A Practical Guide for Gross Pollutant Trap Planning, Design & Procurement

For Member Councils of the Georges River Catchment

Georges Riverkeeper Member Councils

There are many stakeholders and landowners in the Georges River Catchment who each have a responsibility to manage their land in a way that ensures there is a minimal impact on the river and its ecosystems.

Partners

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The Georges Riverkeeper (GRK) received a grant (2021) from the Australian Government's Environmental Restoration Fund program to reduce the amount of litter discharged to the river. The grant includes funding for auditing of GPTs and preparation of a practical guide to assist Councils to better plan, design, specify and operate GPTs to protect the Georges River.

Australian Government

GRK would like to thank the team lead by Ben Wolfgramm and Jamie Ewert and project inception staff Erin Sellers and Beth Salt who secured the grant funding.

Cover image Montgomery Avenue Trashrack drains to Little Saltpan Creek a tributary of Georges River completed in 2019 Optimal Stormwater.

Edition 1: First Published in May 2023 and to be revised periodically. GRK will provide training to members using the Guide for the course outline.

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Definitions

Auditing	Periodic physical inspection and assessment of stormwater assets to report on suitability, performance, condition, defects, rectification, maintenance and WHS.
Bypass Flow	Flow which overtops the weir during high-flow conditions so is not treated by the device.
Catchment Area	The area (ha) which drains to a stormwater outlet or treatment measure.
Cleaning and maintenance	The periodic removal (usually by suction) of gross pollution, debris, sediment, solid and liquid waste from a device/measure, cleaning of screens or racks as required.
Cleaning report	A standard report /template that uses images to report the GPT/ STM condition prior cleaning and outcomes from cleaning activity. It should also provide quantities and type of pollution removed by % or weight and any issues with the asset.
Cleaning specification	A one-page document that simplifies the cleaning process. It details the location and methodology to clean the device and how to conduct an annual/comprehensive clean for the measure.
Cleaning Trigger	The level of pollution build-up that is considered to be full specific to that asset therefore triggering a clean. Typically, 50% of sump depth for devices which store pollution inside the screen chamber.
Comprehensive (or initial) Clean	Usually annual where the entire treatment measure is comprehensively cleaned especially the zones outside of the sump or screens referred to as the volute chamber. Should be carried out prior to asset being handed over from developer to Council.
Combination (suction and high pressure) Unit	Industrial cleaning truck with capacity to vacuum contents of GPTs and also high-pressure cleaning capacity for comprehensive cleaning of screens and structure. Normally 8-10m long twin steer dual axle.
Condition	The overall condition of the device taking into consideration the structure, functionality, defects, age and performance
Confined Space	An enclosed or partially enclosed space where entry is occasionally required to monitor, clean or maintain the stormwater measures. Confined spaces have restricted entry/exit conditions. For a full definition and associated requirements regarding confined spaces see the Work Health and Safety Regulation.
Data Sheet	A one-page document that contains all the key information including location, manufacturer, contact, depth, storage capacity on a single device to be able to monitor it correctly.
Decant	To pump, vacuum and drain excess surface water from the SQID directly or indirectly to other approved landscape area or sewer to reduce the liquid waste transportation and disposal.
Dewater	To drain excess water by gravity using ramps, drying areas and landscape to remove excess water from the pollutants
Diversion Chamber	The chamber created to divert treatable flows from the channel or stormwater system into the GPT.
Exclusion Bars	Bars upstream or downstream of a stormwater inlet or GPT, designed to prevent children from entering.
Effective Storage	The recommended storage at which the GPT should be cleaned – usually 50% of the total storage volume.
Floatable Pollution	Bottles, foam, plastics, sticks, debris or other pollutants with a specific gravity <1.

Gatic lid	Although gatic stands for Gas & Airtight Inspection Covers, and it's a brand, this is also the generic term used for any solid, heavy duty lid, even if it is not a gatic brand lid.
GIS	Global Information Systems databases which hold planning, cadastre infrastructure and other Council asset information
Grab (or crane) Truck	A crane truck fitted with bucket capable of cleaning the GPT without removal of the liquid contents. Also used to remove heavy lids ie not capable by manual handling.
Gross Pollutants	Any material that would be retained by a 5 mm screen (as defined by Allison et al., 1998) which can include litter, debris, plastics, bottles, sediments, leaf and other organic matter
Gross Pollutant Trap (GPT)	A structural measure installed within the stormwater system designed to trap gross pollutants, debris and sediments. Note: many GPTs can also catch material smaller than 5 mm including suspended sediment
Heavy metals	Fine metals such as cadmium, chromium, copper, iron, lead, manganese, mercury, nickel and zinc, which can be toxic when concentrated in the environment.
Hydrocarbons	Compounds such as petroleum, some oils which can be washed into waterways and can be found floating, sinking, soluble, adsorbed to sediment, or emulsified.
Lids & Grates	Lids (solid plate or infill) and grates provide access into and out of the stormwater treatment measures and pits for monitoring, cleaning and maintenance. They range in weight and can be very heavy to lift off.
Litter	Solid matter from human sources such as plastic bags, drink bottles, straws, cigarette butts, polystyrene, paper, etc. that are discarded into the environment.
Low flow bypass	Low flows are common in both large and small stormwater systems. The GPT should have facilities such as capped low flow pipes installed through the weir to allow bypass during cleaning.
Maintenance	All activities required to ensure that a stormwater measure remains operational including cleaning and minor repairs/ works.
Minor clean	Frequent maintenance activities required to ensure the functionality of the treatment measure is operational – eg cleaning exclusion bars.
Major Clean	Similar to a comprehensive or initial clean to recommission GPT operation
Nutrients	A substance that provides nourishment essential for growth. For example, nitrogen and phosphorous are essential for the growth of plants, weeds, or algae etc.
Organic matter	Solid matter derived from plants such as sticks, tree branches, lawn clippings, weeds and leaves.
pH	A figure expressing the acidity or alkalinity of a liquid on which 7 is neutral, lower values are more acid and higher values are more alkaline (basic).
Primary Stormwater Treatment Measure	A hard engineering stormwater treatment measure installed to generally trap pollution larger than 5 mm, including litter, organic debris, coarse sediment/particles. Examples of primary stormwater treatment measures include: pit traps/trapped gullies, gross pollutant traps/wet sump, trash racks/dry traps, nets, floating booms and boom traps.
Rectifications	Works required to repair, optimise and improve performance or restore functionality to treatment measures
Retrofit GPT	Typically a Council driven project to retrofit a GPT onto existing stormwater infrastructure

Secondary Stormwater Treatment Measure	An engineering or natural measure installed to remove fine sediment, suspended solids, nutrients, heavy metals etc. Examples include: permeable paving, oil and sediment separators, media filters, infiltration basins, grassed and vegetated swales, ponds and sediment basins, bioretention and raingardens, and constructed wetlands.
Sediment	Soil particles that have been blown or washed from their source, and commonly end up in our waterways.
Screens	Physical barrier created to trap pollution within stormwater flows.
SQID	Stormwater Quality Improvement Device i.e., much the same definition as stormwater treatment measure.
Survey Staff	Used for monitoring GPTs by measuring to the top of pollutants to report the depth prior to cleaning
Suspended Sediment (or particulate matter)	Includes fine soil particles from erosion and land degradation, and from activity, wear and deterioration from pavements, homes, structures and buildings. Includes airborne particles (dust)
Sump	The lower portion of the GPT designed to contain debris and allow suspended sediment and pollutants to settle out.
Stormwater Harvesting	Stormwater capture, treatment, storage and reuse, commonly for irrigation.
Storage Volume	The volume of pollution that can be stored within the device/measure, which triggers a clean. Note - it is possible to achieve 150% full in some devices if they are not cleaned when cleaning was due.
Stormwater treatment measure swapping	When a specific stormwater treatment measure is identified for installation but when a similar or perceived equivalent measure in installed instead.
Total Nitrogen (TN)	The sum of the Total Kjeldahl Nitrogen (ammonia, organic and reduced nitrogen), nitrate and nitrite is the Total Nitrogen contained in a sample of soil, sediment or water.
Total Phosphorus (TP)	The sum of all phosphorus compounds that occur in various forms contained in a sample of soil, sediment or water.
Total Suspended Solids (TSS)	The measure of the dry-weight of suspended particles that are not dissolved in a sample of water that can be trapped by a filter. Suspended solids in water reduce light penetration in the water column, can clog the gills of aquatic animals, smother aquatic plants, and commonly has adsorbed pollutants attached such as phosphorus, hydrocarbons and heavy metals.
Trashracks	A simple type of GPT that aims to store captured stormwater pollutants in a dry state between storm events. Commonly using vertical steel racks and used on larger catchments.
Turbidity	The measure of relative clarity of a liquid and is the degree to which a transparent liquid scatters light, usually a measure of the amount of suspended material in the liquid. The liquid appears cloudy, muddy or hazy.
WAE	Work as Executed Drawings
Weir	The structure used to divert treatable flows from the network to the GPT for treatment.
Wet Sump GPT	A GPT that stores stormwater pollutants in a wet state between storm events.
WSUD	Water Sensitive Urban Design

1 We Need Gross Pollution Traps!

There is an urgent need to reduce and ultimately eliminate gross pollution, debris and litter discharged to waterways. Gross pollution and litter are dominated by single use products including a huge variety of plastics, polystyrene, packaging material, wrappers, containers including bottles, cups, lids, dispensers, straws, health products such as masks, bandages, cotton buds, sports items, balls, toys, clothing and all kinds of construction debris such as used silicon containers, wrapping, strapping and many other disposal products!

Sadly, these items quickly become waste and are discarded as litter, debris, and gross pollution. During rainfall these *"waste products"* are swept off roads and surfaces into stormwater systems and carried to waterways and oceans as marine debris. While gross pollution and litter are relatively easy to remove as surface debris, the same cannot be said of pollution in waterways.

Once litter reaches a creek or river it becomes more difficult to remove due to dispersion, access, entanglement, and submersion and when it reaches the ocean poses a threat to human health and ecosystems. There is also a growing body of research indicating that microplastic levels in an ecosystem can quickly become toxic and potentially lethal to the organisms residing there.

Whilst the packaging industry, businesses and government grapple with the mountain of packaging used and discarded to the environment local government planners, engineers and the stormwater industry have accepted GPTs as a practical and cost-effective solution to trap and remove litter and gross pollution from stormwater runoff. Hence the construction and operation of properly planned, located, specified, and designed ***gross pollution traps (GPTs) is seen as a practical solution in the war*** against gross pollution and litter which easily migrates and becomes marine debris.

These "structural" measures should be complemented with other capacity building and educational campaigns for schools and community groups and Council to deliver an even better outcome for the environment.

Figure 1 Stormwater debris Blacktown LGA (Source: Optimal Stormwater Jan 2023)

Figure 2 Stormwater in a CDS unit. 3% floats and that's what's seen here, but 97% will waterlog and sink, needs to be cleaned from the sump below. Image c/- Optimal Stormwater 2018.

2 Target Audience

To assist member Councils, the Georges Riverkeeper (GRK) engaged Optimal Stormwater and Water Sensitive Cities Australia (WSCA) for the ***Assessment of GPTs Project in the Georges River Catchment***. The scope of work required a literature review of the GPT industry, stakeholder engagement, conceptual modelling, and preparation of this document - **a *Practical Guide for GPT Planning, Design & Procurement*** to assist GRK Councils with planning, design, specification, and operation of GPTs.

The Guide covers a range of key areas for Councils to reference/use to develop a GPT program tailored to meet the needs of the LGA. The Guide has been prepared for a range of stakeholders including planners, engineers, asset managers and consultants and encourages discussion and collaboration.

Whilst this Guide was prepared for the Georges Riverkeeper, the suggestions, guidance and recommendations provided can really be used by any developer or Council planning or reviewing their response to managing gross pollution and litter.

The success of each LGA's GPT program will contribute to the goal of achieving zero litter to the Georges River!

Figure 3 Stormwater pollution trapped in a CDS unit at Fairfield. Without the insurance of GPTs like this one, all of this would have ended up in our creeks, river and ocean. Image c/- Optimal Stormwater 2018.

3 Georges River GPT Cycle

The Georges River catchment is a large area (930km^2) with varying land use and degrees of urbanisation. For example, Liverpool and Campbeltown LGAs are high growth areas and the majority of GPTs are specified, installed, and handed over through the development cycle. Development control plans (DCPs) with appropriate water quality objectives are therefore the main instrument needed to encourage the use of *appropriate* GPTs and other stormwater quality measures for developers to meet water quality criteria.

By comparison Canterbury Bankstown, Georges River and Sutherland Shire Councils have been through a development cycle so most GPTs are now retrofitted by Council who can control the GPT selection, design and procurement so their use of the Guide will be different from high growth LGAs.

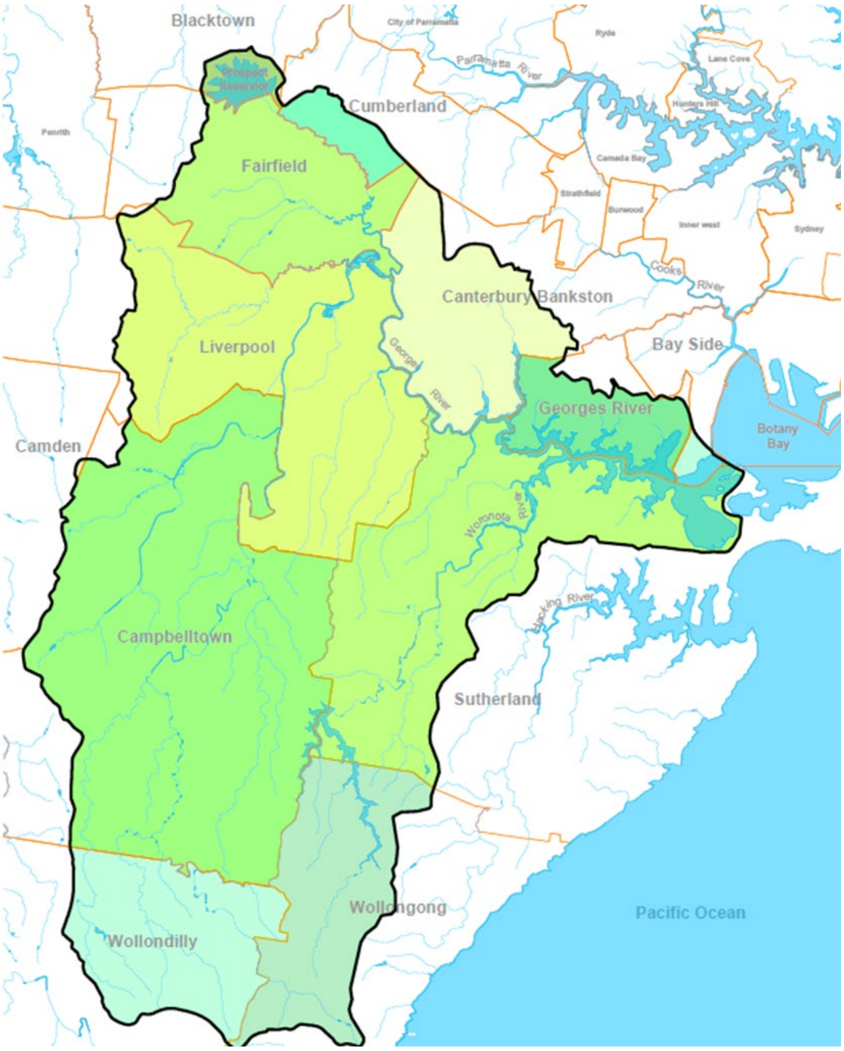


Figure 4 Georges River Catchment with LGA boundary

4 GRK Stormwater Quality Targets

Development Control Plans (DCPs) across the GRK area require developers to meet stormwater pollution reduction targets - *see Table 1 Stormwater Quality Targets/LGA*. ***GPTs are the preferred solution used to target gross pollutants*** (litter, plastic, debris, leaves and other vegetative matter >5mm) however they are also capable of trapping significant loads of suspended sediments.

