付属資料5

ガイドラインVol. 4 汚泥の処理処分

付属資料５　ガイドラインVol.4　汚泥の処理処分

水処理で発生する汚泥は、含水率 98～99%で、流入下水量の 1～2%程度発生し、有機物を多量に含み、放置すると腐敗して悪臭を発生する。また、衛生的にも好ましくないので汚泥を減容・安定化したうえで、利用や埋立を行うために汚泥処理を必要とする。

通常、汚泥の性状は．水分のほか自然石に近い無機物の組成と肥効性のある有機物とで構成され、かつ、有機物当りでは石炭に近い発熱量を有する有用な資源である。このような特性を有する汚泥は、緑農地利用又は建設資材やエネルギー利用等の有効利用を行うことが最も望ましい処理の形態である。

1　汚泥処理プロセス

1.1　概説

汚泥処理は、量の減少（水分除去)、固形物の減少、質的安定化、利用という目的のために行われるが、それらに対応する単位プロセスは以下のとおりである。

量の減少：　濃縮、脱水、乾燥
固形物の減少：　消化、焼却、溶融
質的安定化：　嫌気性消化、コンポスト化、焼却、熔融

汚泥処理施設は、個々の処理プロセスを組合せたシステムであり、計画に当たっては、その組み合わせが重要である

処理方法は、濃縮、消化、脱水、焼却等のプロセスを種々組み合わせて用いるが、この組み合わせは、汚泥の有効利用や埋立等、最終的な利用・処分を想定し、それに適合した方式とする。その選択は、処理汚泥量や汚泥性状、利用・処分の形態、処理技術の動向、環境条件、地域の地理的条件、将来性及び安定性等から定める。選択に当たっての技術上の留意点等は、次のとおりである。

汚泥濃縮は、水処理施設で発生した低濃度の汚泥を濃縮し、後続の消化、脱水等の処理を効率よく行うのに重要であるが、特に水温が高いと汚泥が腐放しやすく、濃縮性が低下する。難濃縮性の余剰汚泥の濃縮法として、浮上濃縮（常圧浮上及び加圧浮上)、遠心濃縮等の機械濃縮があるが、動力費等の増加につながるため十分な検討が必要である。

消化に際しては、汚泥消化タンクの維持管理を適切に行い、消化率を向上させて消化ガスの発生を促進させ、消化ガスの有効利用を図らなければならないが、効率的に消化を行うためには、高濃度の汚泥を消化タンクに投入することが望ましい。嫌気性消化工程では、汚泥中に取り込まれていたりんは脱離液中に放出され、返流されて下水処理系でのりん負荷量が増大することに留意する必要である。消化ガスは、加温用燃料、発電用燃料等として利用されている。

汚泥脱水は、脱水汚泥含水率を低下させることが重要な課題である。従前は、真空ろ過

機等の無機凝集剤使用の脱水機が多用されていた。しかし、近年は、薬品添加に伴う脱水汚泥量増大の抑制、維持管理の容易さ、低含水率化、固形物回収率の向上等の要求、更に、新しい有機凝集剤の開発とあいまって、遠心脱水機等の有機凝集剤使用の脱水機が用いられている。

汚泥乾燥は、後続の処理工程の効率化・安定化を図るために必要に応じて採用される。乾燥方法には自然エネルギーを利用する方法と機械を利用する方法があるが、機械による乾燥による乾燥方式の場合には多くのエネルギーを要するため、前段の脱水工程においてできる限り水分除去を図ることが重要である。また、汚泥乾燥から生じる排ガスには高濃度の臭気が含まれるため、その対策も必要である。

汚泥焼却では、以前は技術的に確立している多段焼却炉が利用されてきたが、脱水汚泥性状の変化、臭気発生の抑制、廃熱利用、焼却灰の利用等から、近年は、流動焼却炉の採用が大半を占めている。また、排ガス中の廃熱は、燃料の節約を目的として回収され、燃焼用空気の予熱、脱水汚泥の乾燥用等に利用されている。

