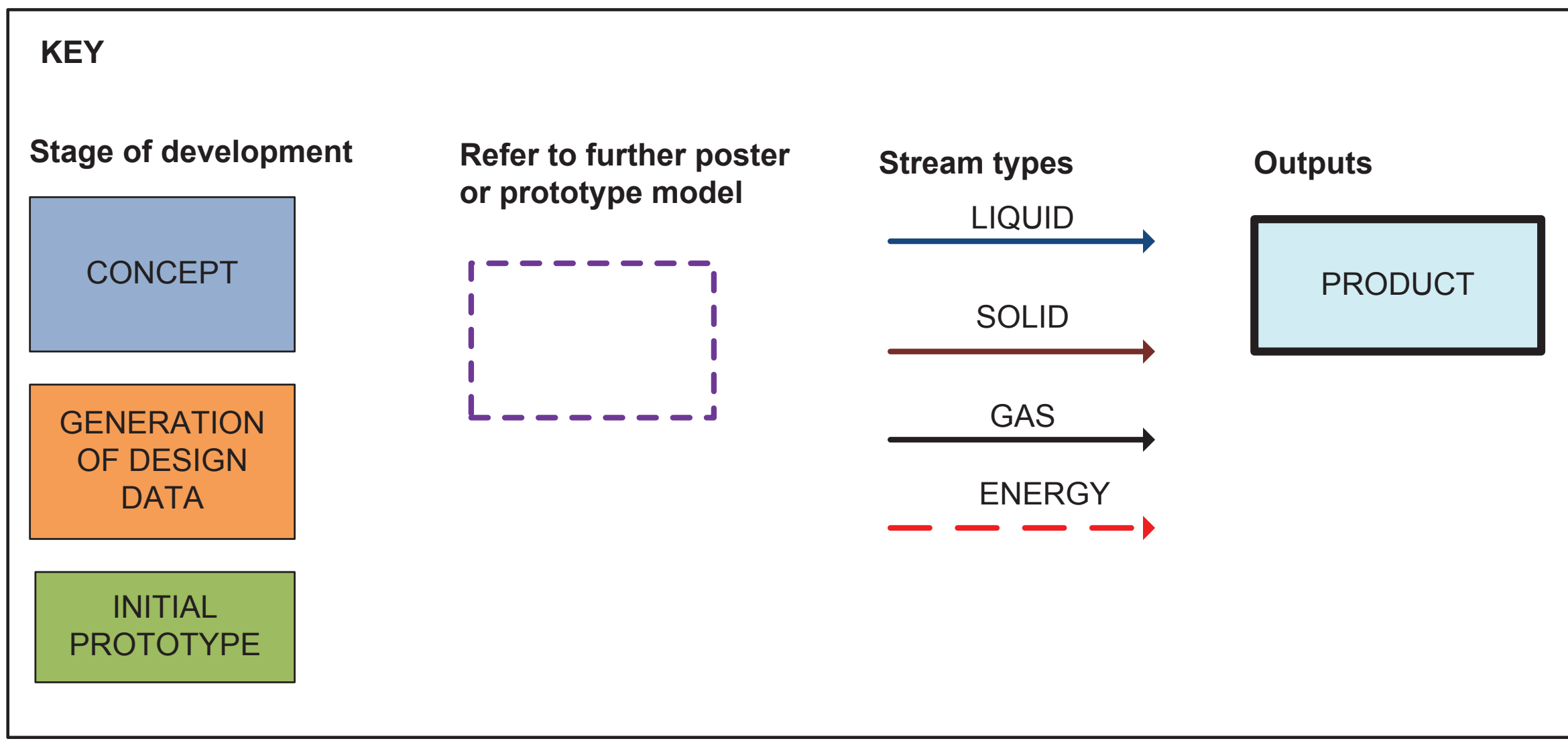