GPTs provide ***primary treatment*** and are typically modelled as part of a ***treatment train.*** ***Secondary treatment*** including filtration, biofiltration, ponds and wetlands are also specified and modelled to target nutrients and suspended solids. When properly designed, constructed, and operated the treatment train can provide significant water quality improvements.

Table 1 provides current DCP targets for GRK Councils. There is strong correlation, and we recommend the adoption of a higher target for GRK particularly for gross pollution of 95%. We also recommend more research into nutrient targets considering where each LGA is in the river system and level of protection needed for receiving waterways. ***We believe raising the bar will help drive even better practice for GRK***.

Table 1 Stormwater Quality Targets / LGA

Parameter	C'town	L'pool	B'side	G River	F'Field	S'Land	BBWQIP	GRK
Gross Pollutants (kg/yr)	90%	90%	90%	100% retention of litter and organic >50mm for flow up to 4EY.	90%	Retention of litter > 50mm to the maximum extent possible for storm events up to 1 in 3 ARI	90%	**95%**
TSS (kg/yr)	80%	85%	85%	80%	80%	70%	85%	**85%**
TP (kg/yr)	45%	60%	60%	40%	55%	20%	60%	**60%**
TN (kg/yr)	45%	45%	45%	40%	40%	35%	45%	**45%**

See more detailed long term water quality targets for Councils in Appendix D

We recommend the gross pollution target of 95% be adopted for GPT retrofit projects however due to the standalone nature of retrofit projects (i.e., not part of a treatment train) the target for suspended sediment be set (e.g., 30-50%) depending on location and receiving water quality objectives.

5 What is an Effective GPT

GPTs can be more than just an engineering measure to protect stormwater quality discharging to local waterways. The conceptual model developed by WSCA emphasise the outcomes that can be achieved by a well-planned and managed (*effective*) GPT in terms of water quality outcomes in the Georges River and Botany Bay. This model could be used as a guide for decision making frameworks. As such careful planning, engagement, design, construction and operation of the GPT will contribute to delivering the "*must do*" outcome needed for a healthy Georges River!

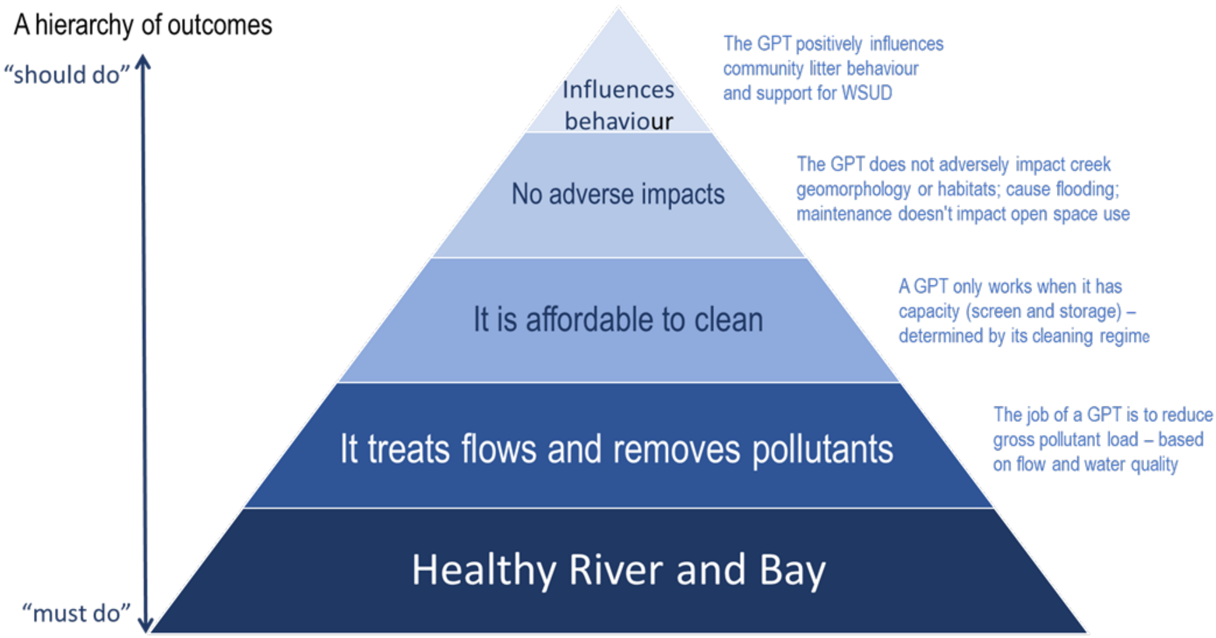


Figure 5 Conceptual model to define what is meant by an 'effective' GPT, using a hierarchy from 'must-do' to 'should-do'. Source: GRK GPT Assessment – Conceptual Model Development (2022)

6 Planning GPTs

6.1 Document Your Drivers for GPTs

It is vital to document internal and external drivers for litter and stormwater pollution controls or else support for your GPT projects may be weak or easily undermined. Drivers can include benefits relating to community expectation, social, economic, environmental, scientific, government mandates, health, and liveability.

Here are some important questions to consider.

- Has catchment or stormwater management planning been prepared to report the specific needs of each waterway?
- Is Councils position and strategic alignment for GPTs clear or do they need strengthening?
- Council may not have a documented driver, but does Council accept the need for GPTs now and for more in the future?
- Do you have community buy-in for GPTs and other water quality initiatives?
- Are there other stakeholders you can collaborate with to strengthen Councils position e.g., GRK, Sydney Water, DPIE?
- Will planning and DCP controls deliver the appropriate GPTs and infrastructure?
- Is Council resourced to manage and maintain the new assets?

Figure 6 Minimising pollution of our estuaries benefits the oyster industry

NSW DPIE Coastal Management Plans and Estuary Management Plans are a great way to document and blueprint SQIDs for capital works funding

Key Questions
1: How strong is Councils commitment to managing stormwater pollution including litter?
2: What can I do to strengthen support for our GPT strategy?

6.2 Collaborate & Communicate

Your Council may have a good *standalone* GPT strategy, but ***can it be improved and strengthened through collaborating with the community and organisations*** such as the GRK, other Councils, catchment groups, water authorities and state government. Sharing experience, resources, reference projects and skills can lead to far greater outcomes and benefit more communities.

Encourage champions within your organisation and collaborate across teams. Speak to your planners, engineers, accountants, and operation staff to ensure each stakeholder's needs are addressed. Collaboration across multiple organisations is possible and will strengthen your plans.

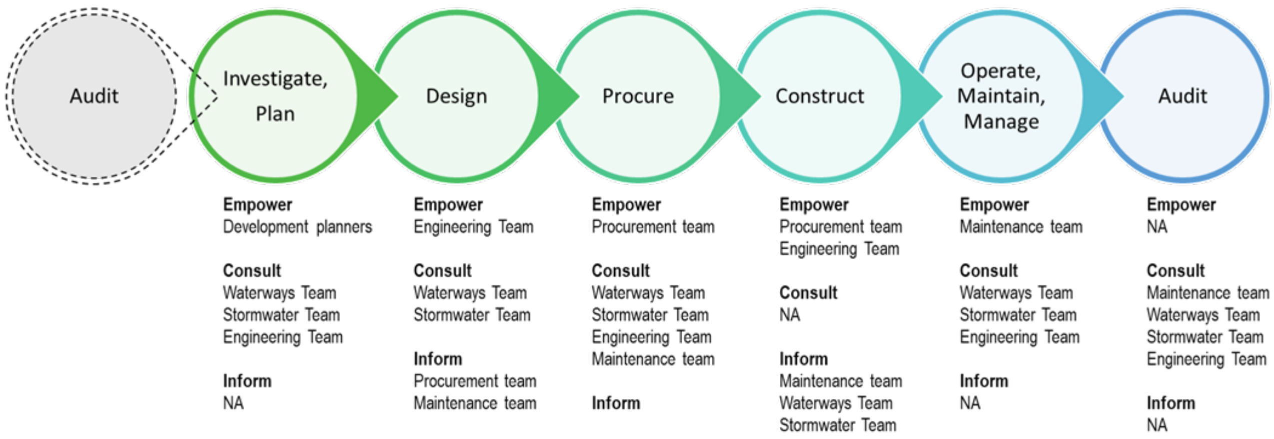


Figure 7 Who should be involved and how will they be engaged at each step in delivering a new GPT. This is based on the IAP2 engagement model. WSCA

Figure 8 Stakeholder workshop Georges Riverkeeper GPT Assessment Sept 2022

6.3 Financial Capacity

It is critical that Council budget allows for auditing and rectification of existing GPTs. Through the auditing process Council builds capacity to better understand the strengths and weaknesses of GPT types, suitability, and useful life. The audit provides a technical and financial basis for funding rectifications, upgrades, and decommissioning. The audit also provides updated information including Data Sheets and Cleaning Specifications so Council can manage operation and maintenance more efficiently. Council can also prepare an Asset Management Plan (AMP) including total life cycle costing for prioritising rectification works and delivering new GPTs.

A good asset management plan and business case is essential to demonstrate you have the financial capacity to build own and maintain GPTs.

Questions to consider:

- What incomes streams support the auditing, rectification, and construction of new GPT's?
- What revenue/ budget funds the operation & maintenance?
- Have you considered whole of life costs and funding arrangements?
- Have you prepared an Asset Management Plan (AMP) or business case for GPTs and other water quality infrastructure assets?
- Does Council understand the current condition and operation & maintenance cost of their current fleet of GPTs? If so, this will demonstrate your appreciation of the financial and operational commitment for these assets.
- Are there other funding opportunities e.g. grants for auditing, construction and maintenance you can tap into? The Stormwater Management Service Charge was created for funding maintenance of these devices, and many Councils use it effectively to fund this critical activity.
- Document funding commitment and future needs at planning stage.
- Are there optimisation plans to leverage existing water quality assets?
  Are there opportunities to create efficiencies in the process by integrating open space or other civil works projects?

Have you prepared detailed designs for one or two GPTs which can be used if other projects drop off Councils capital works construction program?

6.4 Technical Capacity

GPTs come in a variety of shapes and sizes. They can be proprietary products or bespoke designs such as trashracks. Ideally each GPT is specified and designed to meet specific stormwater quality targets and operating conditions. Most Councils have some experience with GPTs however as more products come to the market Council may need assistance to select the most appropriate GPT, carry out hydraulic analysis, engineering and detailed design.

Councils are encouraged to engage with suppliers and stormwater industry professionals to stay informed on advances and issues faced across the industry.

Most Councils within the GRK use consultants or specialists to provide investigation, engineering, and design services for GPTs projects. Some efficiency can be provided by bundling several projects together particularly at feasibility stage. This can simplify coordination and capacity can be built through collaboration on a larger project.

Design is generally delivered through several stages including investigation, feasibility and options assessment, concept and detailed design. Hold points can be used providing Council the opportunity to review and manage the design and be satisfied with project development.

Technical capacity for construction is generally well organised through Council's procurement processes. Council may also opt for a design and construction model for procurement. If a D&C model is used Council should ***ensure a thorough feasibility assessment is conducted*** for the site and clear performance targets and specification requirements for the GPT are documented in the RFT. Council may engage a third party for peer review of the proposal.

6.5 Location of GPTs & Stormwater Management Planning

The GRK are driving a target of ***"zero litter to Georges River"***. To achieve this, part of the solution would be to install and maintain GPTs on nearly every stormwater outlet draining into creeks and waterways connected to the Georges River. This will require comprehensive Stormwater Management Plans (SWMPs) for each LGA with GPTs strategically located to target gross pollution. The GPTs in this plan can then be prioritised and works planned subject to funding.

Where a SWMP does not exist, it should be prepared as a basis for locating and prioritising sites based on expected benefits. The SWMP should identify specific water quality targets for unique water bodies and will allow for the development of treatment trains which can be planned and budgeted for.

Use GIS to map major and minor stormwater catchments. The SWMP should identify land use, high pollution catchments and hotspots. Any existing GPTs or other stormwater quality assets should be mapped as these can influence the Plan. Once a SWMP is prepared Council will be in a better position to deliver a wholistic GPT and water quality strategy for the LGA.

Use existing flood studies, models and GIS to identify potential GPT and WSUD locations. Identify opportunities to use existing GPTs to build treatment trains using wetlands, ponds, and biofiltration to increase benefits. The SWMP should demonstrate a comprehensive understanding water quality requirement within Councils LGA but also externally i.e., what is happening beyond your immediate boundary. Councils should actively seek opportunities to optimise the plan by working with neighbouring Councils, state government agencies such as Sydney Water, and Catchment groups such as the GRK.

Land ownership, community impacts, environmental constraints, utilities, and hydraulic impact should also be factored into selection of potential GPT locations. The SWMP can be used to prioritise works against a variety of criteria including catchment area, pollution targets, environmental benefit, and cost, among other things.

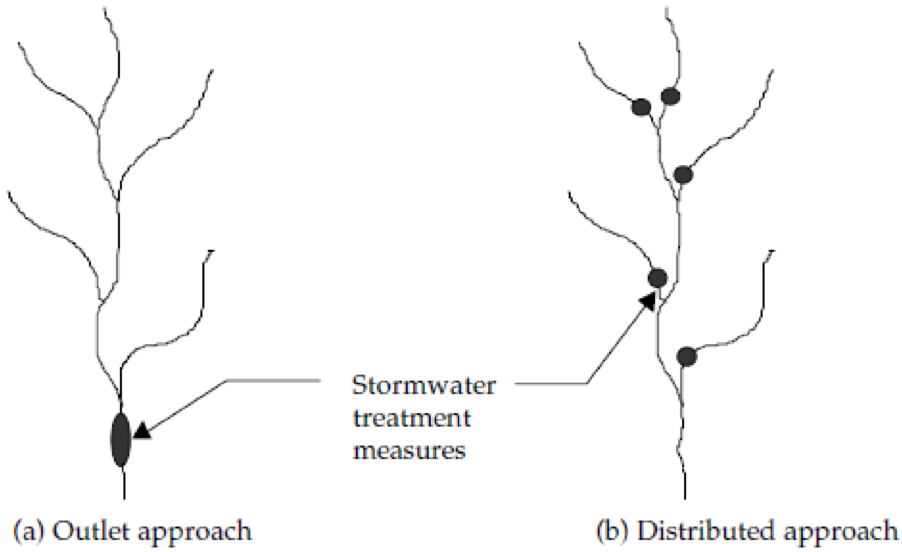


Figure 9 Location of stormwater treatment measures. Source: NSW EPA (1997)

The "distributed approach" (or "source control") option is generally favoured because it is capturing the pollution closer to its source. However, when you add up the capital cost of 5 GPTs versus the capital cost of a single larger GPT, with 4 cleans per year, rather than the 20 cleans required by the distributed approach, for Councils with limited budgets, there is a very good reason to consider the "Outlet approach".

6.6 Types of GPTs in GRK Catchment

There is a wide variety of GPTs used across the Georges River each with varying levels of effectiveness – refer Table 3 Summary of GPT Types by LGA. Most of the proprietary GPT technologies reference performance testing conducted by third party institutes such as universities however much of the research was funded by proprietors. For more information on GPT testing protocols refer to – *Georges River keeper GPTs Effectiveness in Protecting Waterways* prepared by Macquarie University (2021*) and GRK GPT Assessment Literature Review prepared by Optimal Stormwater (2022).*

Metropolitan Councils such as Bayside and Georges River have designed and installed various types of GPTs over several decades through programs such as the NSW Stormwater Trusts whilst Councils in growth areas such as Liverpool and Camden are increasingly receiving GPTs through the development process and the type of GPTs / LGA reflect this.