1.2 主な汚泥処理方式

主な汚泥処理方式を**図 1.1** に示す。

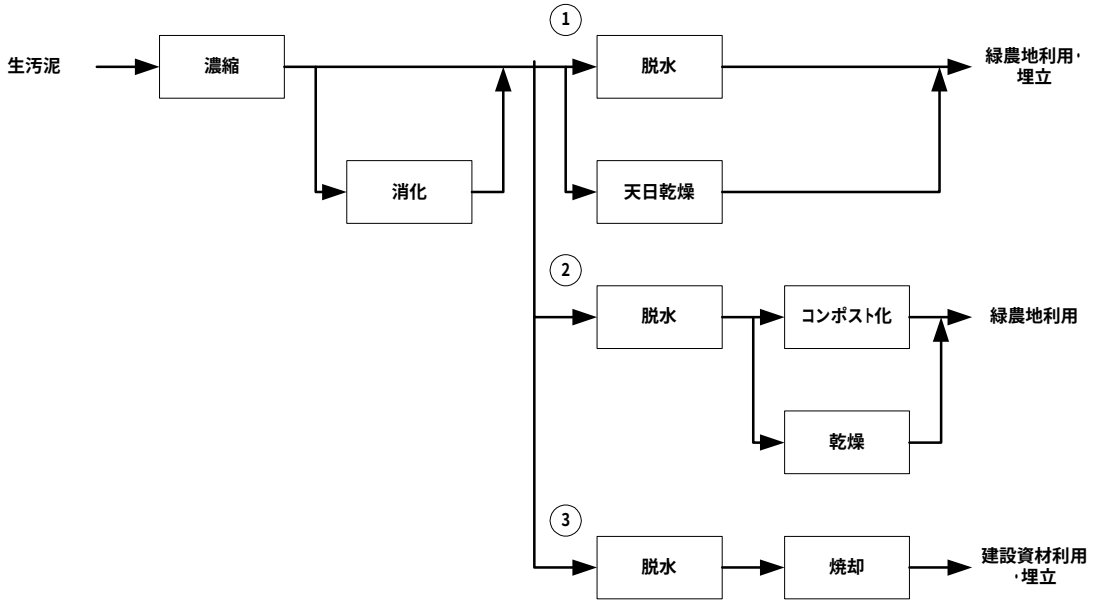


図 1.1 代表的な汚泥処理プロセスの例

①の方法は、脱水汚泥のまま緑農地への利用もしくは埋立するものである。この場合の緑農地利用については、簡便で安価なメリットはあるが、細菌等の安全性の問題があるため、消化工程を導入して質的安定化を図ることが望ましい。また、この処理方式には、臭気の発生や輸送に係る問題もあるため、周辺環境の配慮が必要である。特に、天日乾燥を採用する場合は慎重な対応が求められる。

②の方法は、脱水汚泥を加工し、肥料として緑農地へ利用する方法で、安全性や取扱い性を良くするためコンポスト化又は機械乾燥により粒状等の乾燥汚泥とするもので、緑農

地利用として望ましい形態である。

③の方法は、脱水汚泥を焼却まで行い、灰又はスラグを建設資材等として有効利用するか、もしくは埋立する場合である。建設資材としての利用については、焼却灰では、セメント原料、土質改良材、路盤材、軽量骨材、れんが、タイル、透水性ブロック、コンクリート骨材、陶管等への利用が実用化されている。埋立には、陸上埋立と水面埋立とがある。

1.3 処理プロセスの選定

処理プロセスの選定に当たっては、(1)処理計画汚泥量及び汚泥性状、(2)安定的な利用・処分形態、(3)立地条件、(4)環境対策、の各項目に留意し、単位プロセスの組合せを決めるが、それぞれに複数の方式や機種が存在するため、検討に当たっては、数多くの組合せが考えられる。

したがって、想定される組み合わせごとの建設費、維持管理費、維持管理性等の評価をもとに総合的に判断して、最適な処理プロセスを選定する必要がある。

下水汚泥発生量は下水道整備が進むにつれて今後も増大していくことが予想される。汚泥の処理処分を取り巻く周辺環境が変化して状況においては、下水汚泥の効率的処理及び有効利用を推進していくためには総合的、計画的な取組が必要である。