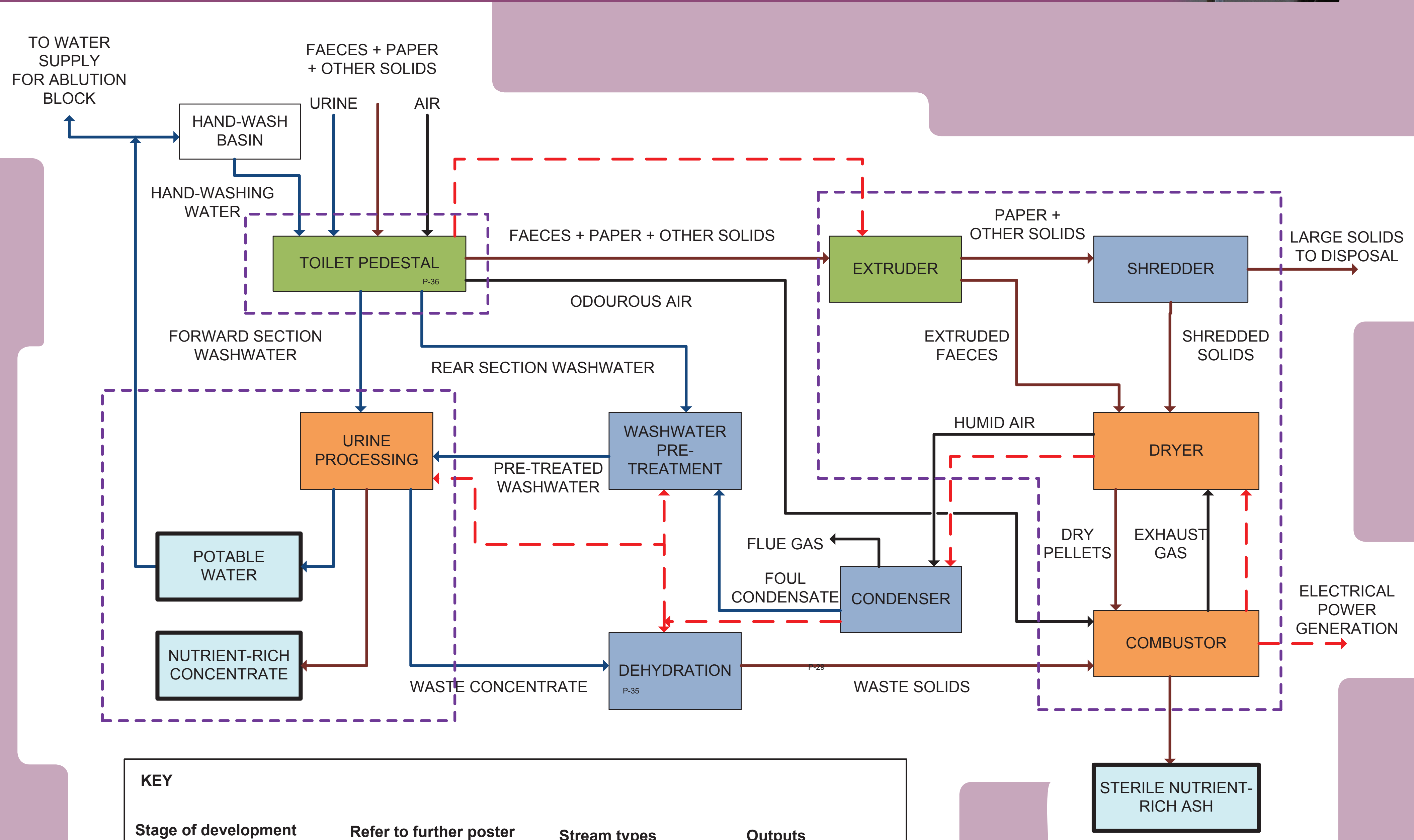