Table 2 Summary of GPT types by LGA

GRK GPT/ SQID Type	Sutherland Shire	Georges River	Canterbury Bankstown	Fairfield	Liverpool	Campbell -town	Bayside	Totals
Trashracks	13	4	18	1	9	5	2	52
CDS Units	9	17	6	14	4	7	2	59
Cleansall	0	4	5	4	12	7	1	33
Humegard	8	1	4		12	40		65
Ecosol	11		5	5	25	10	2	58
Humeceptor	5		4		1			10
Litter Baskets	8		5				4	17
Floating / Litter Booms	11	1	8	7			1	28
Litter Basket /Net	17	1		8	2		4	32
Special Pit	6							6
StormFilter	6			1				6
Silt traps	36							36
Other / GPT	12		2		2			16
Jellyfish						10		10
Georges River GPTs	142	28	57	37	67	79	16	426
TOTAL GPTs/SQIDS	235	30	73	50	224	85	78	775

Councils are encouraged to thoroughly investigate the pros and cons of each GPT technology and select the most appropriate for the catchment area, hydraulic conditions, pollution targets and performance. Councils should also be aware that every proprietor tends to indicate their devices are the best. Councils would do well to avoid believing glossy brochures, and should rather rely on the outcomes of their GPT auditing, and input from relevant experts and also their cleaning contractors.

Councils understand that GPT proprietors are dedicated to marketing their products so have a conflict of interest when it comes to recommending the best long-term solution for Council. Councils can get impartial advice from their fellow Councils, consultants, industrial cleaners and experts in stormwater treatment that aren’t trying to sell a specific GPT.

Figure 10 Not all GPTs are created equally. This particular GPT in Liverpool area had multiple issues that were identified as part of the GPT auditing.

7 Asset Management & Auditing

7.1 GPT Database

Councils need to maintain an accurate and up-to-date database of GPTs and other WSUD assets. Most Councils have a list of assets but often the details are only very basic. ***The more detailed the asset information is, the better*** as the data can be used for auditing, planning, budgeting and optimising operation & maintenance regimes.

GPTs and other WSUD assets should be mapped in GIS to allow for preparation and update of catchment and stormwater management plans. If you have completed a GPT or SQID audit within the last 5 years the data should be of high quality and each asset validated for specification, age, condition, integrity, functionality.

GPT / SQID Asset information should include details outlined in Table 3.

Table 3 GPT / SQID Asset information

Asset Number	Unique identifier No
Asset Type	Describe GPT, Trashrack, biofilter, etc
GPT Specification	Use actual GPT specification if known specification eg CDS 2018 etc
Current GPT Supplier	Nominate current supplier eg Urban Asset Solutions
Installation date	Year of installation or handover
Audit Date	Date of latest audit
Physical address	Closest physical street address
Access requirements	Explain requirements to access the GPT/ SQID for maintenance
Location (GPS)	Northing and Easting
Catchment area	Best possible estimate in hectares (ha)
Receiving waters	Nominate by name immediate creek, estuary, river or bay
Handover date	Date GPT is handed over from developer or contractor
Maintenance interval	Nominate cleaning frequency and latest date device was cleaned
Maintenance reports	File latest cleaning report linked to database
Rectification works	Provide summary of latest rectification works
WAE Plans	Link to WAE plans
Design reports	Link to any design reports

Refer to Appendix F: A good example of an asset database for GPTs - Sutherland Shire

7.2 GPT Auditing

A physical condition audit of GPTs is critical to the preparation of a detailed GPT Asset Management Plan (AMP). Auditing GPTs requires an independent person/ organisation with a high level of experience and understanding of the strengths and weaknesses of GPT technologies, products, designs and requirements for operation & maintenance. The auditing outcomes provide a proper basis to prepare an up-to-date Asset Management Plan (AMP).

Some GPTs require confined spaces entry to audit them so consultants should be trained to conduct this safely having the appropriate qualifications and equipment to do it. Council may request the audit be carried out during operation & maintenance or soon after, however auditing can be delayed due to time-consuming process of cleaning. It is also not recommended to do it this way because the cleaning process can remove evidence of issues (if you are a policeman visiting a crime scene, you don't send the cleaners in first!). Using the GIS information, the consultant should prepare a program to systematically visit each site, conduct the audit and record the key information outlined below, regardless of where the GPTs are in their cleaning program.

1. Detailed *GPT Audit Report* (confirming GPT specification, catchment area, GIS and map location, access information, structural and hydraulic impacts, GPT condition, performance functionality, suitability, cleaning regime, recommendations, minor works and WHS)
2. GPT *Data Sheet* for Monitoring, plus Operation & Maintenance
3. 1 page *Cleaning Specification* – simplified for operators
4. Summary *Rectification Spreadsheet* with, performance and condition rating, suitability, useful life, rectification and upgrade options, ballpark costings and prioritisation.
5. Updated Asset Data for Council GIS systems
6. In-person presentation covering all of the outcomes which provides capacity building and training opportunities for Council, and all Council's questions about GPTs can be answered.
7. Schedule for next audit cycle (typically once per decade). Councils may want to have new GPTs audited so they can get the above information, and get them included into the Council's maintenance regime.

It is recommended that consultants and contractors use a Cloud based app to ensure data from site work is protected, works are conducted efficiently, and without risk of errors during data transfer from paper to digital systems.

It is also recommended that councils ***periodically Audit the cleaning process*** to ensure that GPTs are in fact being cleaned when the contractor claims and that they are being cleaned correctly. For example, if a GPT has been cleaned the sump should be empty of all pollution. If a GPT has been cleaned comprehensively there should be no pollution left behind the screen, in the inlet, outlet, or diversion chamber.

This Audit of the cleaning process should be unannounced and undertaken not longer than one day after a device is said to have been cleaned. The results of the Audit should be reported to the cleaning contractor. Where significant discrepancies are identified this should be formally brought to the attention of the cleaning contractor. Note that not every device needs to be audited, only a selection of them. The recommended frequency to Audit the cleaning process will be determined by the findings, but 2x per annum is the recommended minimum.

GRK website video: ***Why auditing GPTs is so important? (3min MP)***

7.3 Condition Rating

It is critical the performance and condition rating of each GPT is carried out regularly ideally every 5-10 years. The ***condition relates to the physical wear and tear*** on the device and reflects the operation & maintenance program (or lack of it) and any repair work carried out on the asset. The table below describes the relative condition rating for the GPT, potential works required and likelihood of the asset becoming obsolete.

Table 4 GPT Condition Ratings

Rating	Condition	Alternative	Description/ Observations
1	Very Good	No Works Required	Sound GPT, well maintained with no defects. No work required
2	Good	Maintenance Only	Showing minor wear and tear and some deterioration Needs to be re-inspected in 3-5 years. Deterioration has no significant impact on performance of the GPT. Only minor work required
3	Fair	Minor Works	GPT is in a sound, but capacity is affected by minor defects which require attention. Some minor/ moderate rectification work and replacement of fixtures are required within 5-10 years
4	Poor	Major works	GPT is functioning but with problems due to significant defects. Major rectification /rehabilitation and or replacement needed within 5 years
5	Very Poor	Decommission or replace	GPT Asset is not functioning and or has failed due to significant defects. The GPT is at the end of its life and should be replaced as a priority. Urgent replacement/ rehabilitation required

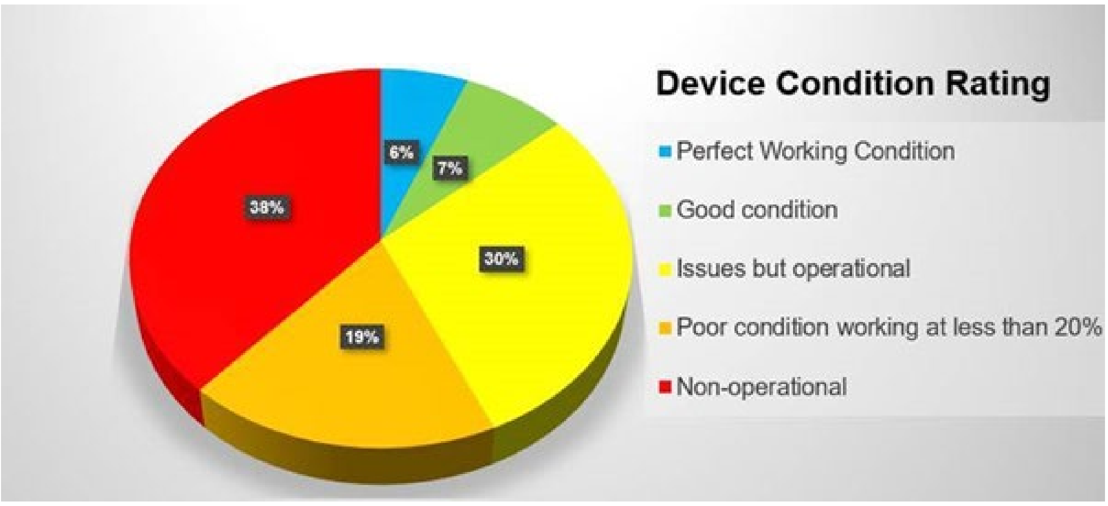


Figure 11 Example Output – Condition Rating

7.4 Performance Rating and Suitability

A performance rating is similar to the condition rating however it records the ***current operating performance and suitability of the GPT*** for the location and condition it is operating in. This rating informs Council of whether the GPT is currently fit for purpose.

Table 5 GPT Performance Rating

Rating	Condition	Description
1	Perfect working performance	The GPT has been specified, designed and installed properly and is operating as intended. Suitability - GPT is specified and designed to current standards.
2	Good working performance	The GPT is operating well with minor issues impacting performance. The technology may be dated or may have capacity issues Suitability - GPT is older than rating 1 but is fit for purpose in current configuration/ catchment.
3	Issues but operational	GPT Asset is functionally but has capacity and performance issues eg undersized, poor access, partial screen damage Suitability - The GPT may not be suitable for use in configuration/ catchment. GPT uses obsolete or technology of lower efficiency. Rectification works and replacement of sections work required within 5 years
4	Poor performance (<20%)	GPT Asset is functioning but with problems due to significant defects. Asset is showing signs of failure or regular bypassing. GPT Obsolescence/ Suitability - The GPT is not suitable for use in configuration/ catchment. The GPT uses obsolete technology of low efficiency. Significant replacement or rehabilitation needed within 3 years
5	Non operational	GPT Asset is not functioning and or has failed due to significant defects e.g. blocked, collapse – major capacity or screen issues – will block and not function in any storm event. GPT Asset has failed and would lead to property damage and or compromise public safety and or life. GPT Obsolescence/ Suitability. The GPT is at the end of its life and should be replaced as a priority. The GPT uses obsolete technology of low efficiency. Urgent replacement/ rehabilitation required within 1yr.

7.5 Useful Life & Operational Life

The GPT Audit should be used to update the ***useful life*** of each GPT. Current condition, performance, and suitability all factor into the useful life of a GPT. The GPT may be in good condition and performing to its original specification, but the technology has become obsolete and no longer meets the pollution removal targets set by Council. In this instance the useful life might be set to nil years.

The useful life should be representative of the GPTs life ***before major works*** are required and should be continuously reviewed as research is carried out. There are many factors that impact the useful life of a GPT including:

- Condition – what is the GPTs condition rating
- Performance – is the GPT performing as intended and to current specifications
- Suitability (obsolescence) – is the GPT fit for purpose and meets the specification required and current needs.
- Market forces – is the technology supported, are spare parts available in the event of damage etc.?
- Are there other factors which impact the useful life e.g., Initial poor construction, inferior material, third party damage, blockages or breakage

Operational life differs to useful life. The useful life can be updated however the operational life (Table 6) is provided by the manufactures for the expected life of materials including, plastic, steel and concrete components. Our recommendation is to adopt the operational life provided by the manufactures and other components of the GPT.

Table 6 Operational Life – GPT components

	Operational life (yrs)			Useful Life (yrs)
Device	Plastic/ FRP internals	Steel internals	Concrete internals and externals	Factors in condition, performance, suitability
CDS Units	40	50	80	20-50
Cleansall	NA	50	80	20-50
Humegards*	NA	50	30	20-40
Ecosol RSF	15	50	50	20-50
Litter Baskets	5 (filter bag)	15	80	5-15
Trashrack	NA	50	100	30-40

* Humegards have moving parts that can fail whilst still being structurally sound.

7.6 Total Life Cycle

Life cycle costing is the sum of all expenses associated with a GPT including design, supply, installation, operation, maintenance, refurbishment, and disposal costs over its life (Standards Australia, 1999, p. 4). As shown in Figure 12, the life-cycle cost provides an important input into a process where stormwater management options are being evaluated. Total Life Cycle costs are an important consideration when determining which sites to prioritise, and which devices to choose for those sites.

Model for Urban Stormwater Interception Conceptualisation (MUSIC) provides a useful function to assess total life cycle costs for a range of GPT types which can be used to evaluate the relative effectiveness of different technologies. The TLCC should be used in the early stages to assess a preferred GPT specification and Councils capacity to build own and operate.

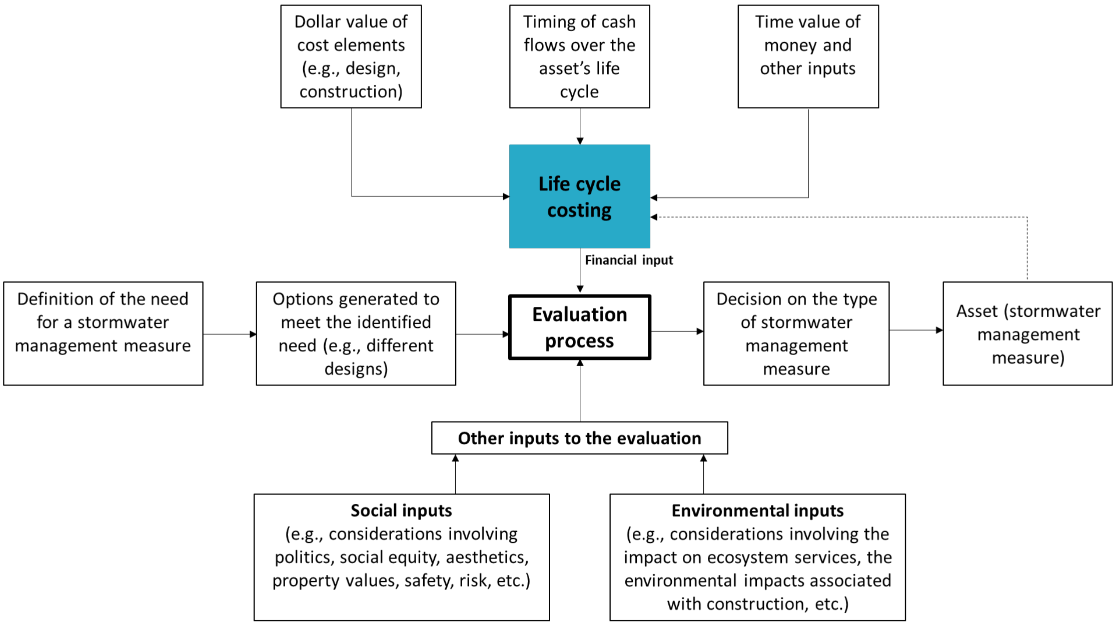


Figure 12 Life cycle costing (Source: AS/NZS 4536:1999 Life Cycle Costing - An Application Guide)

Failure of GPTs is often a result of a poor appreciation of the life cycle cost of a device in a particular site, with underfunded maintenance resulting in non-operational or damaged devices. As a useful rule of thumb, Councils should expect twice the maintenance costs compared to the capital cost over a normal 50-year life.