1.4 汚泥の集約処理

汚泥処理の経済性、エネルギー回収及び資源化と利用に当たっての効率性や処理場の立地条件等から、複数箇所からの汚泥を集約して処理する集約処理は、スケールメリットが働き、建設コスト及び維持管理コストが有利になる。特に、維持管理に係る人件費が大幅に節減される。

集約処理のための汚泥輸送方法には，脱水汚泥の車両、液状汚泥の車両輸送や管路輸送等がある。

1.5 小規模下水処理場における汚泥処理

小規模下水道事業においては、維持管理に占める人件費の割合が大きくなるため、維持管理が容易で、経済的なものとする必要があることから、複数の処理場を対象とした汚泥処理・利用の共同化を積極的に行うことが望ましい。

移動式汚泥処理施設により巡回処理を行う場合は、発生汚泥量、汚泥貯留能力、施設の移動及び稼働時間等を考慮して汚泥処理の方法を定める。

施設巡回型汚泥処理は、移動脱水車のように（各処理場には、汚泥処理施設専任の維持管理技術者が常駐せず)、脱水機（場合によっては濃縮機も）を車両に搭載し、施設運転技術者と共に各処理場を巡回する方法で汚泥処理を行い、維持管理費の軽減を図るものである。

施設巡回型汚泥処理では、各処理場ごとに脱水施設を設ける必要はなく、全体の建設費が安価となるが、同一の脱水施設が各処理場を巡回するため、汚泥の量や質の変化に対する適応性が限定される。

施設巡回型汚泥処理の採用に当たっては、対象処理場の数と処理場間距離並びに施設移動ルート、各処理場の規模と処理方式及び投入汚泥の性状を把握して、巡回に用いる汚泥処理施設規模、巡回頻度、移動時間、処理時間、処理後の汚泥の量と性状等を予測・検討する必要がある。

また、脱水工程が数日に 1 回の間欠運転となるため、汚泥の貯留が必要である。その他に、移動式汚泥処理施設の電源や使用薬品及び一度に発生する分離液の処理等に関しても十分検討する必要がある。

2 汚泥輸送

2.1 概説

汚泥の輸送は、輸送の目的のほか輸送する汚泥の質と量及び周辺環境を十分考慮し、最も経済的な輸送方法を選択することが重要である。汚泥を液状で輸送するときは送泥管やバキューム車で行われ、脱水汚泥等の固体状汚泥で輸送するときはトラックで行われる。管路輸送方式は汚泥の大量輸送が可能であるが、送泥施設の建設、絶持管理が必要となる。車両輸送方式では液状汚泥の大量輸送は不向きであるが、個別の処理場において特別な施設が不要のため小規模下水道に適する。

管路輸送方式で液状の汚泥を送泥するときはできるだけ新鮮な汚泥を速やかに送ることが重要で、施設間の連携を円滑にするため、通常、中継機能を有する汚泥ポンプや汚泥貯留タンクが設けられる。

2.2 管路輸送方式の設計基準

管路輸送方式の送泥管は、次の各項を考慮して定める。

1) 送泥管は短距離の場合 1 条を原則とするが、長距離となる場合は原則として 2 条とする。
2) 材質は、ダクタイル鋳鉄管等の堅固で耐久性を有するものとする。
3) 管内流速は、1.0～1.5 m/s を標準とし、管径は閉そくを避けるため、150 mm 程度とする。
4) 必要に応じて管内の洗浄装置を設ける。

3 汚泥濃縮

3.1 概説

汚泥濃縮の果たす役割は、水処理施設で発生した低濃度の汚泥を濃縮し、その後に続く汚泥消化や汚泥脱水を効果的に機能させることである。濃縮する汚泥には、最初沈殿池で発生する最初沈殿地汚泥と最終沈殿地で発生する余剰汚泥とがある。

汚泥濃縮は、濃縮の方法によって重力濃縮、浮上濃縮及び遠心濃縮の 3 種類に大別できる。

(1) 重力濃縮

重力濃縮は、タンク内に汚泥を滞留させ、自然の重力を利用して濃縮を行い、底部に堆積した濃縮汚泥を汚泥かき寄せ機によって引抜き口に集める。

(2) 浮上濃縮

浮上濃縮には、加圧浮上濃縮と常圧浮上濃縮があり、これまでは加圧浮上濃縮が多く採用されていたが、近年、固形物回収率が高く、装置がコンパクトであり、また、高速回転体や圧力の高いものがないことから補修頻度が少ない常圧浮上濃縮が小規模処理場を中心に急速に普及してきている。浮上濃縮を用いる場合は、重力濃縮では濃縮性の悪い余剰汚泥等を対象とすることが多い。

