

# Aggregate Operators Best Management Practices Handbook

## PART II

### Chapter 5 - 2: Planning Modules

#### PROCESSING MODULE - PM

---

##### Table of Contents

|   |   |
|---|---|
| PROCESSING MODULE - PM .....                | 2 |
| Common Concerns: Aggregate Processing ..... | 2 |
| Addressing Processing Plant Concerns .....  | 2 |
| Processing Plant Location .....             | 2 |
| Plant Type .....                            | 2 |
| The Processing Plant Flow Sheet .....       | 3 |

##### Tables and Figures

|  |   |
|--|---|
| Table PM - 1: Basic types of processing plants .....   | 3 |
| Figure PM - 2: Example of a <i>Processing Plant Flow Sheet</i> for a 500 ton per hour (tph) plant. ....                      | 4 |
| Table PM - 3: Typical processing plant equipment and components and related potential noise,<br>dust and visual issues. .... | 5 |
| Table PM - 4: Concerns, requirements and by-products of aggregate processing plants.....                                     | 6 |

## PROCESSING MODULE - PM

### ***Common Concerns: Aggregate Processing***

The processing plant at an aggregate operation may include crushers, screens, wash plants, generators and conveyors, and is often the focal point for heavy equipment activity at the site. As a result, aggregate processing may cause concerns relating to noise, dust and visual impacts. This module will discuss how and where to set up processing facilities to minimize land disturbance and community and environmental concerns.

Process planning can identify changing plant needs, in order to coordinate improvements with the development of other site activities over the life of a mine. To identify these needs, processing planning should consider:

- extraction planning,
- stockpiling planning,
- stormwater & erosion control planning, and
- traffic planning.

### ***Addressing Processing Plant Concerns***

Processing of aggregate material can use a lot of water and energy, and may create undesirable noise, dust and visual impacts, and by-products such as sediment-laden water and wash-water fines. Reducing or mitigating processing plant concerns can start with the design of the processing plant and with equipment selection and layout. Table PM-3 lists various types of processing equipment, potential concerns associated with them, notes, pointers, and BMPs that can be used to address concerns. Table PM-4 lists some potential concerns and offers suggestions and BMP selections for mitigation.

Safety is an important factor in plant design. Individual equipment should have adequate guarding, conveyor rules should be established and followed, and operating protocols should be clearly established. Refer to the [Health, Safety and Reclamation Code](#) Section 6-8 for plant safety regulations.

### **Processing Plant Location**

The location of the processing plant should allow for the coordination of extraction, stockpiling, load-out facilities, available space and other strategies to contain noise, dust and visual impacts. As Tables PM-3 and PM-4 indicate, strategic location is a primary tool for mitigating processing plants, and sometimes-different factors must be balanced. For example, a high plant location will facilitate the directing and treating of stormwater, whereas low locations are advantageous when noise or dust may be a significant issue. Extraction planning will help determine if and where there will be in-pit crushing or whether a fixed primary crushing station will be used.

### **Plant Type**

Before starting to purchase equipment, an operator should determine what type of processing plant would provide the best balance between optimizing production and potential noise, dust and visual concerns. The basic types of plants are listed Table PM - 1.

**Table PM - 1: Basic types of processing plants.**

|   | <b>Processing Plant Type</b>     | <b>Description</b>   |
|---|----------------------------------|--|
| 1 | <b>Stationary Plant</b>          | <ul style="list-style-type: none"> <li>• buildings and infrastructures with concrete foundations</li> <li>• long-term and large operation</li> <li>• large space requirements</li> </ul>   |
| 2 | <b>Semi-fixed Plant</b>          | <ul style="list-style-type: none"> <li>• less than 10 year life expectancy</li> <li>• skid-mounted equipment and mobile conveyor systems</li> </ul>  |
| 3 | <b>Mobile Plant</b>              | <ul style="list-style-type: none"> <li>• used at different locations for in-pit processing during separate phases of the mine extraction plan</li> <li>• can also be used for smaller operations</li> <li>• equipment is rubber-tired or skid mounted</li> </ul> |
| 4 | <b>Seasonal / Contract Plant</b> | <ul style="list-style-type: none"> <li>• contract processing facility</li> <li>• seasonal or intermittent</li> <li>• rubber tired or skid mounted equipment</li> </ul>   |

After: Pit & Quarry Quarryology 101, Lesson 3 Plant Design / Components, Part 1, "Type of Plant".