7.7 Asset Management Planning

Stormwater management is a service provided by Councils and typically requires its own Asset Management Plan (AMP). A subset of this should include stormwater quality improvements devices (SQIDs) including GPTs. This is appropriate as SQIDs are more dynamic compared to traditional stormwater assets (e.g., pits and pipes) and require frequent interaction for operation & maintenance. An outline of what should be included in the Stormwater AMP is provided below. The AMP becomes the basis for budgeting, prioritisation, and capital works.

Table 7 Typical items included in an Asset Management Plan

Item	Description.
Gross Pollutant Traps	Provide description of assets and their function
Future demand for GPTs	Describe why will GPTs be needed into the future and drivers
Levels of Service	Describe the current and future expectation for service provided by GPTs.
Levels of Technical Service	Describe the resources needed for service activities to achieve the outcome and demonstrate effective performance. These are linked to operations, maintenance, renewal activities that retain service of the asset which was originally intended (e.g. minor repair, servicing, operation etc).
GPTs performance and condition Audit	Provide condition ratings (1-5) and performance ratings (1-5) from the GPT Audit and used it for prioritisation of rectification and upgrade works. (*Note – these values are provided from the GPT Audit rectification sheet)*
Useful Life	Useful life should be determined during the audit using the performance and condition rating but also taking into account suitability, obsolescence and market changes (e.g. no longer manufacturing).
Total Life Cycle Costing	Using information from the audit report, useful life, add catchment areas, capital, operation & maintenance costs, rectification and prioritise works for your GPTs. TLLC is usually done in Excel and is a critical step for the AMP.
Capital Works	Replacement of GPTs is a capital works project. A ranking (1-5) should be used to determine priority of identified renewal.
Risk Management	High risk could have developed if the GPT is not functioning or failing due to significant defects. Urgent replacement or rehabilitation may be required. GPTs in this condition are classified as high or very high risks and should be prioritised for rectification or decommissioning. Where GPTs are operational,

Item	Description.
	and capacity is impacted by minor defects and some repair work is required GPTs in this condition should be classified as Medium and Low Risks. If risks are related to WHS, these will always rate as very high.
Maintenance	Estimate the total maintenance costs for GPTs over a 50-year period. This is used in the LCC. Routine maintenance is the work required to keep assets operating, including immediate repairs restore operation eg replacement of damaged screen sections, minor repairs.
Valuation Forecast	Groups GPTs and allocate replacement value, accumulation depreciation, fair value and depreciation expense.
Key Assumptions	Document key assumptions in preparing the valuations such as: o The condition score is based on audit o The useful life estimate has considered the key factors o Asset renewal and replacement costs uses up to date costs o GPTs have no residual value at the end of the useful life. o Straight-line depreciation and rate
Financial Forecasts	Asset values for GPTs are forecast to increase as new assets are added. New assets will add to the operation & maintenance needs as well as the need for future renewal. Additional assets will also add to future depreciation forecasts.
Creation / Acquisition / Upgrade Program	New works are those that create a new GPT that did not exist. It is forecast that more GPTs across the GRK catchment will be added from new Council projects and assets constructed by developers then handed over to Council particularly in the western Sydney Councils such as Liverpool and Campbeltown
Disposal Plan	Describe any GPTs identified for disposal. Consider do you need to remove them completely or can the structure stay in the ground.
Forecast reliability and confidence	Confidence level and reliability of data is considered high if the AMP is based on a physical audit. Include information from monthly inspections and cleaning operation to increase confidence in data. Good records, procedures, investigations and analysis support the plan.
Improvement Plan	Continue to collect detailed condition and cleaning information from monthly inspections and maintenance of Councils GPTs. Record actual costs of all works to improve unit rates. This will quantify the extent of upgrade/new capital work required.
Renewal and Replacement Program	Renewal and replacement is major work which does not increase the asset's design capacity but restores, rehabilitates, replaces or renews an existing asset to its original service potential. GPTs

Item	Description.
	requiring renewal or replacement should be identified in the GPT Audit. Forecast a 10-year Renewal Program based on the funding required to replace GPTs in accordance GPT Audit. Estimates are subject to final detailed design and open tender pricing.
Funding Scenarios	Use the following scenarios over a 10year period to determine the best one for your Council. Scenario 1 - (Base Case) - assumes a continuation of normal business. Scenario 2 - (Financial Sustainability - Maintain real operating surplus) Scenario 3 - (Financial Sustainability Improvement - Maintain real operating surplus with continual growth) - assumes a continuation of normal business, incorporating additional efficiency savings.
Monitoring and Review Procedures	Priorities are subject to change due to community or environmental needs, early deterioration, sudden failure, or project costings. The AMP should be reviewed during annual budget planning updated to show any changes in service levels and/or resources available to provide those services as a result of budget decisions. The AMP should have a life of 4 years.
References	o GPT Audit (from consultant) o IPWEA, 2015 Practice Note 5 Stormwater Drainage, Institute of Public Works Engineering Australasia, Sydney o IPWEA, 2006, 'International Infrastructure Management Manual', Institute of Public Works Engineering Australasia, Sydney, www.ipwea.org/IIMM o IPWEA, 2008, 'NAMS.PLUS Asset Management', Institute of Public Works Engineering Australasia, Sydney, www.ipwea.org/namsplus. o IPWEA, 2015, 2nd edn., 'Australian Infrastructure Financial Management Manual', Institute of Public Works Engineering Australasia, Sydney, www.ipwea.org/AIFMM. o IPWEA, 2015, 3rd edn., 'International Infrastructure Management Manual', Institute of Public Works Engineering Australasia, Sydney, www.ipwea.org/IIMM o IPWEA, 2012 LTFP Practice Note 6 PN Long Term Financial Plan, Institute of Public Works Engineering Australasia, Sydney

8 Investigation & Design

8.1 Investigation & Design Guide

Technical requirements for GPT investigation, specification and design require several disciplines. GPT sites can be complex and include ownership, environmental, hydraulic, and engineering constraints. We encourage Councils to engage internally with operation & maintenance staff, procurement, and asset managers to ensure their needs are considered in the design process.

Thorough investigation, feasibility and options assessment, concept design and budgeting are needed to determine if a project will proceed and ensure an optimal outcome. Preliminary investigation is followed by hydraulic analysis, specification, engineering, and detailed design. The GPT specifications and design process generally follow the stages described below although some may be more straightforward.

Desktop Study, Data Review and Catchment Mapping

A desktop assessment including review of Council GIS drainage data is helpful for site selection, catchment mapping, preliminary hydraulic modelling (4EY), specification, and preliminary concept design. Catchment areas can be mapped using drainage network and contours and characterised into land use for modelling.

Lands use, ownership, pollution hot spots and environmentally sensitive areas should be mapped and confirmed. Other information including other relevant GPT reference sites, flood studies, survey information and other reports may provide helpful background for the project.

Location Section & Site Investigation

Once a location has been identified for the GPT more detailed investigation is needed. Several site visits may be needed to fully understand the opportunities and constraints for design, construction, and operation of a GPT. Consider what impacts the GPT will have on the surrounding infrastructure, environment and community during construction and operation.

Also, what are the major risks for the project and what investigations are needed? Are there adjustments to the drainage network needed to locate the GPT? Plan to conduct DBYD investigation and potholing especially if there are risks of a clash with the GPT works. Consider what the geotechnical conditions might be and what construction techniques might be needed?

Environmental Benefits and Impacts

The environmental benefit of the GPT should be well described and modelled to document its intended benefits. It should be clear why the GPT is being installed. Council may wish to conduct a geomorphology assessment on the impact of a GPT on the creek and the sediment budget of the creek. If the GPT is located at the end of a drainage line it is unlikely the GPT will impact the sediment budget.

A preliminary review of environmental factors (REF) is also recommended to identify environmental constraints and identify mitigation strategies particularly during construction. Once a site is approved a topographical survey is critical for hydraulic modelling, concept, and detailed design.

GPT Specification

The GPT should be specified to meet the water quality requirements whilst also satisfying the hydraulic requirements ie safely bypassing excess flow. Proprietary products have pollution retention claims however based on the stakeholder consultation with GRK member Councils a strong preference for vortex units using CDS technology was noted.

Despite knowledge of which devices are working the best, developers are still installing proprietary products (Humegard, Ecosol, Cleansall) which rely on settling and direct screening (because developers focus is on commercial benefits the functionality of the GPTs is not a primary concern rather approval for the development is). Advances in trashrack designs also provide good opportunities for retro fitting onto large catchments. Council should conduct a thorough investigation into the appropriate specification for each location (*refer to GPT Literature Review for GRK Optimal Stormwater October 2022)*. Councils should be aware that just because a GPT works well in one situation, does not automatically guarantee it will work well somewhere else.

The GPTs should be specified to treat the 4EY (3month event) and retain the pollutants to achieve the load reduction targets of approx. 95% removal. On larger catchments (40+ha) the 6EY (2month event) may be appropriate as this provides over 90% volumetric treatment. *Councils should know however that these removal percentages only apply to devices that don't block and go into premature bypass. So these removal efficiencies are not possible for direct screening products that function by blocking and store pollution within their screening areas – refer Australian Runoff Quality Chapter 8. 2006.*

They should also be carefully modelled to ensure hydraulic impacts are contained and flooding nor increased as a result of the GPT. It may help if an options assessment is prepared to compare several GPTs and make a selection based on this. Once a preferred GPT specification is decided, preliminary design can commence.

Preliminary GPT Design

Hydraulic analysis, pollution modelling, access requirements, preliminary GPT specification and concept design should be prepared. Local facilities for dewatering should be assessed and identified as this can significantly reduce operating costs. Engagement with suppliers is typically needed and their recommendations assessed against project requirements. A preliminary cost estimate should be prepared and include a generous contingency.

Figure 13 Example of working area around the GPT designed for safe access and operation.

Options Assessment

Where several GPT options are possible an options table including pros and cons, costs/ benefit and feasibility should be prepared. This should lead Council to a preferred and feasible option(s) weighted in favour of delivering the best environmental outcome for the investment. Ideally it should be possible to make a firm recommendation at this point.

Review (Hold Point)

Council will need to provide feedback on the options assessment and may seek clarification to make a decision on a preferred GPT specification. At this point, Council's that don't have a lot of internal experience, may once again choose to get assistance from experts or specialists to review the proposed solution.

Concept Design

Using the preferred option a final concept design should be prepared and a draft REF finalised. Geotechnical conditions should be investigated now at the preferred site and this information shown on the concept drawings. More detailed hydraulic analysis and engineering may be needed.

Review (Hold Point)

Council will need to provide feedback on the concept design and may seek clarification as the design progresses. This can be conducted as a design workshop or project review.

Detailed Design & Issued For Construction (IFC) Documentation

Detailed design processes are generally well structured and if followed mitigate risk associated with construction and operation. General arrangement plans followed by detailed plans, sections, elevations and details should provide all the necessary information for construction. Borelog details should be provide on elevations and plans note what level of service investigation has been conducted ie potholing v DBYD. Turning circles for twin steer duel axle combination unit Cleaning Trucks should be used for driveways and access roads.

Safety in Design

Safety in Design is a risk management process for Local Governments and provides a way to integrate measures early in the design to eliminate or minimise risks to health and safety throughout the life of the asset (GPT) being designed. For example steeper driveways to the GPT may need to be designed with corrugations to eliminate the risk of operations personnel slipping.

Construction

Detailed design drawings should be issued for construction (IFC). They should be thorough and detail all the engineering and design elements needed for the successful construction. Request for Information (RFIs) should be responded to promptly by the designer to ensure works continue uninterrupted. Contingency design if required should be prepared promptly for approval and costing any variation. Setout works should be conducted by a registered surveyor if the scale of the project requires. Works as Executed (WAE) drawings should be prepared at the end of construction and any variation to the construction plans highlighted.

Figure 14 Delivery of the GPT to site requires careful coordination with supplier, crane operators and traffic control.

Practical Completion & Defects Liability

Practical Completion (PC) provides a hold point to ensure the workmanship, materials and design intent has been achieved to the required standards. Work as Executed (WAE) Plans should be prepared and forwarded to Council identifying any variation from the IFC documentation. It also provides an opportunity in the 12 months defects liability to monitor the performance and operation of the new asset and rectify any defects or omissions.

Operation & maintenance Plan

A detailed operation & maintenance plan (OMP) should be prepared in draft at detailed design stage and updated when the project has been completed. Use photos and images from the completed project. The operation & maintenance plan should include a *Data Sheet* and *One-page-cleaning-spec*. It is recommended to use the ***Guideline for the Maintenance of Stormwater Treatment Measures 2022*** for as the basis for the O&M Plan.

Figure 15 Cleaning large GPTs require specialist industrial cleaning plant. Seen here is a "Combo Suction Jetter Truck" and the vehicle on the right with the big red arm is the "Grab Truck".

8.2 GPT DESIGN GUIDE TABLE

This section steps users through the entire process of planning, investigation design, procurement, installation, and operation of a GPT project. It should be used as a checklist when assessing feasibility of GPT projects and planning and designing new GPTs. It can also be utilised by Council staff from non-engineering backgrounds to aid understanding the decision-making processes during a GPT project.

Table 8 Checklist for assessing GPT feasibility

	Item	Guide	Output
Planning	Document Drivers	Document internal and external drivers for litter and stormwater pollution controls	Documented drivers
	Collaborate & Communicate	Communicate within Council (e.g., stormwater team, waterways team, engineering team) and more broadly (other Councils, catchment groups, water authorities and state government) to improve catchment outcomes	Support, strengthened outcomes
	Financial capacity	Ensure Council has the funding to support planning, investigation design, installation, operation and maintenance of GPTs	Business case or asset management plan
	Technical capacity	Stay up to date with innovations and trends in the stormwater industry. Engage consultants and/or suppliers if required.	Consultant procurement
	GPT strategic planning	Ensure GPTs are strategically located to achieve catchment objectives by developing a SWMP	SWMP
Investigation	Catchment Area	Catchment areas should be mapped using GIS and physical inspection if required to validate catchment	Area in hectares (ha)
	Characterisation	Catchments are to be characterises % impervious and land use. This is used in MUSIC Modelling and hydraulic analysis (DRAINs)	% impervious/ use

	Item	Guide	Output
Design	Location	Determine the approximate location for the GPT. Review ownership and local environment.	Location map and images
	Conduits	Confirm the size and condition of the stormwater conduits the GPT will be constructed on. This information will need to be surveyed for depth to invert and other stormwater assets in proximity.	Pipe, culvert or channel dimension in mm.
	Utilities (preliminary)	DBYD can be used as a first pass for location and potential clashes which may impact GPT location. Topographical survey, services scanning, and non-destructive digging should be used to confirm utilities in proximity to the GPT which may impact design, construction and operation. For example, overhead power can impact the construction and operation of cleaning boom.	DBYD (check overhead utilities)
	Topographical Survey	A topographical survey is essential to confirm the stormwater system, utilities, structures, vegetation and other physical characteristics of the site. The survey will be used as the basis for hydraulic modelling and detailed design.	Topographical survey and 3D model in CAD.
	Hydraulic Modelling (pre-development)	Preliminary hydraulic modelling should be prepared to confirm predevelopment flows for treatable flows rates (4EY), minor and major storms. DRAINs modelling is generally used for this. The model can then be used to assess the hydraulic impact of various weirs and GPTs on the system. Overland flow from pipe systems and water levels from open channels can be modelled and reported.	Treatable Flow (4EY) minor and major storms. Use K factor provided by manufacturer