加圧浮上濃縮は、汚泥の粒子に微細気泡を付着させ、汚泥の水に対する見掛け比重を小さくして、浮上分離させるものである。

常圧浮上濃縮は．起泡助剤の添加により生成した気泡と汚泥中の固形物とを混合装置で高分子凝集剤の添加により吸着させ、汚泥を浮力により浮上濃縮させるものである。

(3) 遠心濃縮

遠心濃縮は、高遠心力の場において固液分離を行い、汚泥の濃縮を行うものである。遠心濃縮機は、重力濃縮しにくい余剰汚泥でも短時間で 4%程度に濃縮することが可能である。設置面積も重力濃縮に比べて小さい。しかし、消費電力は、他の濃縮法に比べて最も大きい。

汚泥の濃縮が不十分なときは、あとの汚泥処理の効率低下を招くばかりでなくー懸濁物を多量に含んだ分離液が水処理施設に戻り、処理水の水質悪化の原因となることがある。このため、重力濃縮しにくい余剰汚泥等は遠心濃縮機や浮上濃縮タンクなどで機械濃縮するケースが増加しつつある。特に濃縮汚泥の含水率が 98%以上となった場合には、分離濃縮について検討することが必要である。

また、汚泥の集約処理を行う場合は、性状の異なる汚泥を処理することになるので、機械濃縮設備のような汚泥の強制濃縮プロセスが不可欠となってきている。
なお、濃縮に先立ち前処理として、除砂及び除塵設備を設けることが望ましい。

3.2 設計基準

設計基準を**表 3.1** に示す。

表 3.1 濃縮方法と設計基準

濃縮方法	設計基準	備考
重力濃縮	● 形状は、原則として円形とする。 ● 数は、原則として 2 基以上とする ● 固形物負荷は 60～90 kg･ds/(m^2･d)とする。 ● タンクの有効水深は、4 m 程度とする。	
加圧浮上濃縮	● 形状は、円形、正方形又は長方形とする。 ● 数は、原則として 2 基以上とする。 ● 固形物負荷は 100～120 kg･ds/(m^2･d）、固形物回収率は 85～95%を標準とする。 ● タンクの有効水深は、4.0～5.0 m を標準とする。	加圧浮上タンク、加圧ポンプ、空気溶解タンクなどで構成される。
常圧浮上濃縮	● 形状は、原則として円形とする。 ● 数は、原則として 2 基以上とする。 ● 固形物負荷は 25 kg･ds/(m^2･h)程度、固形物回収率は 95%以上を標準とする。 ● タンクの有効水深は、4 m 程度とする。	加圧浮上タンク、起泡供給・混合装置、薬品供給装置などで構成される。
遠心濃縮	● 台数は、原則として 2 台以上設置する。 ● 濃縮汚泥の含水率は 96%程度、固形物回収率は 85～95%を標準とする。	遠心濃縮機、汚泥供給タンク、汚泥供給ポンプなどで構成される。

4 汚泥消化

4.1 概説

消化には、嫌気性消化と好気性消化の 2 方式があり、両者とも微生物による汚泥中の有機物の分解･安定化を主目的としている。好気性消化は、一部の小規模な処理場あるいは供用開始まもない処理場で暫定的に採用されている。嫌気性消化は、嫌気的状態に保たれた汚泥消化タンク内で、有機物を嫌気性微生物の働きで低分子化、液化及びガス化する処理法である。この結果、汚泥量の減少と質の安定化、また、衛生面の安全性が図れる。このため、消化汚泥は、ケーキ状で最終処分が可能である。

