to this challenge.

Typical surburban single-family residential to quadplex residential GSI implementation scenario. Residences should incorporate a rain garden or two as the majority of their front-yard landscaping and route rear-yard flows to rainwater harvesting vessels that support vegetable gardening and container watering. Rain gardens in the rear yard are also feasible but sometimes residents prefer the rainwater harvesting option. More ambitious rainwater harvesting setups can be used for toilet flushing (permitted), laundry (not yet permitted), and other domestic uses.

Rainwater harvesting can also be set up for flood mitigation (rate control) purposes by merely detaining rather than retaining rainwater. When used for flood mitigation, the storage capacity of the vessel must be available when it rains—it is no use if the vessel is full. A leaky outflow (orifice control) accomplishes this by draining water after a rain event so capacity is available the next time it rains. Usually, a combination of a leaky amount for flood mitigation and an amount for landscaping or other purposes can be designed to meet both flood mitigation and water security/ potable offset objectives. **The emphasis to-date on rainwater harvesting merely as a potable conservation tactic is a lost opportunity for stormwater management.**

Rain gardens can also be designed to be leaky, not leaky, or a combination, depending on the watershed objectives. One of the advantages of rain gardens over rainwater harvesting is that they are low-tech and are passively drawn down, without requiring operator intervention.

To provide a sense of the amount of water in question, whether in the form of rainwater harvesting, rain gardens, green roofs or other on-site storage, an estimate of the volume to be retained for stormwater management purposes on a suburban lot would be approximately in the range of 4 to 7 m^3.

Examples of Drought-Resilient GSI in Alberta

The Okotoks bioretention/storage chamber 'drought resilient LID' research and demonstration project directs runoff from a parking lot through a bioretention area and stores runoff in arch-style underground chambers, for later luxuriant landscape irrigation of a school open space. Funded in part by AEPA's WRRP. (Photo courtesy Magna Engineering)

The North Glenora Resilient Landscaping Demonstration and Research project in Edmonton is a paired study of a rain garden with and without an underground wicking, milk-crate-type storage chamber. The photo shows newly planted gardens after an intense storm, with water fully absorbed in 20 minutes. Runoff is collected from the community rink shack. Funded in part by AEPA's WRRP.

The Remington green roof in Quarry Park, Calgary is made up entirely of drought-tolerant native plants and is irrigated from parking lot runoff collected in an onsite mini-wetland that dissipates runoff through enhanced evapotranspiration on the roof. The green roof incorporates an amenity space used for social gatherings. Developer/ builder funded.

The County of Wetaskiwin administrative offices entrance was converted from a windswept heat trap that also caused nuisance flooding in the adjacent parking lot into a mini-wetland (foreground) and rain garden (background). The area quickly became an amenity space. Funded in part by AEPA's WRRP. (Photo courtesy County of Wetaskiwin)

Parkdale Community Hall rain garden on an ALIDP bus tour in July 2024, after City of Calgary feedermain-break-related watering restrictions. Plants are mostly native. Both the sod and plants are drought-tolerant and were not noticeably affected by not being watered, even though the area is only a few years old with only a partially established root mass. Funded in part by AEPA's WRRP.