	Item	Guide	Output
Design	Pollution model (MUSIC)	An estimate of annual pollution loads and GPT removal efficiency should be used to size the pollution storage capacity needed for the GPT. Assume a cleaning frequency of 3-4 months for storage capacity.	Pollutant estimate / annum (tonne/annum)
	Suppliers	Council or consultants should provide a specification brief for suppliers to respond to. Some consultants may already have a database of GPTs and expedite this step. The GPT specification should meet the key criteria including treatable flow rates, pollution removal efficiency, pollution storage and hydraulic impacts. Supply costs should also be sought. (CAUTION - beware of exaggerated claims, and not comparing apples with apples).	Supplier Specification, standard drawings and supply only costs
	GPT Specification	Using feedback from suppliers and Councils own knowledge of GPTs from their audit, a preferred specification or options should be considered for GPTs. The GPT should also be specified to target the specific pollutant types of relevance in the downstream waters. Topography should be considered and steepness of the conduit grades. Vortex GPTs work better in steep grades and settling type devices operate better in lower grades <1%. If above-ground trashracks are the preference adequate area is required due to driveway access and typically larger footprint required. Hydraulic modelling. Each GPT type has a different hydraulic impact. Council may want a trashrack, net, boom or proprietary GPT. But the number #1 rule of GPT design is….. don’t cause flooding!	Preliminary GPT specification

	Item	Guide	Output
Design	Hydraulic modelling (post development)	Once the GPT specification has been selected a post development hydraulic model should be prepared. This will confirm changes to the hydraulic grade line and overland flows. The stormwater system, diversion chambers weirs may need to be modified to ensure treatable flows, design flows and overland flow is managed.	Hydraulic Report.
	Access design (vehicle & personnel)	Access, for large combination units (10m long 3.8m high 16-wheel twin steer) including parking, turning and pavement need to be designed for operation & maintenance. If the GPT is going into an existing pavement the pavement reinstatement needs to be designed. Drafting in the maintenance vehicle onto design plans is useful to illustrate the impact of these large vehicles on the site or road and reach of telescopic boom for cleaning whilst parked. Also ensure safe access for personnel is provided including steps irons, railings and safe walking area.	Use CAD Auto turn to draft the access design. Pavement design Safety in design review
	Environmental Assessment	Council may require a review of environmental (REF) impacts to be prepared. This should identify sensitive areas such as heritage and EEC or ownership which need to be considered in the design process. The REF should reinforce the environmental benefits of the project. It should also reference potential impacts during construction and key considerations to inform the Construction and Environmental Management Plan (CEMP)	REF

	Item	Guide	Output
Design	Concept Design	A preliminary GPT design should be prepared using all of the investigation, modelling, and environmental impacts. Major impacts should be drafted sufficiently to illustrate the impact of the project on the site.	Plans sufficient for workshop and costing
	Costing (preliminary)	Use the concept design to prepare a draft BOQ and preliminary costing for each GPT option. Council may need to engage with suppliers to provide supply and deliver costs. The costs should cover the major activities and include a 20-30% contingency for this preliminary stage. Operation and maintenance costs should be estimated for engagement with asset managers. Cost benefit and life cycle costs analysis maybe used to inform the options assessment.	Cost estimate for Options Capital OM LCC
	Stakeholder Consultation	Concept design should be used for stakeholder (internal & external) and community consultation. It is advisable to keep an open mind as the community can throw curve balls into the project requiring a rethink of the approach. It is also advisable to commence this early allowing stakeholder to shape the project outcome. If there are historical flooding issues at the site, then the locals will know.	Stakeholder input to project.
	Options Assessment	Council may be presented with several options. The options can be assessed against all the investigation criteria. Pros and cons should be factored into the screening process. A GPT recommendation should be possible at this stage	Options Assessment (table)

	Item	Guide	Output
Design	Concept Design Report	Council may request the investigations to be reported in a concept design report. They may also be satisfied to receive the information as it is prepared.	Concept design report – draft
	Hold Point	Council may wish to introduce a hold point to review the investigation, modelling and concept design. A workshop could be used to share the background and design rational. Council should seek clarification to be satisfied with the concept design.	Consolidated Feedback to designer/ consultant
	Geotechnical Investigation	Geotechnical investigation should be carried out when the location of the GPT is confirmed. This will allow for the most accurate representation of material for construction, spoil reuse and contamination. Boreholes should be taken and soil characterised for foundation material and water table. Contamination analysis should be undertaken to determine presence of unsuitable material or specialist disposal requirements. Waste classification should also be provided. (Typically 1-2 boreholes is sufficient at the location of the proposed device)	Geotechnical Waste Classification and Contamination Investigation.
	Detailed Design	Based on the investigation and concept design stages Council should proceed to detailed design	

	Item	Guide	Output
Design	Draft Detail Design	Council feedback and concept design should be used to progress detail design. All elements of the project need to be engineered and documented. Retaining walls, pavements design, access route, vehicle layback, tree removal, utility protection, tree protection zones, structures, landscape and planting plan and other design elements need to be documented. Materials need to be sized and specified and Councils Engineering and Design Guides used where applicable. Opportunities for decanting facilities should be incorporated where possible.	Draft Detailed Design (50%)
	Hydraulic Modelling (Final)	Using the detailed design and final GPT specification the hydraulic modelling should be finalised. If any changes to the preliminary modelling should be and used to update the detailed design.	Hydraulic Modelling Report (final)
	Cost Estimate (final)	The bill of quantities should be finalised, and cost estimate updated. The costing should include all the construction activates for including establishment, spoil disposal, supply and delivery, drainage and disestablishment etc.	Cost Estimate (final used for tender)
	Cost Estimate (operation)	Costs for operation and maintenance of the new GPT should be estimated and used for consultation with the asset management team for forward budgeting.	OM Cost estimate

	Item	Guide	Output
Design	Operation & Maintenance Manual (draft)	Prepare a site-specific Operation & Maintenance Manual. Data sheets and cleaning specifications should be required for all new GPTs (not just existing ones). Site specific access and cleaning instructions should be clearly explained.	Draft OM Manual
	Design Report (optional)	Update the Concept Design Report to Final. Document the decision-making process and agree outcomes.	
	Safety In Design (SID)	Safety in design should be conducted and used to identify construction and operational risks. Design should be updated to respond to the SID process.	SID Table
	Detailed Design (100% & For Tender)	Detailed design will be progressed to 100%, Council may wish to also receive an interim 90% design issue. Any new information to improve the design should be included in the detailed design.	Detailed Design (For Tender)
	Detailed Design Documentation	A full package of all deliverables should be bundled and submitted to Council. All Reports, investigation and design... should be finalised and submitted.	Final DD Package.
	Issue For Construction (IFC)	Council may wish to provide the IFC at Tender Stage. Design documentation should be prepared to	IFC Detailed Design for Construction

	Item	Guide	Output
Procurement	TENDER STAGE	Council to manage procurement process. Consultant to support Council responding to any request for information (RFI) during the tender process. *(Design Brief should include provision of RFIs / item or hourly rates during tender and construction)*	Preferred Contractor
Installation	Construction	As above and review WAE and participate in defect liability and handover	Review WAE and 12-month defect period to monitor quality
	HANDOVER	A handover of the asset to Council to manage should be completed. A final inspection (see Appendix B) should be undertaken to ensure the GPT has been constructed in accordance with the design requirements and construction specifications.	Planning Consent requirement or Internal Procedure for retro-fitting GPTs
Operation	ASSET MANAGEMENT	Council should setup their GIS to capture key attributes of the new GPT or water quality asset. The new GPT asset should be capitalised and included in the AMP. Add the GPT to their current fleet and advise the maintenance contractor of the new asset. Maintenance cost to be negotiated.	GPT lodged into GIS. GPT Capitalised
Operation	Operation & Maintenance	Monitor the operation and maintenance of GPTs. Review cleaning reports to validate the performance of the GPT. Consider opportunities to optimise cleaning regimes through decanting of liquid if possible, onsite or nearby. Attend a few cleanings every year, to understand more about devices, and make better decisions moving forward.	Ensure Cleaners have the Data Sheets and Cleaning Specs…. And most importantly, know how to use them!

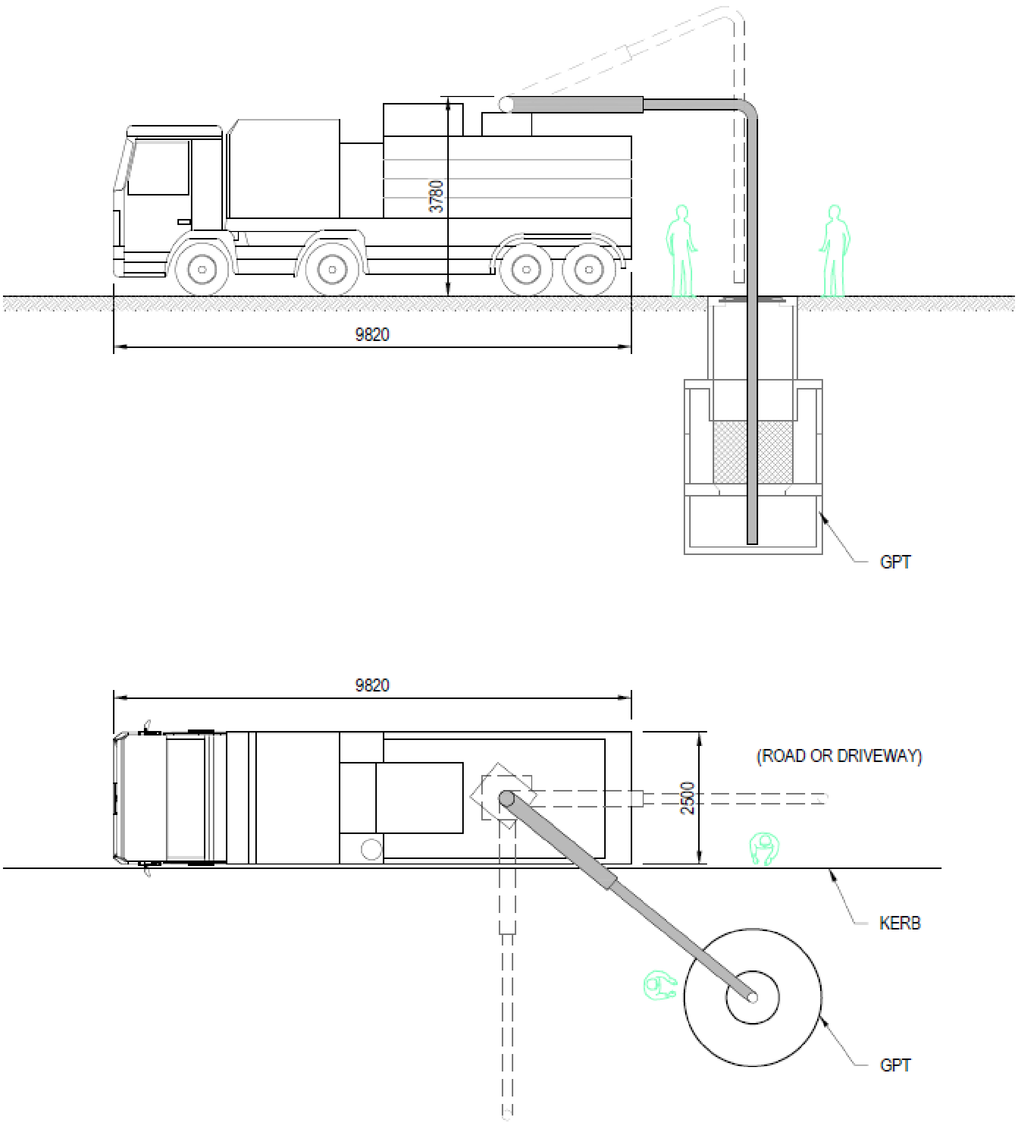


Figure 16 Example of planning and design for GPT Maintenance for overhead and ground clearance

Figure 17 High pressure cleaning of screens and internal areas of the GPT is recommended for every clean.

9 Procurement

This section applies to Council retrofit GPT projects. Procurement processes for construction projects are well established for Councils. Councils typically use Australian Standard AS4300 General Conditions of Contract for Design and Construction projects and project specific schedules are prepared for tender.

We encourage GRK Councils to consult with its members to benefit from their experience.

Options for procurement of GPTs include:

Table 9 Options for GPT procurement

Option	Scope	Pros/ Cons
Design	GPT Investigation, options assessment, specification, concept, detailed design and issue for construction documentation	This allows Council to control and manage the investigations, options assessment, lock in the GPT specification and design. This ensures council is satisfied with the level of investigation and design standard achieved. Council will then package the design and specification into tender documentation for construction. *Selection criteria for proponents should be weighted (50-60%) to previous project and team experience.*
Design & Procure GPT	The design is provided as above however Council purchases the GPT directly from the manufacturer.	This has the advantages of controlling the GPT specification and design standard but also allows Council to procure the supply and delivery of the GPT directly from the manufacturer. Council can negotiate the best price directly with the manufacturer. Close cooperation with the successful contractor is needed to ensure timely delivery to site for construction. If the project is delayed Council is potentially liable for holding costs.

Option	Scope	Pros/ Cons
Design & Construct	Council (or consultant) will include a design brief for the GPT specification and construction and on approval the contractor will construct the GPT.	This model provides a “one stop shop” for procurement and can be more efficient. Council (or consultant) will undertake site investigations and possibly a concept design for the GPT. A brief will be prepared for the contract setting out the design criteria for the GPT such as pollution removal targets, location, preferred technologies and cleaning methods. This model requires the contractor to team with an experienced consultant to prepare a preliminary specification and design which meets the design criteria on which his construction price is based. Council can then assess the submissions to determine who is best suited for the project. Council will use several hold points throughout the design process to be satisfied the design criteria has been met. The main challenge with the D&C model is Council can be attracted to a lower price at the cost of meeting the performance criteria targets.

Each option has pros and cons. Some Councils prefer the efficiency of the Design & Construct model however it requires Council understanding what is accurate and what is not in submissions from tenderers. What may appear to be a good solution on paper, may have serious flaws or exaggerated performance claims and exaggerated flowrates. It can be challenging for Councils that are not familiar with the major GPTs, to know what is marketing hype and what is fact. Whilst there are cost and timing benefits, the D&C project process has a higher element of risk. For example a D&C proposal may not have been hydraulically modelled thoroughly hence this would need to be factored into the assessment.

If Council chooses a design model they can be confident it has been hydraulically modelled and the design is fit for purpose. In this way Council is assured of delivering what they need however the process will take longer. Neither is right or wrong and both options can be successful with good design, project and quality management but Council should be aware of the risks.

As discussed in Section 6.2 we encourage engagement with your design and asset management teams during procurement, construction and defects period to ensure stakeholders needs are met and the desired outcome achieved.

10 Construction

Councils would typically use AS4300 to manage GPT construction, but many other construction contract options exist. Developers package it with civil and stormwater works, and experience tells us that capital cost is the only criteria they use in most cases. GPT works typically fall into the domain of civil and stormwater construction. Contractors participating would need to demonstrate experience, credibility, skills and be resourced appropriately. Some GPTs require deep excavations (5-10m) as inground GPTs can be deep once located below pipe inverts. Also experience with groundwater management, flow diversion, steel fabrication and concrete construction are typically required. Contractors should prepare and submit mandatory QA requirements and detail methodology describing activities such as:

1. Placement of order for GPT (to avoid delays)
2. Submit preliminaries (WHS Plan, CEMP Plan, SWMS, TCP)
3. Site Establishment (site shed, amenities, fencing, erosion control, utilities)
4. Pedestrian & Traffic Control
5. Utility mapping (hydro-excavation)
6. Demolition & recycling
7. Construction of stormwater diversion pits and pipes
8. GPT Excavation & Spoil management
9. GPT installation
10. Backfill and compaction
11. Landscape and reinstatement
12. Demobilise the site
13. WAE drawings, O&M Manual & Handover
14. Practical Completion
15. Defects Liability

There are many other construction activities and requirements which are provided in the construction contract documentation. Council will need to be satisfied the preferred contractor has the skills, capacity and experience to deliver a successful GPT project.

