

On-Site Stormwater Detention in NSW — Past, Present and Future

Drew Bewsher, BE(Hons), MS(Civil), FIE Aust, CPEng
Director, Bewsher Consulting Pty Ltd

Don Still, BE(Hons), MEng(Sci), CPEng
Director, Bewsher Consulting Pty Ltd

Summary

On-site stormwater detention (OSD) policies have been widely implemented by local government authorities in the state of New South Wales, Australia. For example, it is now estimated that over 75% of local government authorities in the Sydney metropolitan area have an OSD policy in place. This is in sharp contrast to the late 1980's when only a handful of councils had OSD policies.

With the rapid acceptance of OSD by local government, some sections of the community may view OSD as a panacea for all their stormwater problems. However not only is this a fallacy, but there are emerging problems with the implementation of OSD.

Inspection of installed OSD systems has shown that a significant proportion of systems are either not functioning at all or not functioning as designed. Hence it is evident that significant funding for monitoring, education and maintenance is required to make OSD work. In many cases insufficient resources have been available to date.

The paper discusses the looming difficulties with OSD in New South Wales and poses the question as to whether a re-think of policy is warranted.

1. INTRODUCTION

It is a well known fact that as catchments are urbanised, the frequency and severity of flooding increases because of:

- c greater run-off from roads, roofs and other sealed surfaces when compared with the more pervious surfaces which were previously in the catchment;
- c quicker run-off via gutters, drains, pipes, etc, when compared with the slower runoff generally achieved in a less developed catchment; and
- c loss of natural flood storage areas as floodplains are filled, channels straightened, etc.

Where catchments are partially developed and stormwater infrastructure is in place, the effectiveness of this infrastructure to deal with flood problems may be slowly eroded if further development proceeds without adequate controls.

On-site stormwater detention (OSD) is the temporary storage of site stormwater so as to restrict the discharge leaving the site. The objective of most NSW council OSD policies is to ensure that for all flood events up to and including the flood standard (e.g. 100 year), new developments and redevelopments do not increase stormwater discharges in any downstream areas. Thus OSD functions to maintain the status quo, rather than to reduce existing flooding problems.

OSD storages are normally constructed as part of new developments and may be located above ground (e.g. in landscaped depressions or parking areas) or below ground (e.g. underground concrete tanks or buried pipes), or as a combination of above and below ground storages. Water is temporarily detained in these storages because the storage outlets are restricted by some means, such as an orifice plate bolted to outlet pipe, length of small diameter pipe, system of baffles, etc.

OSD systems should not be confused with the large publicly owned detention basins that are often located in playing fields adjacent to major trunk drainage systems. The particular characteristic that distinguishes OSD systems is however not their size (although they are generally very small in size e.g. 5m³ to 20m³), but rather the fact that OSD systems are located within private property, upstream of a council's trunk drainage system.

OSD systems have achieved a rapid rise to fame and popularity amongst some policy makers within NSW councils in recent years, particularly in the established areas of Sydney. The purpose of this paper is to examine the reasons for the increase in OSD popularity, to evaluate OSD's benefits and disbenefits, and to suggest that a rethink of OSD policy may be required.

2. OSD — THE PAST

The oldest proponents of OSD in NSW have been the Councils of Wollongong and Ku-ring-gai. The city of Wollongong began the development of OSD policies following severe flooding in March 1975. Although when first introduced the OSD policy encountered some severe objections (bordering on hostility in some cases), there is now widespread acceptance of Council's policy amongst consulting engineers and developers.

Ku-ring-gai Council began to introduce OSD for new developments in 1980. There are now many hundreds of developments within Ku-ring-gai where OSD has been applied.

Until the mid-1980's there were few if any other councils with formal OSD policies in place and the first technical forum was organised by the Water Resources Panel of the Institution of Engineers in April 1989. At that seminar it was noted that while very few Sydney councils had formal OSD policies in place, many were in the process of developing such policies.

Awareness and interest in OSD in NSW has been significantly increased following the establishment of the Upper Parramatta River Catchment Trust.