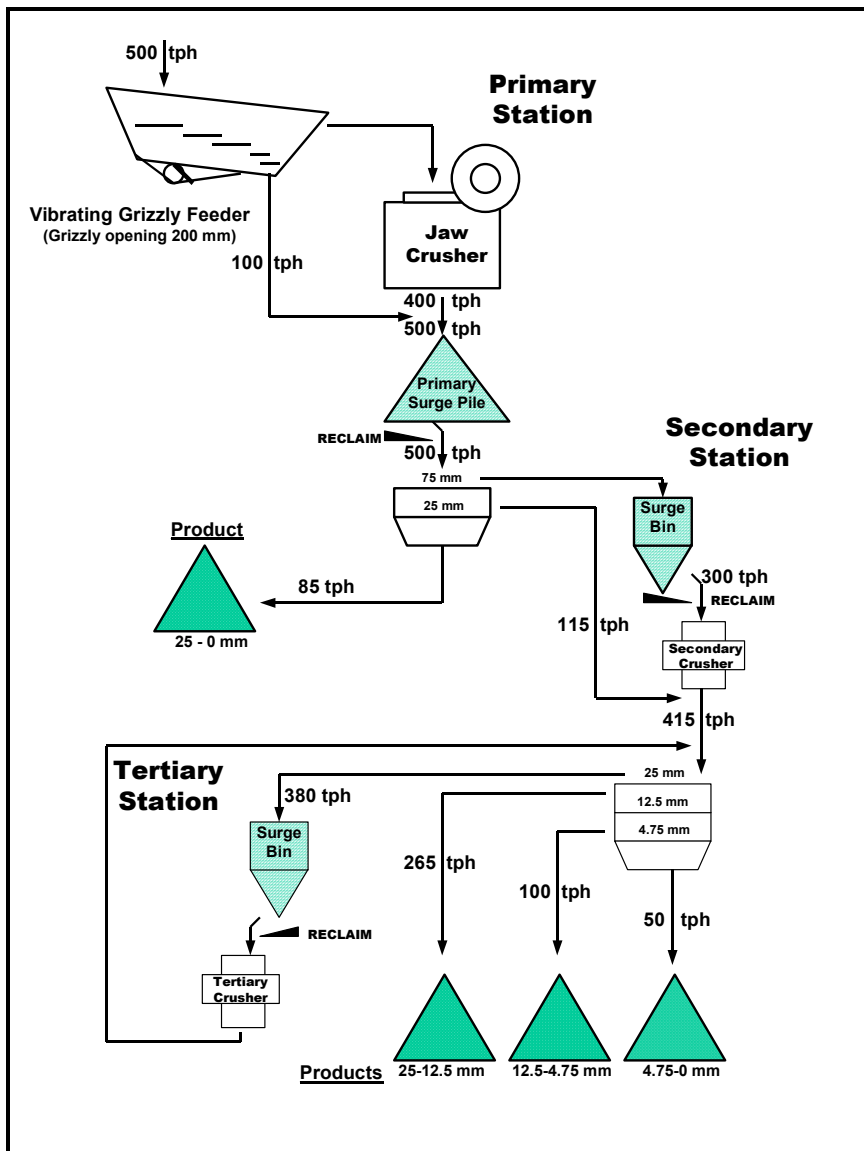
### **The Processing Plant Flow Sheet**

The selection of specific equipment with individual production capacities should be based on the type and estimated volume of processing proposed for the operation. This selection can be assisted using a *Processing Plant Flow Sheet*, as illustrated in Figure PM - 2. The *Flow Sheet* illustrates the "planned" configuration of machines, conveyors and chutes, and shows estimates of the tonnes-per-hour flow of each component. When putting together a *Processing Plant Flow Sheet*, an operator can begin to solve some of the following problems:

- What is the best plant type? (stationary, semi-fixed, mobile, or seasonal)
- What are the crusher requirements? (crusher required? contract required? size, type, power requirements, etc.)
- Should wet or dry processing be used?
- What types of screening will be required? (fractionation needs, screen types, volume, numbers of screens, sizes, etc.)
- Will sand screws be used?
- What are the washing requirements?
- How will surge piles be used? (where, how deposited, how big, reclaim equipment, etc.)

The *Processing Plant Flow Sheet* attempts to predict processing plant performance given the variability of the raw material feed, rates of feed and desired production and output rates. It can also help to predict the space requirements for equipment, stockpiles, support facilities and access. Pointers for equipment selection and planning notes are given in table PM-3 for many of the typical equipment types and components in an aggregate processing plant.

**Figure PM - 2: Example of a *Processing Plant Flow Sheet* for a 500 ton per hour (tph) plant.**



After: Bowers et al. 1990, figure 8.18, page 8-70.

**Table PM - 3: Typical processing plant equipment and components and related potential noise, dust and visual issues.**

| Component                | Description  | Issue   | Process Flow Sheet Pointers  | Planning Notes   | BMPs   |
|--------------------------|--|---|--|--|--|
| <b>Crusher</b>           | <ul style="list-style-type: none"> <li>reduces the size of material</li> </ul>   | <ul style="list-style-type: none"> <li>noise</li> <li>dust from feed and discharge</li> </ul>   | <ul style="list-style-type: none"> <li>make large size (&gt; 4 : 1) reductions in stages</li> <li>primary crushers are usually jaw crushers</li> </ul>   | <ul style="list-style-type: none"> <li>noise travels in uninterrupted lines of sight, and can reflect off barriers and buildings</li> <li>place crusher in hollow or low on the property</li> <li>use working face as noise barrier for primary crusher</li> <li>enclose or surround crushers with berms, walls or other sound barriers</li> <li>surround with or locate near thick vegetation</li> <li>water spray into the crusher feed can effectively reduce dust</li> </ul> | <ul style="list-style-type: none"> <li><a href="#">Berm</a></li> <li><a href="#">Drop Height</a></li> <li><a href="#">Dust Skirts</a></li> <li><a href="#">Equipment Selection</a></li> <li><a href="#">Fences</a></li> <li><a href="#">Lighting Management</a></li> <li><a href="#">Sinking the Plant</a></li> <li><a href="#">Water Spray</a></li> </ul> |
| <b>Screens</b>           | <ul style="list-style-type: none"> <li>separate aggregates into various sizes</li> </ul>   | <ul style="list-style-type: none"> <li>noise</li> <li>dust from feed and discharge</li> <li>wet screenings produces silt laden water</li> </ul> | <ul style="list-style-type: none"> <li>dry screening reduces product drying and water processing requirements, yet may require dust suppression</li> </ul>   | <ul style="list-style-type: none"> <li>polyurethane and rubber screens are quieter than wire cloth screens</li> </ul>  |  |
| <b>Conveyors</b>         | <ul style="list-style-type: none"> <li>transport aggregate on powered belts</li> </ul>   | <ul style="list-style-type: none"> <li>dust from feed and discharge</li> <li>visual</li> </ul>  | <ul style="list-style-type: none"> <li>variable height conveyors can limit stockpile segregation and dust</li> </ul>   | <ul style="list-style-type: none"> <li>dampen material to reduce dust at transfer points</li> <li>variable height conveyors may reduce dust generation and visual impacts</li> </ul>   |  |