Request for Information (RFIs) should be responded to promptly by the designer to ensure works continue uninterrupted. Contingency designs (if required) should be prepared promptly for approval and costing any variation. Setout works should be conducted by a registered surveyor (if the scale of the project requires, but in some cases there is no benefit from doing this). Works as Executed (WAE) drawings should be prepared at the end of construction and any variation to the construction plans highlighted. Council should issue a letter of Practical Completion so the warranty period can formally start.

Practical Completion (PC) provides a hold point to ensure the workmanship, materials and design intent has been achieved to the required standards. Work as Executed (WAE) Plans should be prepared and forwarded to Council identifying any variation from the IFC documentation. It also provides an opportunity in the 12 months defects liability period for Councils to monitor the performance and operation of the new asset and then any defects or omissions can be addressed by the developer under warranty.

11 Handover & Compliance

Many GPTs and SQIDs are installed through the development process. GPTs are generally installed early in estate construction with other drainage assets and can quickly become *default* sediment and erosion controls. GPTs are generally not maintained during construction and unbeknown to the contractor will quickly fill and become non-operational. It is therefore critical that the GPT is maintained during this period. Hence development consent should mandate maintenance of GPTs throughout the construction stage. Ideally it should mandate monthly photos of the GPT and monitoring results.

Once the estate development is complete assets are inspected and handed over to Council. Hold points include occupancy certificates, practical completion, or subdivision completion. GPTs will need a comprehensive clean and inspection using the Guidelines for the Maintenance of Stormwater Treatment Measures (Stormwater NSW) prior to handover to Council - refer to the section on Handover and Compliance.

If the GPT is compliant with the inspection it should be accepted and added to Councils asset registry and included in their LGA wide operation & maintenance program. If the GPTs are procured directly by Council a similar process should be followed. The new GPT should be capitalised in the AMP. It can then be added to the Operation and Maintenance program.

Beware that private certifiers should not be used for this process, because they are not confined spaces trained, cannot climb inside the GPTs, and generally don’t understand what to inspect for when they are in there. Thousands of GPT have historically been handed over with no inspection or a useless inspection and then Council ends up wearing the thousands of dollars in extra cleaning and rectification costs. So, if Council cannot inspect it themselves, engage someone who can. It is fast, cheap and easy if you know what you are doing.

Validation of Council GPTs program is critical to demonstrate outcomes are achieved. The most common method is to review the cleaning reports provided by cleaning contractors (see example). Whilst this provides evidence the clean has been completed it does not validate or verify the performance targets established in the design stage.

At present, there is minimal quantifiable information available on the benefits of GPTs in the Georges River catchment on downstream water quality. One *opportunistic* study by Georges Riverkeeper was able to verify the positive impact of a Bandalong Boom on litter deposits downstream by conducting floating litter counts both before and after installation. Similar opportunities within LGAs should be identified and utilised to validate GPT projects.

While anecdotal and personal experience of staff within Councils indicates most devices have a positive impact, there is a need for more rigorous water testing regimes at locations both upstream and downstream of the devices. While this may not provide direct benefit to staff who have worked with these devices for years, it would provide incoming and future staff with confidence that the devices are providing the intended positive outcomes.

But if this is too complex or expensive, Councils can look at catchment area vs pollution load removed, and this will typically indicate (anecdotally at least) which devices are working the best, and which aren’t.

12 Operation & Maintenance

Properly scheduled and resourced operation & maintenance is key to the success of your GPT program. Poor operation & maintenance practice is the main cause of GPT failure and non-operation. To ensure GPTs operate effectively from handover & commissioning it is important that operation & maintenance requirements are considered during planning, design and construction to ensure the SQIDs can be efficiently maintained.

All Councils in the GRK should have a copy of Stormwater NSW Guidelines for the Operation & Maintenance of Stormwater Treatment Measures 2022

Proper operation & maintenance of GPTs is essential to realise the benefits of the investment. Unfortunately, many GPTs and SQIDs have suffered neglect as Councils have struggled to manage and maintain their devices. The planning and construction typically fall to the engineering teams for delivery however operating and maintenance cost and budgets need to be understood and committed to from the outset to deliver the benefits. Councils are encouraged to have this important discussion early and document an operation & maintenance plan and costs for each project.

Operation & maintenance requirements for SQIDs shall be summarised in an Operation & Maintenance Plan (O&MP).

Figure 18 A number of lids require removal for operation & maintenance of GPTs and a number of lifting tool are needed – that includes for auditing too!

13 Appendices

A. Early Asset Management
B. Handover Inspection for Gross Pollution Traps (GPTs)
C. Gross Pollution Trap Handover – Inspection Checklist
D. GRK DCP Water Quality Targets
E. GRK Conceptual Modelling Summary

APPENDIX A - New GPT Handover Checklist

Description	Stages GPT Planning – Operation				
	Development Application These stages should also be used if Council is designing the GPT internally	**Construction Certificate**	**Construction**	**Handover** (use list to audit compliance and include OM personnel)	**Operation** (add the new GPT to Councils list for OM)
Confirm operation & maintenance responsibility within Council	●			●	●
Nominate GPT specification (does this align with Council preferences?)	●				
Concept design of GPT and general arrangement (Consistent with engineering and landscape guide. Utilities to be identified if retrofit project)	●				
GPT maintenance access design, requirements and location (Allow for auto-turn design for dual-steer 16-wheel combination unit 10m)	●		●	●	●
Describe maintenance methods, equipment, and personnel (Internal resources or contracted)	●			●	●
Estimate GPT operation & maintenance costs	●				

Description	Stages GPT Planning – Operation				
	Development Application	**Construction Certificate**	**Construction**	**Handover** (use list to audit compliance and include OM personnel)	**Operation** (add the new GPT to Councils list for OM)
	These stages should also be used if Council is designing the GPT internally				
Provide specific GPT monitoring activities	●			●	●
Detail design of GPT and construction staging		●	●		
GPT Inspection methods and routine (regular monitoring is promoted)		●			
Operation & maintenance Plan (during and post construction draft only and finalised post construction)		●	●	●	●
Work-as-executed drawings (WAE)			●		
Comprehensive initial clean prior to handover and acceptance (The GPTs can be non-operational if not cleaned prior to handover)			●		
Photos of GPT and components in a clean and operational state			●		
Practical Completion (Inspection and acceptance)			●		
Financial Completion (Council projects invoices paid)			●		

Description	**Stages GPT Planning – Operation**				
	Development Application These stages should also be used if Council is designing the GPT internally	**Construction Certificate**	**Construction**	**Handover** (use list to audit compliance and include OM personnel)	**Operation** (add the new GPT to Councils list for OM)
Add GPT to Councils GIS database and update GPT OM List to include in maintenance program.				●	●
12month defects liability period (rectify defects or non-compliances during DLP,)			●		
Return Bonds (Council construction projects)			●		
Commence Operation & maintenance of GPT					●

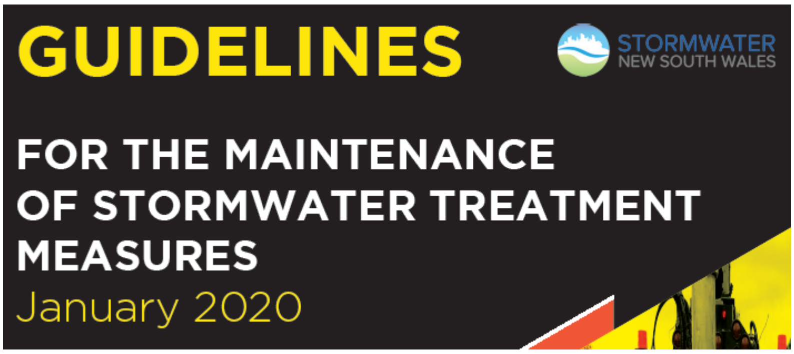
APPENDIX B -Handover Inspection for Gross Pollution Traps (GPTs)

This procedure is to be followed when the GPT(s) are being prepared for *HANDOVER* to Council *Asset Management and Operations team*. Operational Acceptance/ Handover is a critical milestone for Council and follows the construction process. The *HANDOVER INSPECTION* must demonstrate the GPT has been constructed in accordance with the approved design. And it must demonstrate is it clean and fit for handover.

Urban Development Construction Phase – GPT Operation & Maintenance
GPTs are typically installed early as part of the civil and stormwater construction and quickly start to accumulate litter, sediment, and debris. GPTs do provide a barrier during construction but need to be maintained during this stage. If left, they will quickly fill to the point of becoming non-operational and excess pollution bypassing the GPT will impact water quality and assets downstream.

The estate developer/ contractor is responsible for cleaning the GPT throughout construction on a 3 monthly cycle.

Liquid contents of the GPT can be dewatered and sediments managed on site to avoid costly disposal. The operation & maintenance of GPTs should follow the ***NSW Guidelines for the Operation & Maintenance of Stormwater Treatment Measures 2022***. The Guidelines provide specific cleaning procedures for the majority of GPTs being installed.



Use the checklists on the following pages for HANDOVER and Operational Acceptance.

A comprehensive clean of the GPT is required immediately prior to an Operational Acceptance inspection.

The inspection should not be delayed after cleaning or the GPT may fill again prior to the inspection.

APPENDIX C - Gross Pollution Trap Handover – Inspection Checklist

Inspector	**Date**
GPT ID (from plan)	ID in Council Database
Address / Lot/ Location	Added to database
GPT Specification	
Inspection attendees	
Consultant/ Contact	
Plans provided	

Compliance (provide design certificates and photo evidence of compliance)

Item	Complies (√/ X/ NA)	Action if non- compliant/ responsibility	Complete/ comment
GPT specified has been installed			
GPT is installed in correct location			
GPT depth to invert/ overall is consistent with design			
The connecting conduits/pipes are consistent with design			
Access to the GPT has been constructed in accord with road design.			
Bollards, gates and fencing has been installed in accordance with approved design.			
GPT lids are in correct position and can be opened, and have been greased (if gatic style lids)			
GPT has been maintained and is free of debris and sediment			
GPT has received a comprehensive clean in accordance with "yellow book" (including behind screens) and is fully operational			

Performance (provide functional design certificates and evidence of compliance)

Item	Complies (√/ X/ NA)	Action if non- compliant /Responsibility	Complete/ comment
The GPT is free of damage and is operational			
The GPT weir is operational and provides high flow bypass			
Are the screens clean and operational?			
Has provision of low flow bypass been provided?			
Are the any outstanding issues? (i.e. backwater, odour, spills, vandalism, damage, access issues)			
Have steps irons been installed (if specified)			
Has flow benching been installed (if specified)			
GIS & Database			
Has the GPT been added to the Council Asset register			
Has a ***Data Sheet*** been prepared for operation & maintenance			
Has a ***One-Page-Cleaning-Specification*** been provided			
Have the WAE plans been submitted			

Inspector Comments

Next Step

If all the items are compliant the inspector can signoff the *HANDOVER Inspection* below. If any of the items are non- complaint the developer/ contractor must rectify the issue and provide photo evidence or relevant documents to confirm the work has been completed and can be signed off. Once the GPT has been signed off the asset becomes the property of Council and is to be maintained along with other GPTs in Council.

GPT HANDOVER ACCEPTANCE – SIGNOFF

Inspector	Signature	Date
Other	Signature	Date

Defects Liability Period

The developer/contractor will be responsible for rectification of any damage, failures, noncompliance during the 52 weeks defects period.

APPENDIX D - Development Control Plan (DCP) Water Quality Targets

Liverpool Council WSUD Technical Guidelines 2016

WSUD can be applied at all scales and in all types of urban development and redevelopment to meet stormwater treatment targets identified in Council's DCP including:

- reduce the baseline annual pollutant load for litter and vegetation larger than 5mm by 90%;
- reduce the baseline annual pollutant load for total suspended solids by 85%;
- reduce the baseline annual pollutant load for total phosphorous by 65%; and
- reduce the baseline annual pollutant load for total nitrogen by 45%.

Botany Bay Water Quality Improvement Program Targets (BBWQIP)

Stormwater reduction targets recommended for urban development in the Botany Bay Catchment.

Stormwater Pollutant	Greenfield Developments Large re-developments	Multi-unit dwellings. Commercial developments. Industrial developments. Small re-developments.
Gross pollutants	90%	90%
Total suspended solids (TSS)	85%	80%
Total phosphorus (TP)	60%	55%
Total nitrogen (TN)	45%	40%

Bayside Council

Stormwater reduction targets recommended for urban development in the Botany Bay Catchment.

Stormwater Pollutant	Greenfield Developments Large re-developments	Multi-unit dwellings. Commercial developments. Industrial developments. Small re-developments.
Gross pollutants	90%	90%
Total suspended solids (TSS)	85%	80%
Total phosphorus (TP)	60%	55%
Total nitrogen (TN)	45%	40%

Reduction in chlorophyll-A (Chl-A) and turbidity levels required to meet these targets.

Area	Reductions needed	
	Chl-A	Turbidity
Upper Georges River Estuary	44%	91%
Middle Georges River Estuary	38%	74%
Lower Georges River Estuary	19%	38%
Lower Cooks River Estuary	42%	52%
Botany Bay	Target met	Target met

Georges River Council

7.3 Stormwater Quality Requirements for Sites of Area Greater than 2000 Square Metres

For sites of area greater than 2000m2 Stormwater Quality Improvement Devices (SQIDs) are to be installed that will ensure that stormwater discharge from the site meets the following performance criteria:

- All general requirements as specified in Section 7.2.
- Achieve a minimum of 80% retention of the Suspended Solids (SS) average annual load.
- Achieve a minimum of 40% retention of the Total Phosphorus (TP) average annual load.
- Achieve a minimum of 40% retention of the Total Nitrogen (TN) average annual load.
- Achieve a total retention of litter and organic matter greater than 50mm for storm events of up to exceedances per year (EY) (1 in 3 months) frequency.
- Achieve a total retention of oil and grease for storm events of up to EY.

Fairfield Council

	Commercial & industrial development
Gross Pollutants	90%
Total suspended solids (TSS)	80%
Total phosphorus (TP)	55%
Total nitrogen (TN)	40%

To meet the targets, developments have the choice of either submitting a deemed to comply solution or a WSUD strategy, as outlined below.