Early on, the Trust and its constituent councils, (Holroyd, Parramatta, Baulkham Hills and Blacktown), embraced OSD for catchments of the Upper Parramatta River. Most commendably the Trust has initiated and funded research and investigation into the function of OSD. The Trust has also been aware of the need to educate the community and the profession about OSD, and has initiated and/or participated in a number of seminars and workshops concerning OSD. This has also increased awareness of OSD amongst councils in NSW and provided a lead for many councils to follow.

3. OSD — THE PRESENT

A survey of OSD practice within councils in the Sydney and greater Sydney area prepared in 1992 (Reference 3) indicated that approximately 75% of councils have OSD policies operating and a majority of the remaining councils have policies under active consideration. Based on the details provided in References 1 and 3, and the author's own investigations, it is estimated that there may be almost 3000 OSD systems in NSW with the vast majority located in the metropolitan centres of Sydney and Wollongong. The capital cost of such systems may be in the order of \$10–\$50 million.

Development of OSD practice in NSW is currently being directed towards remedying policy deficiencies which have been identified. Two such deficiencies which are currently being tackled are:

- c the lack of uniform policies between councils;
- c the lack of adequate guidelines for planning, design, construction and maintenance.

Whilst many councils and groups have an interest in OSD, probably the two bodies taking the greatest lead are:

- c the Upper Parramatta River Catchment Trust, who have recently published their second edition of the "On Site Stormwater Detention Handbook" (Reference 4); and
- c the Sydney Coastal Councils' Group who are currently finalising their draft "On Site Stormwater Detention Guidelines For Urban Councils" (Reference 3).

Both References 3 and 4 are comprehensive documents and go part way to remedying the dearth of practical written information which has been available in the past.

4. OSD — THE PANACEA

The term 'panacea' is used because OSD may be regarded as a remedy for many of our stormwater ills. The various benefits of OSD are reported to include:

- c it can be funded immediately (i.e. by the developer) and does not require any capital outlay for council;
- c it protects downstream properties from increases in flooding resulting from new developments. Thus it protects councils against claims for damage arising from increased runoff from new developments or redevelopments;
- c public land for larger detention basins may not be available adjacent to existing trunk drainage systems;
- c the cost of upgrading existing drainage systems is often beyond the financial means of councils;
- c the OSD system tackles the problem at its source, before the increased flows enter a council's drainage system;
- c some water quality improvements will also result from some deposition of coarse particles and the trapping of litter on outlet-protecting screens within OSD storages.

Whilst there are such various benefits there are possibly two main reasons why we have OSD today:

- (a) **Legal Liability:** Councils face increasing pressure to permit developments to proceed in catchments with known or unknown flood problems. Councils generally have insufficient time, money and other resources available to investigate or remedy existing flooding problems before the development proceeds. If councils allow developments to proceed which may aggravate downstream flooding, they run a risk of ending up in court. No council wants to run this risk and OSD provides a means of ensuring that flood problems will not be aggravated.
- (b) **Funding:** When it comes to upgrading stormwater infrastructure, councils are often unable to find sufficient funds. It is perceived that there is little political benefit to be gained from upgrading infrastructure, and thus any policy which requires the developer to fund the necessary works, in lieu of the council, may be readily endorsed.

5. OSD — THE PROBLEM

The main proponents of OSD readily admit that OSD has problems. A survey of OSD practice in 1993 and 1994 (References 1 and 3) has revealed that approximately 60% of OSD systems were not operating as designed. The reported problems have included:

- c deficient storage volume—this was particularly common in landscaped storages, and was often the result of incompetent construction, deficiencies or volume losses associated with landscape finishing;
- c uncertain discharge control—a wide variety of discharge control devices have been used. The discharge rates from many outlets cannot be predicted with any confidence. Drowned outlets, skewed inlets and crudely fabricated outlets in unsuitable material were common;
- c screening—screening was often not provided, or the wrong size. When provided, screening was often fabricated in corrodible material;
- c decomposing organic material—this was causing odour problems in unvented storages;
- c inappropriate layout—often costly storages had been constructed on sites where opportunities for relatively low cost driveway and/or landscaped area storages existed;
- c access and structural design—often underground structures had inadequate access or the structural design appeared inadequate for the anticipated water loadings.