| <b>Chutes</b>            | <ul style="list-style-type: none"> <li>direct falling aggregate into a feeder</li> </ul>   | <ul style="list-style-type: none"> <li>dust from feed and discharge</li> </ul>  | <ul style="list-style-type: none"> <li>gravity feed is controlled by material size and moisture content</li> </ul>   |  |  |
| <b>Grizzly</b>           | <ul style="list-style-type: none"> <li>static rejection of oversize</li> <li>removes fines to bypass primary crusher</li> </ul>                        | <ul style="list-style-type: none"> <li>dust</li> <li>noise</li> </ul>   | <ul style="list-style-type: none"> <li>commonly overloaded and inefficient</li> </ul>  |  |  |
| <b>Surge Pile</b>        | <ul style="list-style-type: none"> <li>isolates components of processing plant, smoothing out erratic production rates</li> </ul>                      | <ul style="list-style-type: none"> <li>dust</li> <li>noise</li> <li>appearance</li> </ul>   | <ul style="list-style-type: none"> <li>should be large enough to ensure no one piece of equipment overwhelms / undersupplies the next station</li> <li>large piles allow for operational flexibility, but are segregation-prone and require more space</li> </ul>      | <ul style="list-style-type: none"> <li>sprinklers should not be used on surge piles with automated recovery tunnels, as high moisture content may limit flow rates and processing efficiency (not an issue for front-end loader recovery)</li> </ul>   | <ul style="list-style-type: none"> <li><a href="#">Drop Height</a></li> <li><a href="#">Dust Skirts</a></li> <li><a href="#">Signage</a></li> </ul>  |
| <b>Transfer Points</b>   | <ul style="list-style-type: none"> <li>where a stream of aggregate, such as on a conveyor, makes an abrupt change in direction or elevation</li> </ul> | <ul style="list-style-type: none"> <li>dust</li> </ul>  |  | <ul style="list-style-type: none"> <li>hoods control exposure to wind and reduce dust</li> </ul>   | <ul style="list-style-type: none"> <li><a href="#">Drop Height</a></li> <li><a href="#">Fences</a></li> <li><a href="#">Water Spray</a></li> </ul>   |
| <b>Washing / Rinsing</b> | <ul style="list-style-type: none"> <li>rinsing material to remove fine particles to meet product specifications</li> </ul>                             | <ul style="list-style-type: none"> <li>silt-laden water</li> </ul>  | <ul style="list-style-type: none"> <li>budget for 10 - 40 litres per tph</li> <li>use proper high pressure nozzles</li> <li>keep material in thin layer to wash</li> <li>prior to washing, remove as many (dry) fines as possible</li> <li>pre-wet material</li> </ul> |  | <ul style="list-style-type: none"> <li><a href="#">Lighting Management</a></li> <li><a href="#">Settling Pond</a></li> </ul>   |
| <b>Settling Ponds</b>    | <ul style="list-style-type: none"> <li>recovery and disposal of suspended fines from wash water</li> </ul>   | <ul style="list-style-type: none"> <li>suspended load discharge</li> </ul>  | <ul style="list-style-type: none"> <li>keep storm water separate from processing water</li> </ul>  | <ul style="list-style-type: none"> <li>for decanting, closed circuit settling ponds require substantial land base, with periodic clean outs</li> <li>containment cells, clarifiers, and flocculants</li> </ul>   | <ul style="list-style-type: none"> <li><a href="#">Settling Pond</a></li> </ul>  |