Canterbury Bankstown Council

Not Available

Campbelltown Council

3.2 Water Quantity

The Campbelltown City Council, Development Control Plan (DCP) sets objectives for the reduction of pollutants in runoff from new developments, these targets are shown in Table 1

Table 1: Water Quality Objectives

Pollutant	Reduction Target
Total Suspended Solids (TSS)	80%
Total Phosphorous (TP)	45%
Total Nitrogen (TN)	45%
Gross Pollutants	90%

Pollutant	Goal (Long-term)	Treatment Objective (Short-term)
Post Construction Phase		
(a) Existing Development		
Suspended solids (SS)	Suspended solids load to achieve natural dry and wet weather concentrations for the catchment	70% retention of the SS average annual load
Total Phosphorus (TP)	The load of phosphorus from the catchment meets ANZECC guidelines for aquatic ecosystems	20% retention of the TP average annual load
Total Nitrogen (TN)	The load of nitrogen from the catchment meets ANZECC guidelines for aquatic ecosystems	35% retention of the TN average annual load
Faecal coliforms	The load of faecal coliforms in catchment waterways meets with ANZECC guidelines for consumption of seafood	90% retention of the Faecal coliform average annual load
Litter	No anthropogenic litter in waterways. Organic litter occurring at natural levels of the catchment at natural levels of the catchment	Retention of litter greater than 50mm is to the maximum extent possible for storm events of up to 1 in 3 month ARI
Oil and Grease	No visible oils and grease in waterways	Retention of oil and grease are to the maximum extent possible for storm events of up to 1 in 3 month ARI
Toxicants	No toxicants entering waterways	Limit the application, generation and migration of toxic substances to the maximum extent possible
(b) New Development (or Redevelopment)		
Faecal coliforms	The load of faecal coliforms in catchment waterways meets with ANZECC guidelines for consumption of seafood	Areas with more than 50% imperviousness, a 90% retention of the faecal coliform average annual load
Construction Phase		
Suspended solids (SS)	Suspended solids load from site does not exceed natural levels	70% retention of the SS average annual load leaving site. Refer to Table 5.1a below for more details for sizing of sediment retention basins.
Coarse Sediment	No coarse sediment leaves the site in addition to natural loads	Retention of sediment larger than 0.125 mm for storm events of up to 1 in 3 month ARI at the site
Oil and Grease	No visible oils and grease enter waterways from site	Total retention of oil and grease for storm events of up to 1 in 3 month ARI
Toxicants	No export of toxicants from site	Limit the application, generation and migration of toxic substances to the maximum extent possible

APPENDIX E - GRK Conceptual Modelling Summary

About conceptual models

Conceptual models aim to represent the way that a particular system works. This becomes the basis for analysing the system as a whole, rather than focusing on individual parts in isolation (and then wondering why the system outputs are not improving).

We build a conceptual model by defining key terms, identifying the component parts and then explaining how these parts relate to each other. We use data collected during the review phase of the project- interviews and workshops with council staff, together with a literature review.

Conceptual models are tools to build a shared understanding of how a system works, and which relationships are critical in determining the outputs of that system.

Conceptual models are mainly about explaining these relationships. The ideal conceptual model is a mathematical one that expresses the specific relationship between components of the model. In reality most conceptual models describe relationships in qualitative terms , such as text, images or process diagrams.

A conceptual model describing relationships helps us to simplify a complex system (such as network of GPT managed by multiple councils) into something that is easier to understand, diagnose and manage. Having this understanding allows managers to define a preferred future state for the system and to establish performance criteria for critical elements in the conceptual model. This helps managers identify what is required to get from the current state to the preferred state.

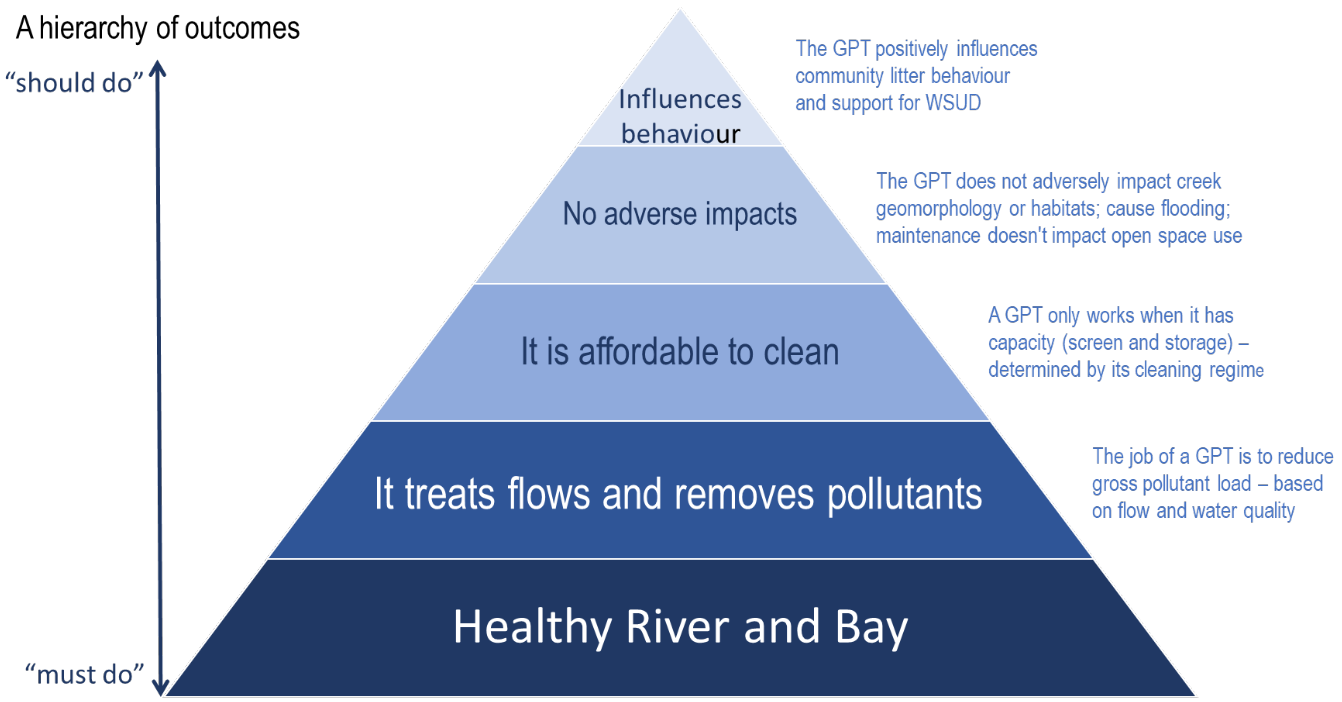


Figure 1 - Conceptual model defining an 'effective' GPT, using a hierarchy from 'must-do' to 'should-do'

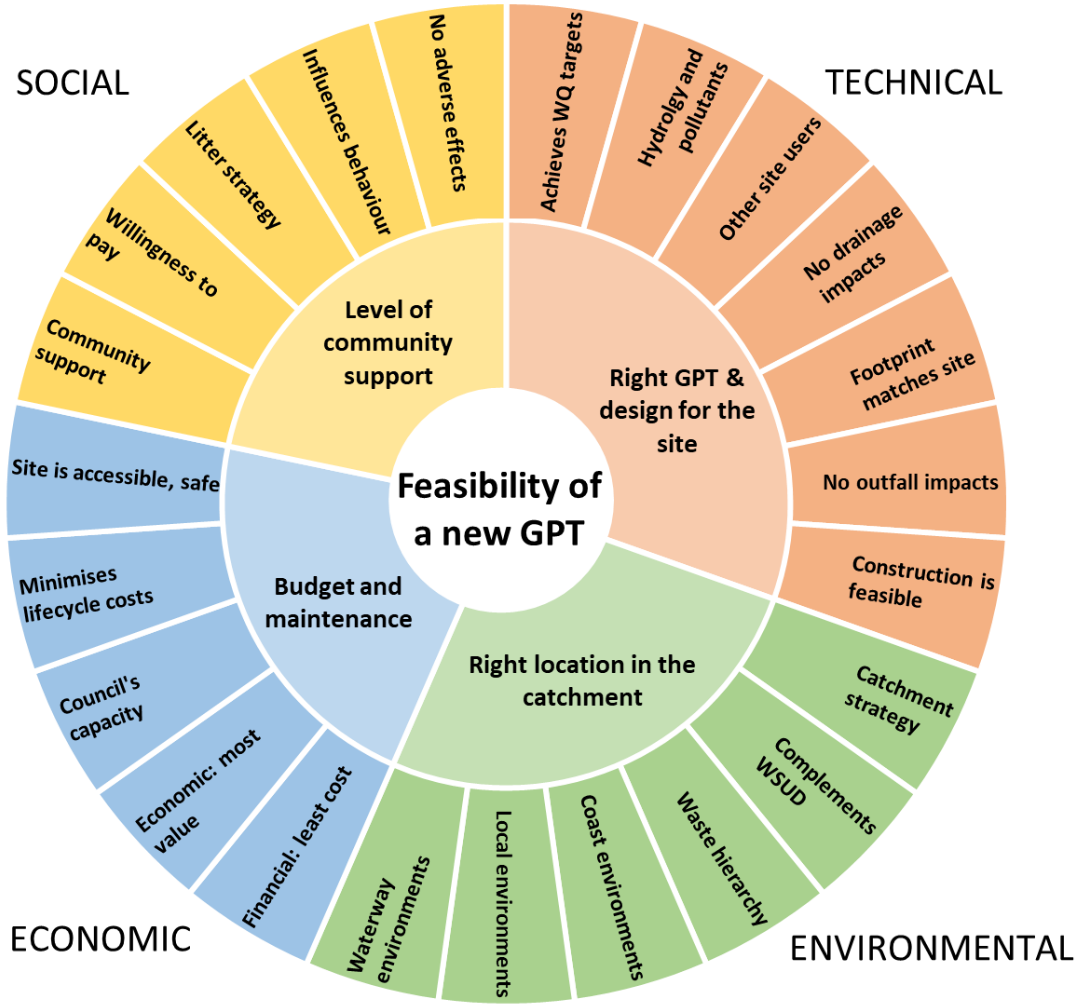


Figure 2 - Conceptual model of factors to be considered in assessing the 'feasibility' of a new GPT

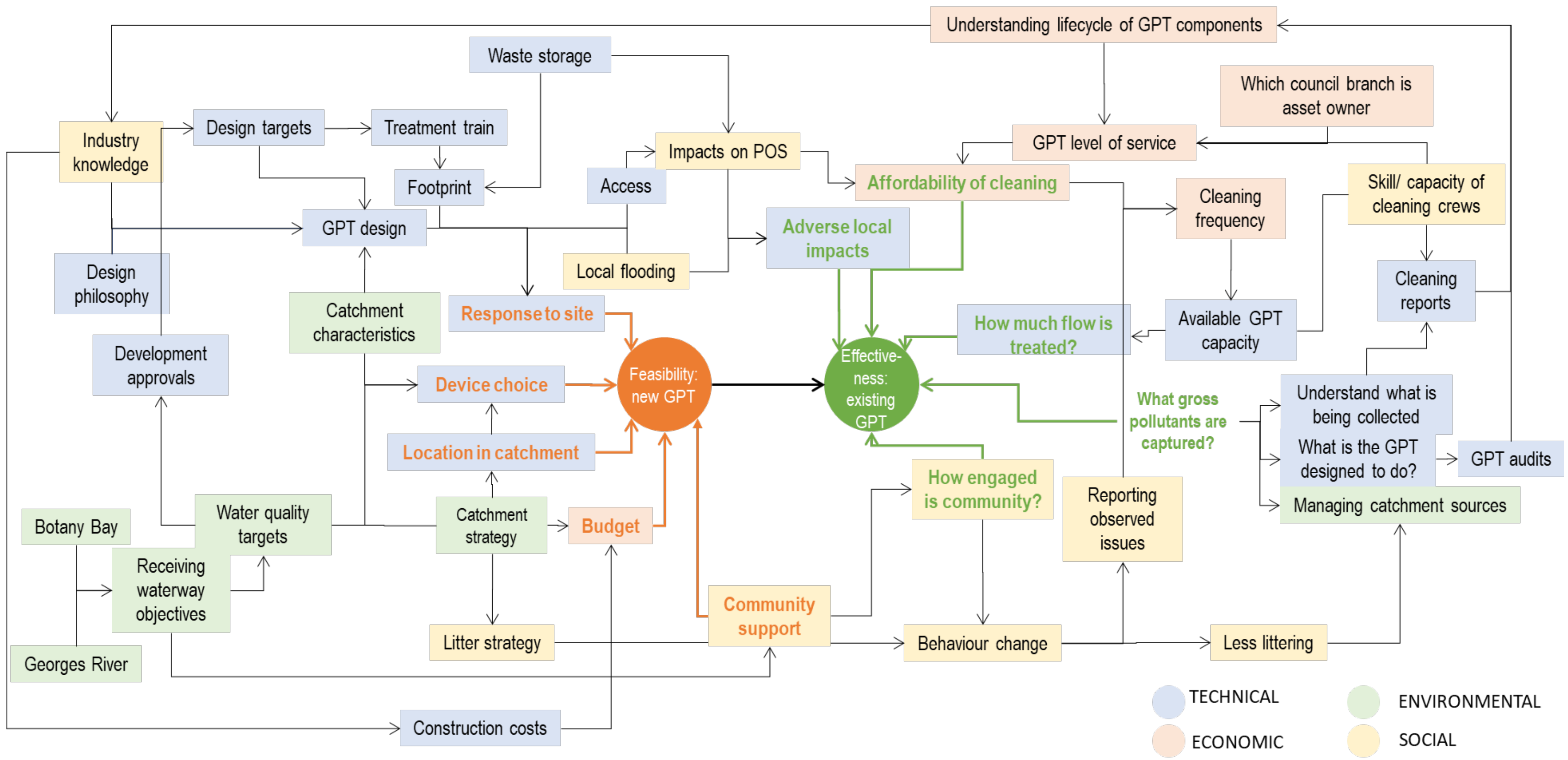
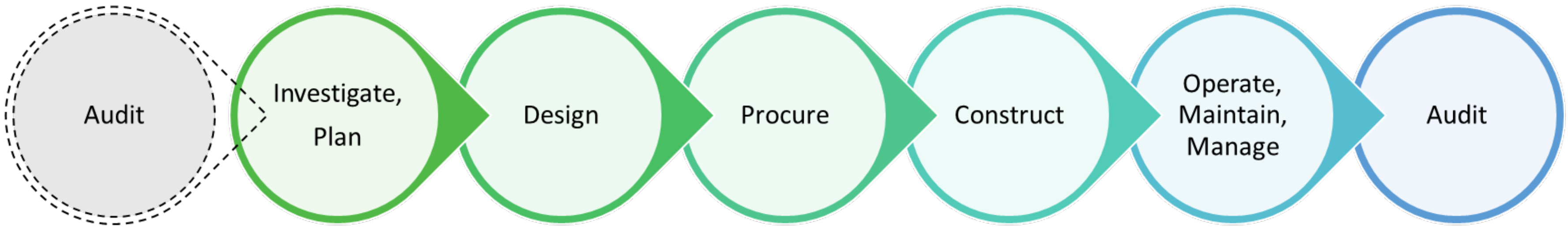


Figure 3 – Casual influence map showing the relationship between factors (identified during this project) that influence the effectiveness and feasibility of GPT



Investigate, Plan

Empower
Development planners

Consult
Waterways Team
Stormwater Team
Engineering Team

Inform
NA

Design

Empower
Engineering Team

Consult
Waterways Team
Stormwater Team

Inform
Procurement team
Maintenance team

Procure

Empower
Procurement team

Consult
Waterways Team
Stormwater Team
Engineering Team
Maintenance team

Inform

Construct

Empower
Procurement team
Engineering Team

Consult
NA

Inform
Maintenance team
Waterways Team
Stormwater Team

Operate, Maintain, Manage

Empower
Maintenance team

Consult
Waterways Team
Stormwater Team
Engineering Team

Inform
NA

Audit

Empower
NA

Consult
Maintenance team
Waterways Team
Stormwater Team
Engineering Team

Inform
NA

Figure 4 - Who should be involved and how will they be engaged at each step in delivering a new GPT. This is based on the IAP2 engagement model[1]

[1] See https://iap2.org.au/wp-content/uploads/2020/01/2018_IAP2_Spectrum.pdf

Enabling factors to support water-sensitive innovations

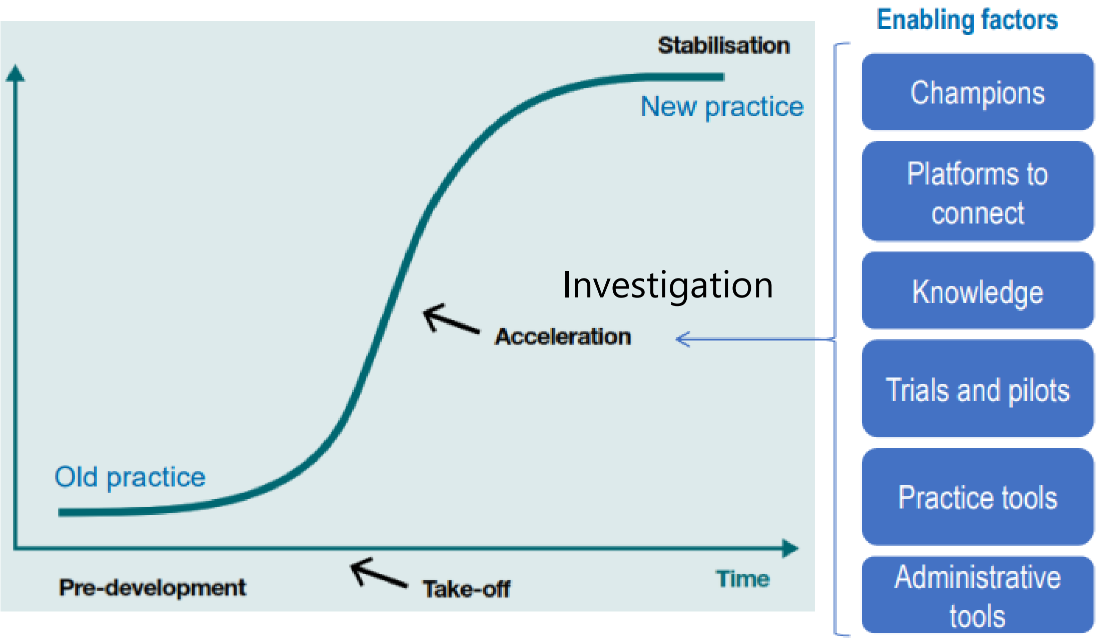


Figure 5 – The CRC for Water Sensitive Cities' Transition Dynamics Framework is a conceptual model of system change. It identifies 6 enabling factors that accelerate the implementation of new innovation.