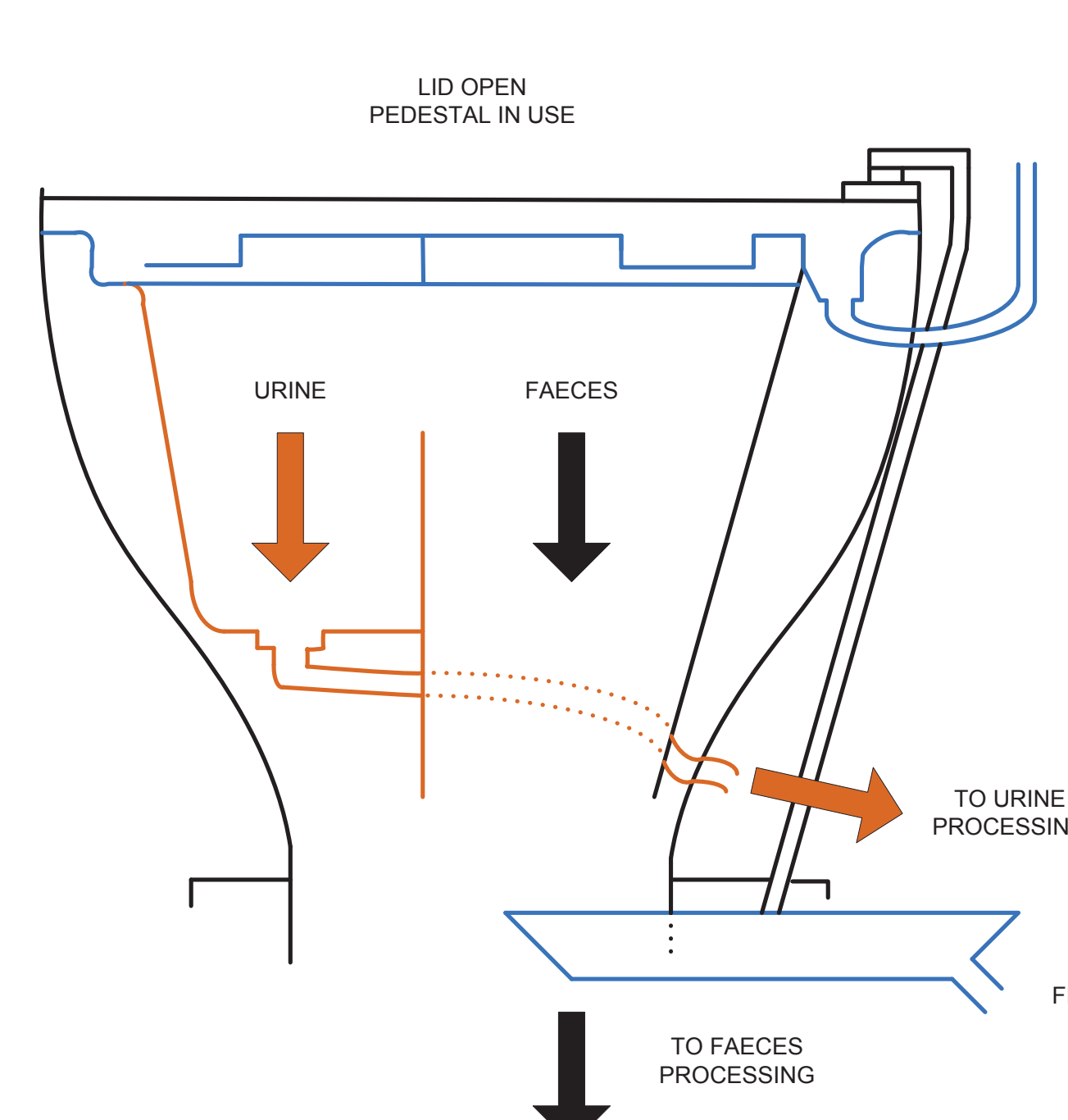