**Table PM - 4: Concerns, requirements and by-products of aggregate processing plants.**

| Factor                 | Related Plan                         | Issue   | Mitigation   | BMPs   |
|------------------------|--------------------------------------|---|--|--|
| <b>Water Supply</b>    |                                      | <ul style="list-style-type: none"> <li>washing / rinsing can use 10 - 40 litres per tph, of which a significant portion is lost in processing</li> </ul>  | Makeup Water Options: <ul style="list-style-type: none"> <li>captured storm water</li> <li>water well</li> <li>municipal water</li> <li>water licence from local stream or lake</li> </ul>   |  |
| <b>Energy</b>          |                                      | <ul style="list-style-type: none"> <li>energy can be a major component of the cost per tonne of product</li> <li>mobile electric generating plants may be noisy and dusty</li> </ul>  | <ul style="list-style-type: none"> <li>purchase energy from a grid</li> <li>use enclosed plants with appropriate mufflers</li> </ul>   |  |
| <b>Noise</b>           | <b>Noise Plan</b>                    | noise may be generated by: <ul style="list-style-type: none"> <li>power plants</li> <li>rock impacting metal</li> <li>equipment noise (crushers)</li> <li>loaders used to supply the plant</li> <li>load out facilities &amp; trucks</li> </ul> | <ul style="list-style-type: none"> <li>use rock on rock transfer points</li> <li>use rubber or polyurethane products for screens, chutes and truck liners</li> <li>use low profile processing systems so noise is absorbed or blocked by the landscape</li> <li>use non-audible back-up alarms (<a href="#">HSRC Section 12.31</a>)</li> </ul> | <ul style="list-style-type: none"> <li><a href="#">Berm</a></li> <li><a href="#">Buffer Zone</a></li> <li><a href="#">Fences</a></li> <li><a href="#">Sinking the Plant</a></li> </ul>       |
| <b>Dust</b>            | <b>Dust Plan</b>                     | potential sources of dust include: <ul style="list-style-type: none"> <li>roads</li> <li>feeds and discharges for conveyors, crushers, screens</li> <li>front end loaders moving material,</li> <li>loadout facilities</li> </ul>               | <ul style="list-style-type: none"> <li>water roads or use surfactants (calcium chloride)</li> <li>wheel washer</li> <li>wash down trucks</li> <li>pave high use areas</li> <li>install bag house</li> <li>water sprays</li> <li>wind breaks</li> </ul>   | <ul style="list-style-type: none"> <li><a href="#">Buffer Zone</a></li> <li><a href="#">Drop Height</a></li> <li><a href="#">Dust Skirts</a></li> <li><a href="#">Water Spray</a></li> </ul> |
| <b>Visual</b>          | <b>Visual Landscape Plan</b>         | <ul style="list-style-type: none"> <li>processing facilities may be less attractive than overall surroundings</li> </ul>  | <ul style="list-style-type: none"> <li>low profile processing systems</li> <li>use downcast lighting</li> <li>berms for screening</li> <li>vegetation cover to blend in with native vegetation</li> <li>select a location which is hidden by local topography</li> </ul>   | <ul style="list-style-type: none"> <li><a href="#">Berm</a></li> <li><a href="#">Buffer Zone</a></li> <li><a href="#">Fences</a></li> <li><a href="#">Lighting Management</a></li> </ul>     |
| <b>Water Treatment</b> | <b>Processing Plan</b>               | <ul style="list-style-type: none"> <li>process water is heavily silt-laden,</li> <li>in very high rainfall locations, periodic discharge may be necessary</li> </ul>  | <ul style="list-style-type: none"> <li>closed circuit settling ponds for decanting (requiring substantial land base, with periodic clean outs)</li> <li>containment cells</li> <li>clarifiers</li> <li>approved flocculants</li> <li>dilute occasional discharge with stormwater</li> </ul>  | <ul style="list-style-type: none"> <li><a href="#">Settling Pond</a></li> </ul>  |
| <b>Silt</b>            | <b>By-product and Recycling Plan</b> | <ul style="list-style-type: none"> <li>recovery and disposal of fines from settling pond, retention basin and other sediment traps such as check dams</li> </ul>  | <ul style="list-style-type: none"> <li>remineralization as an agricultural supplement</li> </ul>   |  |
| <b>Stormwater</b>      | <b>Stormwater Plan</b>               | <ul style="list-style-type: none"> <li>stormwater may cause erosion and deposition of fine sediment in local waterways</li> </ul>   | <ul style="list-style-type: none"> <li>place processing plant in a locally high and dry location</li> <li>wash down equipment to prevent rain water siltation off equipment surfaces</li> </ul>  | <ul style="list-style-type: none"> <li><a href="#">Ditches</a></li> <li><a href="#">Retention Basin</a></li> </ul>   |