また、汚泥量が減少することにより、脱水、焼却等の後続の処理設備の容量の縮小化が可能となる。

有機物が分解を受けたあと、消化汚泥は汚泥脱水設備に送られる。また、2 段消化方式により脱離液が発生する場合は、一般的に脱離液は水処理施設に送られ処理される。一方、嫌気性消化の副産物として生成するメタンを主成分とした消化ガスは脱硫後、加温用燃料、焼却炉の補助燃料として利用される。

汚泥を汚泥消化タンクで消化温度に応じて適当な消化日数をとると、投入汚泥中の有機物は液化及びガス化により 40～60%減少する。

4.2 設計基準

設計基準を**表 4.1** に示す。

表 4.1 好気性消化タンク及び嫌気性消化タンクの設計基準

項目	単位	設計基準	
		好気性消化	嫌気性消化
最小タンク数	No.	2	2
最小固形物滞留時間	Days	10	18
有機物負荷	$KgVS/m^3.d$	1.6 – 4.8	0.8 – 1.6
供給固形物濃度	%	2	2 - 6
撹拌方式		エアレータ 散気装置	ガス吹き込み 機械撹拌 ポンプ撹拌
最小水深	m	3	7.5
タンク形状		円筒状 矩形	円筒状 卵形
最大タンク寸法	m	径 25 長さ 25	径 25
溶存酸素	mg/L	1 - 2	-

5 汚泥脱水

5.1 概説

一般に濃縮汚泥あるいは消化汚泥の含水率は 96～98%の状態にあり、この汚泥を含水率 80%程度に脱水すると、液状のものがいわゆるケーキ状となり．汚泥容量は 1/5～1/10 程度に減少し、取扱いが容易になる。

脱水には、ろ過式と遠心分離式とがあり、ろ過式はろ過圧やろ過方式によって、ベルトプレスろ過磯・加圧ろ過磯・真空ろ過機・スクリュープレス脱水機がある。このうち、加圧ろ過機及び真空ろ過機は、他の方式にくらべ脱水性能や維持管理性（特に脱水汚泥の増加）等において劣っているため、最近は新設での採用例はほとんどない。また、スクリュープレス脱水機は小規模な施設で採用されつつある。

ベルトプレスろ過機は凝集汚泥を連続走行するろ布で重力ろ過後、2 本のロール間に挟み込み転圧脱水する。

遠心脱水機は、凝集汚泥を高速回転する円筒ボウル内へ投入し 2000 G 程度の遠心力場で固液分離し脱水する。である

ベルトプレスろ過機、遠心脱水機ともに有機凝集剤で汚泥を調質し、脱水性の良い凝集フロックを生成し脱水する。最近は無機凝集剤と有機凝集剤を併用する場合もある。

5.2 設計基準

基準を**表 5.1** に示す。

表 5.1 脱水方法と設計基準

脱水方法	設計基準	備考
ベルトプレスろ過機	(1) 容量及び台数は、次式によって求める。 $B = \frac{1{,}000\ (1 - w/100) \cdot Q}{V \cdot t}$ ここに, B：必要有効ろ布幅 (m) w：汚泥の含水率 (%) Q：供給汚泥量 (m3/d) V：ろ過速度 (kg/(m•h)) t：1 日の運転時間 (h/d) $N = \frac{B}{b}$ ここに, N：台数（台） b：1 台当りの有効ろ布幅（m/台） (2) 脱水汚泥の含水率は、標準型で 76～83%、高効率型で 76～80%程度を標準とする。 (3) ろ布は，目詰りしにくく，耐久性のあるものを用いる。 (4) ろ布の速度及びろ布緊張圧は，可変できるものとする。 (5) 防臭対策としてカバーを考慮する	ベルトプレスろ過機、薬品注入装置、汚泥貯留タンク、汚泥供給タンク、凝集混和タンクなどより構成される。
遠心濃縮機	(1) 容量及び台数は、次式によって求める。 $N = \frac{Q}{q \cdot t}$ ここに、 N：台数（台） Q：供給汚泥量（m^3/d） q：1 台当たりの容量（m^3/h） t：1 日の運転時間（h/d） (2) 脱水汚泥の含水率は、80～84%、高効率型で 77～81%を標準とする。 (3) スクリュー部等の材質は、耐久性のあるものを用いる。 (4) 差速は可変できるようにする。	遠心脱水機、薬品注入装置、破砕機、汚泥貯留タンク、汚泥供給タンクなどより構成される。
スクリュープレス	(1) 容量及び台数は、次式によって求める。 $N = \frac{Q}{q \cdot t}$ ここに、 N：台数（台） Q：供給汚泥量（m^3/d） q：1 台当たりの容量（m^3/h） t：1 日の運転時間（h/d） (2) 脱水汚泥の含水率は、74～83%を標準とする。 (3) スクリュー部の材質は、耐久性のあるものを用いる。	スクリュープレスは円筒状スクリーン、スクリュー羽根で構成され、両者の間の容積は脱水汚泥の出口方向に向かって縮小されている。