TOILET SYSTEM OVERVIEW



SOURCE SEPARATION

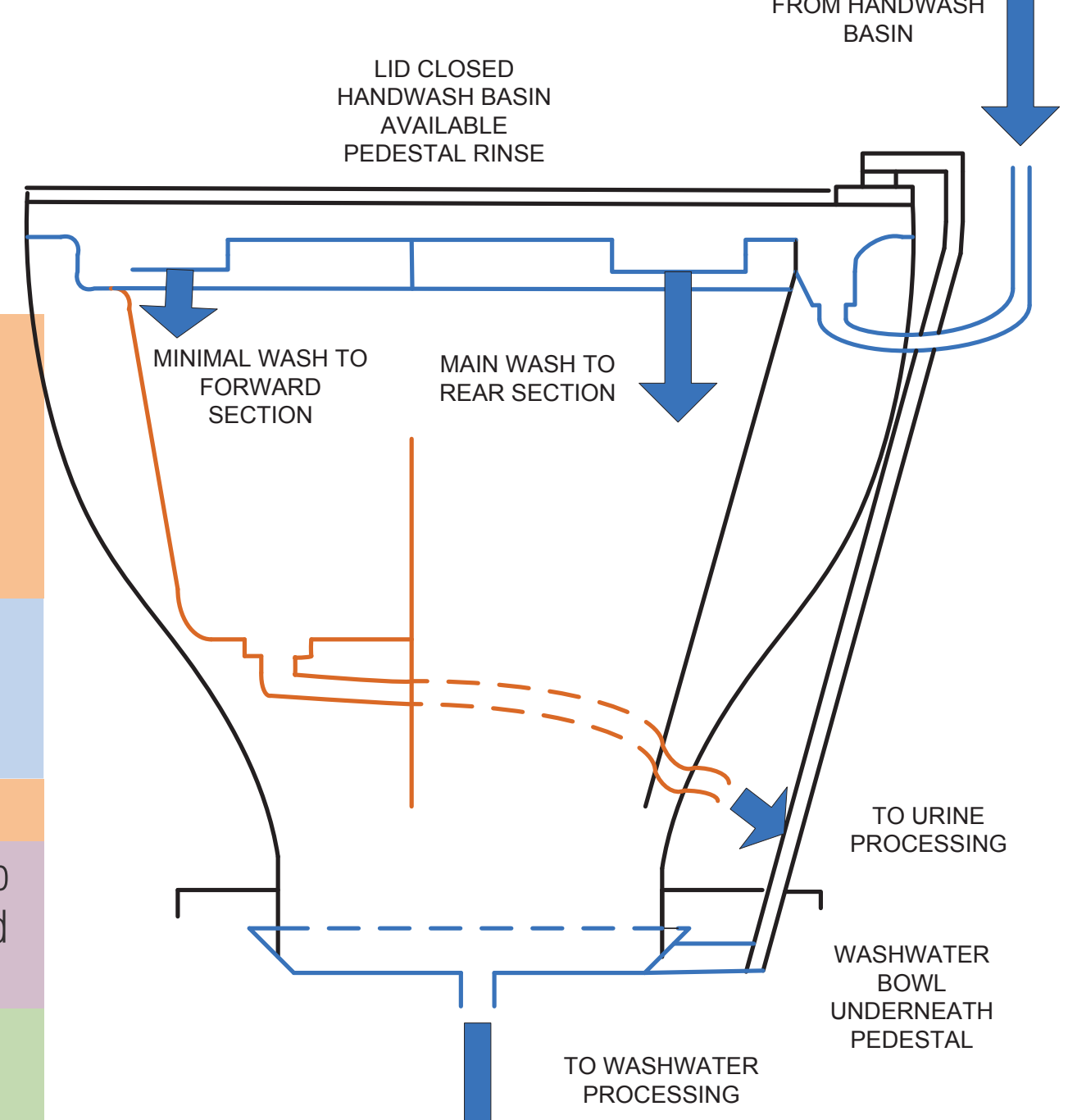
- ### DESIGN PRINCIPLES
- A Maintain components that constitute useful resources (nutrients and energy sources) in as concentrated form as possible and segregated from unlike components – reduces downstream energy requirements for resource-recovery.
 - B Combine streams for processing when concentrations of the streams are as similar as possible.
 - C Confine undesired components (e.g. pathogenic material and components with potential to disrupt the treatment process) to the lowest number of streams possible
 - D Pedestal and toilet unit processes designed to fail safe if any influent stream mis-directed to wrong section of pedestal or if non-excreta components are disposed of via the toilet



Urine

Up to 88% of excreted nitrogen and 67% of phosphorus are excreted from the body in the urine stream (proportions are dependent on diet). Potassium and sulphate ions are also present (Mihelcic et al 2011).

- Low pathogen content
- Relatively low fouling potential for membrane treatment processes
- Small washwater volume to minimise dilution
- Waste concentrate from urine processing is sent to further dehydration and then combusted with dried faeces.
- Urine processing system incorporates a first stage screening step to remove faecal contamination



Washwater

Maintain faeces as dry as possible to reduce energy requirements for drying

Maintain urine as concentrated as possible

Minimise faecal contamination of urine (reduced pathogen content and potential for membrane fouling)

Divert soap and detergent products that could interfere with membrane treatment processes for urine

Washwater pre-treated before passing to appropriate stage of membrane system for urine treatment.

Waste concentrate from washwater pre-treatment is sent to further dehydration and then combusted with dried faeces.

Movement of washwater bowl under pedestal is interlocked with closing of toilet seat and will be interlocked with uncovering of the handwash basin – prevents accidental addition of water to the faeces stream. Manual hook mechanism for bowl will be provided to allow user to clean pedestal and still divert washwater.

Waste concentrate from washwater pre-treatment is sent to further dehydration and then combusted with dried faeces.

Faeces & solids

In low-income communities assumption that faeces has a relatively low in water content does not hold – therefore cannot rely on liquid-solid separation processes (e.g. sieves) to segregate urine from faeces streams.