Water sensitive transitions follow an S-curve:

1. Pre-development is when no changes to the status quo can be detected in practice, but the foundations for change are laid.
2. Take off is when momentum for change builds and hits a turning point, with system shifts becoming more noticeable.
3. Acceleration is when changes are accumulating, and is attracting wider attention.
4. Stabilisation is when a new equilibrium is reached and operating at large.

While transition can be uncertain and unpredictable, researchers have developed frameworks to steer this process. The Transition Dynamics Framework (with its 6 enabling factors) is an example used by the CRC for Water Sensitive Cities.

These enabling factors work together to reinforce shifts in the social and institutional enabling conditions for change.

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Figure 5 – These 'enabling factors' can be used to accelerate implementation of new innovations

Enabling factor	What is it?	What does it mean for GPT in GRK?
Champions	Key individuals working on specific change-related projects - within their own organizations and across organizations.	Use key GPT contacts within each council to project manage joint projects.
Platforms for connecting	Informal structures and processes for coordination and alignment amongst practitioners.	Catchment –wide community of practice for GPT managers
Investing in new knowledge	Projects that invest in addressing knowledge gaps. Often accompanied by capacity building activities.	Joint investment in water quality monitoring. Build a joint database to understand lifecycle costs of GPT in the George River catchment.
Projects and trials	Demonstration and pilot projects, linked closely with new knowledge projects.	Joint trials of new GPT devices
Practice Tools	Tools and guidance for implementation of new innovations. This includes practical guidelines and design tools.	Design philosophies for GPT feasibility assessments. A GPT manager at GRK to consolidate the roles in individual organisations. Run the GPT maintenance program as a jointly funded, whole of catchment program to gain economy of scale initiatives. Formalise GPT catchment-wide data and information sharing platforms. Share information on as-constructed costs for different devices in the catchment, and factors that inference costs.
Administrative tools	Administrative instruments including policy, planning and regulation to support new innovation.	Catchment strategy and shared water quality targets

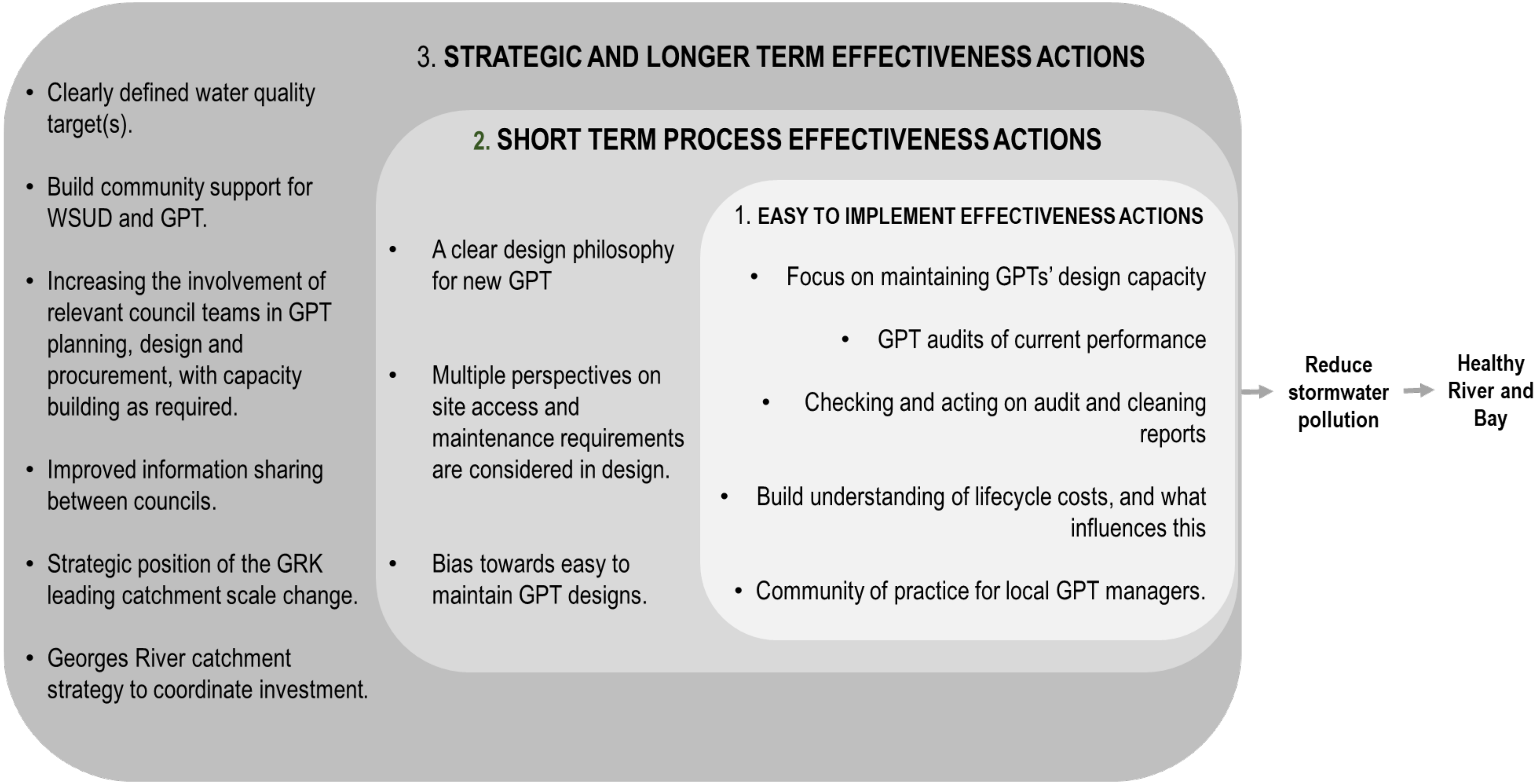

Figure 8 - System map identifying the factors to be strategically employed to improve GPT management in Georges River catchment, based on the enabling factors

APPENDIX F – Example – Sutherland Shire GPT Data

geometry	GIS ID	Device Type	Sub Type	Location	Site Description	Suburb	Eng Drawing No	Catchment Area (Ha)	Dimensions	Cost ($)	Date Built	Current Status	Maintenance Responsibility	Sub Catchment	Major Catchment
X: 329906.	69	Wetland	Wetland	Captain Cook Drive	H1 Site - opposite Cron	Cronulla	13683	22 Ha		250,000	December 1999	Constructed	Civil Works	Woolooware Ba	Botany Bay
X: 318180.	92	GPT	GPT	Bundanoon Road	Cresent Creek	Woronora Heights	14139	26 Ha		42,000	2001	Constructed	Civil Works	Forbes Creek	Woronora River
X: 327472.	115	GPT - Other	Floating Litter Trap	Murrami Avenue	Canal in park	Caringbah	Bandalong Dr	91.6 Ha	5m long trap	27,150	July 2003	Constructed	Civil Works	Woolooware Ba	Botany Bay
X: 317407.		D-Gross Pollutant	CDS	Beltana Close Reserve	Parkwood Drive	Menai	16128	38		257000	1/10/14	Existing		Still Creek	Woronora River
X: 317318.	187	GPT - Other	Trash Rack	Bottle Forest Rd	Near Rear of No.2 Mim	Heathcote	15299	4.9 Ha	3360mm x 600mm	10,000	March 2008	Constructed	Civil Works	Kangaroo Creek	Hacking River
X: 323820.	159	GPT - Other	Trash Rack	The Esplanade		Sylvania		8.2 Ha		600	June 2005	Installed	Civil Works	Oyster Bay	Georges River
X: 330288.	318	Gully Pit Pollutant	Enviropod Pollutant Filt	Links Avenue	opposite lifeguard buil	Cronulla			600mm x 500mm	250.00	2014	installed	Civil Works	Bate Bay	Pacific Ocean
X: 322407.	209	End of pipe trap	Nettech Device	Oyster Creek	Opposite 117R Carvers	Oyster Bay	File Ref No. SD	4.3 Ha		6220	May 2009	Installed	Civil Works	Oyster Creek	Georges River
X: 317228.	29	GPT - Other	Silt Trap	Llanberis Drive	Bushland	Menai		0.9 Ha				Existing	Stormwater Mar	Still Creek	Woronora River
X: 315670.	160	GPT	Enviropod Stormfilter	Windle Place		Menai		2.4 Ha		Paid by Develope		Installed	Civil Works	Mill Creek	Georges River
X: 320716.	199	GPT	Stormwater360 Vortecl	Eton St	End of Eton St near Scc	Sutherland	File Ref No. SD	8.8 Ha		96813	January 2009	Installed	Civil Works	Saville Creek	Port Hacking
X: 329622.	75	GPT	GPT	Hume Road (opposite \	Cronulla Golf Course	Cronulla	13264	44.5 Ha	9.0m x 3.0m x 1.2r	92,000	January 1997	Constructed	Civil Works	Woolooware Ba	Botany Bay
X: 324989.	306	GPT	Trashrack		Ewey Creek adjacent t	Miranda					2004	Constructed	Civil Works	Ewey Creek	Port Hacking
X: 325636.	182	GPT - Other	Litter Basket	Beauford Avenue	Residential	Caringbah	NA	0.83 Ha	600mm x 600mm x		Unknown	Installed	Civil Works	Turriell Bay	Port Hacking
X: 326070.	166	End of pipe trap	Storm trap	Whites Avenue	End of road	Caringbah	DMS SD/03/83	11.6 Ha	675 mm diameter	5000	November 2006	Installed	Civil Works	Turriell Bay	Port Hacking
X: 327744.	15	GPT	GPT	Gannons Road	Woolooware Golf Cour	Woolooware	13763	16.9 Ha		113,000	February 2000	Constructed	Civil Works	Woolooware Ba	Botany Bay
X: 329293.	9	GPT	GPT	Sturt Road	Cronulla Golf Course	Cronulla	13261	18.5 Ha	4.0m x 2.0m x 1.2r	45,000	January 1997	Constructed	Civil Works	Woolooware Ba	Botany Bay
X: 315857.	156	GPT	CDS	Forum Drive	Residential	Heathcote	CDS Drawing (	14 Ha	4.03 (L) by 1.95m (	Paid by Develope	March 2005	Installed	Civil Works	Woronora River	Woronora River
X: 316856.	109	Wetland	Wetland	Silverleaf Row	Reserve	Menai	14471	8.6 Ha	1500 cubic meters		2001	Constructed	Civil Works	Woronora River	Woronora River
X: 316313.	89	Wetland	Wetland	Wilson Parade	Emergency Control Cer	Heathcote		1.6 Ha				Constructed	Civil Works	Kangaroo Creek	Hacking River
X: 330494.	301	Detention Basin	Sedimentation Trap	Greenhills Street	Adjacent to Greenhills	Greenhills Beach				structed by Devel	2012	Constructed	Civil Works	Quibray Bay	Botany Bay
X: 321582.	177	GPT - Other	Trash Rack	Gore Avenue	Savilles Creek	Kirrawee	Plan No 1510	19.5 Ha		30,000	May 2007	Constructed	Civil Works	Saville Creek	Port Hacking
X: 329163.	3	GPT	GPT	Deeban Walk	Tonkin Park	Cronulla	12886	58.6 Ha	3.7m x 8.4m x 0.8r	85,000-91,000	June 1995	Constructed	Civil Works	Gunnamatta Bay	Port Hacking
X: 321687.	229	GPT	CDS	2R-50R Cremona Road	Car park Como Pleasur	Como		1.00	CDS PL0506	20,000	July 2010	Installed	Civil Works	Carina Bay	Georges River
X: 324028.	146	GPT - Other	Trash Rack	Alkaringa Road	Corner Alkaringa and F	Miranda	14661	50 Ha	Stepped Rack, tota	42,000	May 2005	Constructed	Civil Works	Gymea Bay	Port Hacking
X: 323228.	52	GPT - Other	Trash Rack	Coonong Road	Coonong Creek	Gymea Bay	13145	15 Ha		8,500		Constructed	Civil Works	Gymea Bay	Port Hacking
X: 327611.	95	GPT	GPT	Northumberland Road	Behind Industrial units	Caringbah		12.5 Ha			May 2001	Constructed	Civil Works	Woolooware Ba	Botany Bay
X: 322133.	173	GPT	Ecosol GPT	Stirling Avenue	Reserve in residential	Kirrawee	DMS SD/03/9	4.1 Ha	RSF 4450	25,380	May 2007	Installed	Civil Works	Oyster Creek	Georges River
X: 317147.	72	GPT - Other	Silt Trap	Llanberis Drive	Bushland	Menai		2.7 Ha				Existing	Stormwater Mar	Still Creek	Woronora River
X: 321906.	118	GPT	Humeceptor	Oak Road	Kirrawee Carpark (entr	Kirrawee		0.13 Ha	STC2-2 cubic metr	20,000	October 2001	Constructed	Civil Works	Dents Creek	Port Hacking
X: 330765.	300	Detention Basin	Sedimentation Trap	Greenhills Street	Adjacent to Greenhills	Greenhills Beach				structed by Devel	2012	Constructed	Civil Works	Quibray Bay	Botany Bay
X: 330202.	190	GPT - Other	Litter Basket	Mitchell Rd	20-34 Mitchell Rd - car	Cronulla	File Ref No. SD	0.18 Ha		3,911 (altogether	June 2008	Constructed	Civil Works	Bate Bay	Pacific Ocean
X: 324383	212	GPT	Trash Rack	Gymea Bay	Foreshore of 58 Alkarir	Gymea Bay	File Ref No. SD			48,000 approx	June 2009	Installed	Civil Works	Gymea Bay	Port Hacking

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