6 汚泥乾燥

汚泥乾燥施設は緑農地利用等の有効利用を目的とした水分調整、焼却処理の省エネルギー化や安定化等、様々な用途に適した取扱い性の向上等を目的として採用される。

6.1 天日乾燥

6.1.1 概説

天日乾燥は、主としで自然のエネルギーを利用し、脱水助剤を必要としないため経済的であり、機械脱水にみられるような煩雑な維持管理が不要であるが、反面乾燥汚泥のかき取りなどに人手がかかる。

小規模処理場においては、広い土地が確保できる可能性が高くて周辺への影響が余り懸念されない場所であれば、天日乾燥による汚泥乾燥床の採用が考えられる。

一般に、汚泥乾燥床は、消化汚泥に適しているとされている。生汚泥や消化の不十分な汚泥に対しては、消化汚泥よりも更に広大な乾燥床が必要となり、かつ、臭気やはえ（蝿）等の発生等による二次公害が懸念される。このような場合には、石灰による汚泥の安定化並びに悪臭防止を図る石灰や凝集剤の使用により、透水速度を向上させるなどの改善策が必要となる。

汚泥乾燥床の必要面積は、投入汚泥性状・量、当該地域の気象条件を考慮した乾燥日数、投入固形物負荷、投入厚等により定めるものとするが、投入固形物負荷は原則として 4.0 kg/m^2 以内とする。

汚泥乾燥床の炉床は、原則としては砂利層（200～300mm 程度）と粗砂層（150～300mm 程度、砂粒径 0.7～2.0 mm）により構成するものとし、砂利層下部には、ろ液の排水を考慮して適切なこう配を設け、その最深部には 100～200 mm 程度の有孔管等による集水施設（こう配 10‰程度）を設ける。

また、降雨による影響を避けるためには、経済性や耐久性の検討を行ったうえで、必要に応じて定置式又は移動式の屋根を設置する。

乾燥床の施設計画に当たっては、乾燥汚泥のかき取りや搬出、補充用ろ床材の搬入方法等について十分な検討が必要である。

6.1.2 設計基準

天日乾燥床における汚泥種別ごとの標準必要面積を**表 6.1** に示す。

表 6.1 天日乾燥床 標準必要面積

汚泥種別	面積 (m^2/人)	固形物負荷 (kg dry solids/m^2・yr)
一段消化汚泥	0.1	120 – 150
二段消化汚泥（生物膜法）	0.12 – 0.16	90 – 120
二段消化汚泥（活性汚泥法）	0.16 – 0.23	60 – 100
二段消化汚泥（凝集材添加）	0.19 – 0.23	100 – 160

6.2 スラッジラグーン

6.2.1 概説

消化汚泥の乾燥を目的として、乾燥床の代替としてラグーンが用いられることがある。ラグーンは臭気の問題等、周辺環境への影響から、脱水汚泥、石灰系汚泥、並びに多量の脱離液を伴う汚泥等には適さない。ラグーンの機能は乾燥床と同様であり、汚泥の脱水性には気候（気温、降雨量）の影響が大きい。ラグーンにおいては、今後いっそう厳しくなる環境及び地下水基準により、地下排水管や地下浸透による脱水には限界があるため、蒸発（気化）率の高い地域において最も適する。ラグーン下部に飲料水用の帯水層が存在する場合には、ラグーン内部をライニングするなど、地下浸透への対策も必要である。