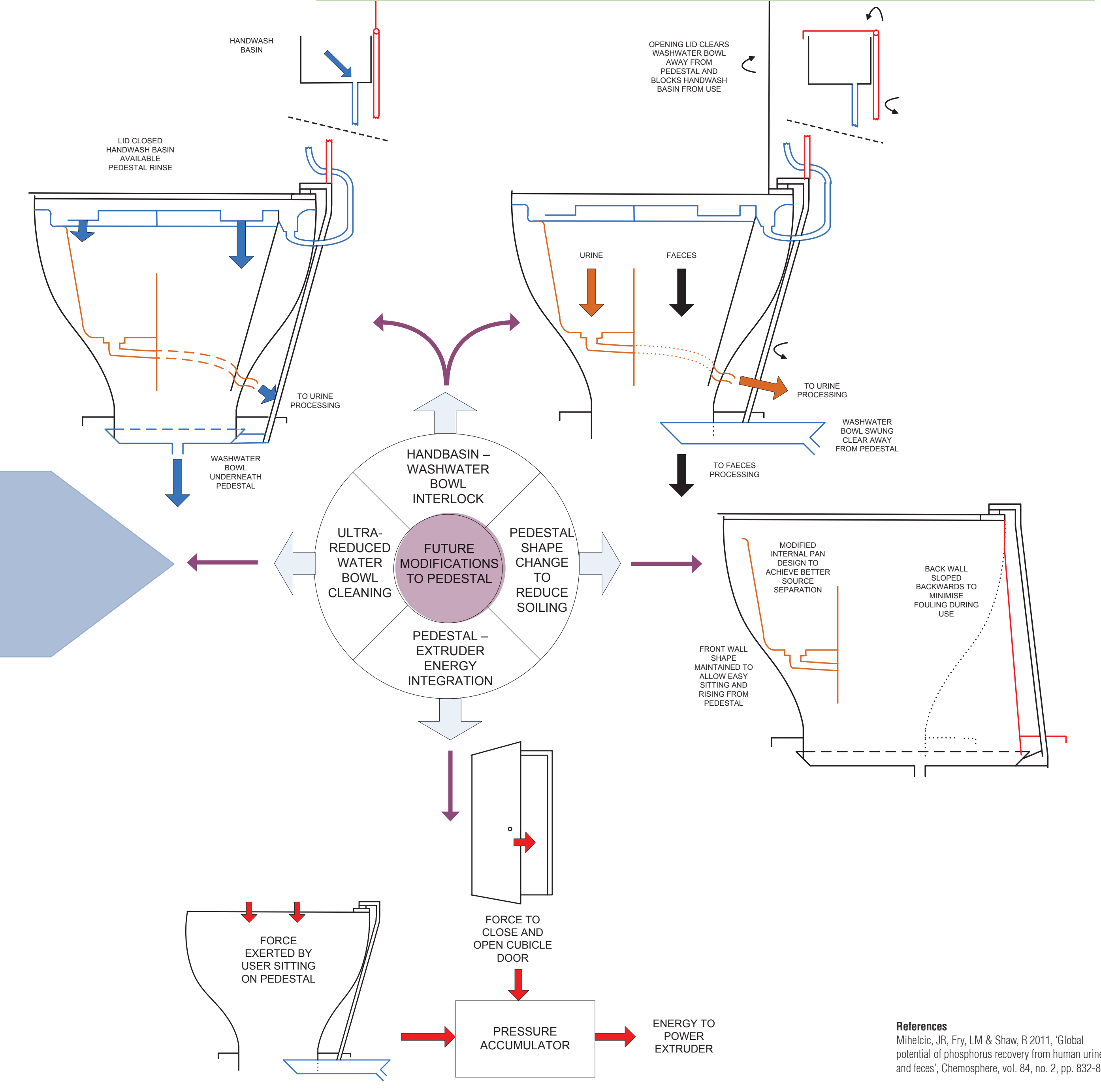
Segregation of the energy source (faeces) stream

Confine majority of pathogenic material to one stream

Receive waste solid streams from urine and washwater processing for combustion with dried faeces

For the community ablution block context assumption must be made that a variety of non-faecal solids will enter the toilet apart from toilet paper (e.g. newspaper, plastics, clothing) – these are separated at the extruder stage of the process.

PEDESTAL DEVELOPMENT



References
Mihelcic, J.R., Fry, J.M. & Shaw, R. 2011, 'Global potential of phosphorus recovery from human urine and faeces', Chemosphere, vol. 84, no. 2, pp. 832-839.