In addition to these construction problems, other potentially serious issues concerning the future of OSD are arising. These include:

- c **ongoing maintenance:** Because OSD systems are on private land, maintenance is primarily the responsibility of the owner. Lack of owner awareness about the presence and function of OSD, lack of willingness to carry out the maintenance, and other reasons, make on-going maintenance a difficult issue. Most new OSD policies now incorporate positive covenants on the property title which require the owner to maintain the OSD structure and give council the power to enforce maintenance. Whilst such covenants are a step in the right direction, property owners may be unaware or uninterested in such covenants, and councils may lack determination and/or resources to enforce such maintenance;

- c **failure to address our stormwater infrastructure problem:** Sydney's stormwater infrastructure is grossly under capacity and its rectification will require a massive injection of capital funds. OSD, when it works, can only maintain the status quo and stop problems from getting worse.

It is possible that OSD has diverted attention away from the rectification of our infrastructure problems in three ways:

- its function is misunderstood by many people who believe that successive implementation of OSD storages will gradually solve our infrastructure problem;
 - secondly, many OSD policies have eliminated Section 94 (Environmental Planning and Assessment Act, 1979) contributions for stormwater. Whilst Section 94 contributions cannot be used to reduce existing infrastructure deficiencies, there are economies of scale to be achieved by remedying both existing and future deficiencies with one set of works. Without Section 94 contributions, councils are less likely to tackle their infrastructure problem;
 - thirdly, the benefit of OSD, in terms of reducing flood discharges, is often small compared with the magnitude by which flood discharges exceed the capacity of our existing stormwater systems. This is particularly so in older areas of Sydney with heavily urbanised catchments.
- § **lack of education:** This is a major problem with OSD. The successful implementation of OSD relies on builders, designers and site owners understanding the function of their OSD systems. Improving understanding must therefore be a key goal. However one must ask whether such a goal is achievable;
 - c **lack of council resources and/or commitment to make OSD work:** One could be forgiven for thinking that the rapid acceptance of OSD by some councils has been because they perceive that "OSD doesn't cost Council anything". Nothing could be further from the truth however. Whilst there are no capital construction costs for councils, the recurring education, monitoring, maintenance, etc, costs are large and there may be few councils who are prepared to resource OSD to the level required to make it work.

6. OSD — THE FUTURE

OSD has an uncertain future. Its future is at risk from attacks on three fronts:

- c **community backlash:** One must ask whether the development community will continue to accept the imposition of OSD. One must also ask whether existing residential communities, who are actively opposing new development in their catchments, will latch onto the pitfalls of OSD and publicise these in an attempt to have development stopped;
- c **legal challenge:** A future court hearing which receives a submission regarding the poor performance of OSD systems to date, may well consider that OSD would not guarantee adequate protection to the downstream environment;
- c **the next large flood:** How quickly public opinion changes with a flood. In the future following such an event, the media (and the government) may look for a scapegoat. Will the public realise that OSD was never intended to solve their existing flood problems? Will the engineering profession be excused from promoting OSD when surveys have shown that 60% of storages are not functioning as designed? Will councils who have overlooked their infrastructure problems and failed to collect Section 94 contributions be exempt from the spot light? Let us all beware.

A rethink of OSD may be required. Let us be aware of OSD's deficiencies as well as its benefits. Let us not embrace OSD until we have thoroughly investigated all options in a catchment and we are convinced that it's in the long term interests of the community. In some situations OSD may be the only option left, but let's treat it that way, ie. as the last resort.

If OSD is adopted in a catchment, then adequate funds for monitoring, maintenance and education must be provided. We must ensure that the decision makers are aware of this, and that OSD policies are not promoted where such funding is unavailable.

Has the OSD pendulum swung too far? Possibly it has.

7. REFERENCES

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KEYWORDS: Stormwater, urban drainage, on-site stormwater detention.