汚泥の投入は、汚泥がラグーン内に均等配分されるよう配慮されなければならない。有効水深は、0.75～1.25m程度とし、蒸発（気化）がラグーンにおける主要な脱水メカニズムである。通常、脱離液排水のための設備が設置され、脱離液は水処理施設へ戻される。また堆積した汚泥は機械的に除去され、通常、固形物濃度 20～30%である。ラグーンの使用サイクルは数ヶ月から数年まで幅があるが、通常、1.5 年程度の投入期間に対し 0.5 年程度の休止期間を取る。固形物負荷はラグーン容量に対し 36～39 kg/m^3・yr である。ラグーンは、

清掃及び緊急時の対応等を考慮し、原則として 2 池以上設置する。

6.2.2 設計基準

スラッジラグーンの設計基準を**表 6.2** に示す。

表 6.2 スラッジラグーンの諸元

項 目	諸 元
池　数	2 池 以上
有効水深	0.75 – 1.25 m
固形物負荷	36 – 39 kg/m^3・yr

7 汚泥焼却

7.1 概説

汚泥焼却は、脱水汚泥を大気圧下で焼却に必要な理論空気量以上の空気を供給して燃焼させるものである。汚泥を焼却する目的は、減量化と安定化である。汚泥中の有機物の燃焼と水分の蒸発により大幅に減量化されると同時に、焼却残さとして無機物である灰しか残らないことから安定化する。

汚泥焼却炉には、その構造から流動焼却炉、多段焼却炉、階段式ストーカ炉、回転乾燥焼却炉などがある。近年は、流動焼却炉の採用が圧倒的に多い。

汚泥焼却施設の計画に当たっては、汚泥処理方式及び最終処分方法を検討するとともに、処理場の立地条件、経済性、運転操作の難易、安全性、環境対策等を考慮する。

流動焼却炉の特徴は次のとおりである。

1) 焼却効率が高く未燃分が極めて少ない。
2) 少量の過剰空気（空気比 1.3 程度）での運転操作が可能である。
3) 炉内に機械的な可動部分がないため、絶持管理が容易である。
4) 炉内温度の自動制御、熱回収が容易である。
5) 炉の排ガス温度が臭気分解温度以上で制御されるため、排ガスの臭気対策を別途考慮する必要はない。
6) 流動媒体の蓄熱量が大きいため、短期間停止の場合立ち上げ時に始動用バーナー運転が不要である。間欠運転を行っても機能上大きな支障はない。

流動焼却炉は、一般に立形中空円筒形で、炉の内部はウィンドボックス、流動層及びフリーボードからなり、炉本体は耐火れんがなどを内張りした鋼板製シェル構造によって構成される。流動層の底部には空気分散板が配列され、流動用空気の均一分散及び炉の停止時における流動媒体のウィンドボックスへの落下防止を図っている。

炉内の流動層を形成する流動媒体（一般には珪砂）は、ウィンドボックスから吹巻上げられた空気によって水の沸騰状態のような挙動をしながら炉内を流動し、吹き込まれる補助燃料によって熱せられる。

炉に供給された脱水汚泥は、流動層内の流動媒体と接触し、かくはん効果を伴った急激な熱伝達を受け、水分の蒸発及び汚泥の粒子の燃焼分解が起こる。燃焼温度は、850℃程度である。燃焼後の焼却灰は、フリーボード部へと舞い上がり、そこを通過する 4～6 秒の間に燃え残りの可燃物と流動層において揮発した可燃ガスとが燃え尽くされる。炉から排出する焼却灰は約 50～300μm の細かい粒子となり、燃焼ガスとともに炉から飛び出し集塵装置によって捕集される。

流動焼却炉は、排ガスが高温となることから、熱効率を高めるために熱回収が行われている。また、排ガス中の臭気成分は、熱によって分解されるので、一般には脱臭装置を必要としない。流動焼却炉は、原則として連続運転とするが、流動媒体の熱容量が大きく、1～2 日程度炉を休止させても炉内温度降下が緩やかであるため、耐火材等に悪影響を与えることが少なく、間欠運転も容易である。

7.2 設計基準

処理規模及び基数は、次の各項を考慮して定める。

1) 処理汚泥量の年次変化を考慮する。
2) 汚泥性状の年間変動及び稼働率を見込み、処理規模を決定する。
3) 定期点検時及び焼却設備停止時に対応するため、基数は原則とし複数化する。
4) 一時的な負荷変動に対応するため、機器に余裕率を見込む。
5) 設備更新時の対応について考慮しておく。

8. 汚泥利用

今後、下水道普及率の向上等に伴い、下水汚泥発生量は更に増加するものと考えられる。こうした下水汚泥の処理・処分を取り巻く周辺環境が変化する中で、今後は、下水汚泥の効率的処理及び有効利用を総合的・計画的に推進する取組みが一層求められる。

8.1 緑農地利用（コンポスト）

8.1.1 概説

下水汚泥は、窒素やりんの肥効成分のほか、各種の有機物や無機物で構成されていることから緑農地への有機質補給資材としての利用価値は高い。

下水汚泥の緑農地利用形態として、下水汚泥コンポスト、乾燥汚泥、脱水汚泥、焼却灰等があるが、肥効成分、取扱いやすさ、衛生面を考慮すると、下水汚泥コンポストは望ましい方法である。

下水汚泥のコンポスト化(堆肥化)とは、下水汚泥中の易分解性有機物を好気性雰囲気において微生物によって分解(又は発酵という)させて、緑農地に利用可能な形態・性状までに安定化することをいう。

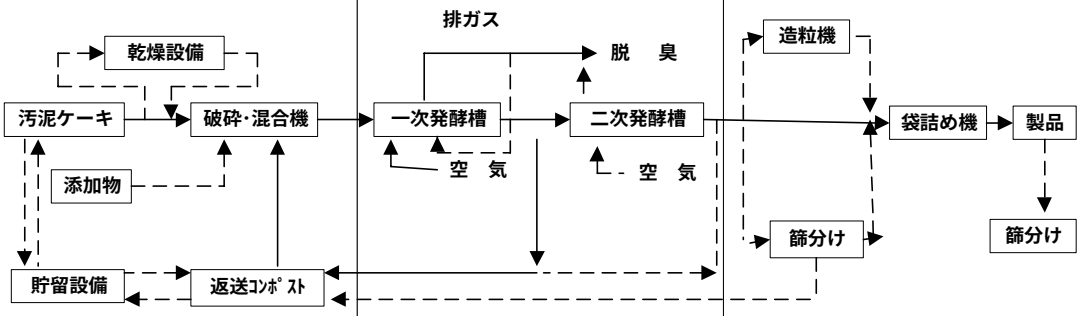
コンポスト化施設の基本プロセスと主要設備を**表 8.1** に示す。

前調整工程では、良好なコンポスト化を進めるために、通気性の改善、含水率の調整及び pH 調整を行う。そのため、コンポスト原料となる脱水汚泥にコンポストの返送、モミガラ、オガクズなどの副資材を添加し、破砕・混合を行って発酵槽への投入混合物とする。

発酵工程では、有機物の分解と水分の蒸発が進行するが、一般にその反応過程は一次発酵と二次発酵に区分されている。一次発酵では温度の上昇や、水分の蒸発が急激に進行し、二次発酵では緩慢なものとなる。この発酵期間中には、発酵に必要な酸素の供給（通気）と発酵途中の混合物を適当な頻度で混合（切返し）を行い反応を促進させる。

製品化工程では、主に製品コンポストの出荷、使用及び貯蔵等に際しての取扱い性をよくするために、ふるい分け、造粒及び袋詰めなどを行う。

表 8.1　下水汚泥の堆肥化プロセス

	前　調　整	発　　酵	製　品　化
基本プロセス			
主要設備	・各種ホッパ ・計量器 ・破砕・混合設備 ・搬送設備 ・貯留設備 ・（乾燥設備）	・発酵槽 ・切返し装置 ・通気設備 ・取出し・返送設備 ・搬送設備 ・（脱臭設備）	・取出し設備 ・ホッパ ・計量器 ・袋詰め設備 ・（返送設備） ・（篩分け設備） ・（造粒設備） ・（貯蔵設備）

8.1.2　設計基準

製品コンポストの品質は、次の項目が要求される。

1) 対象となる作物、緑化植物等の育成を促し、障害を防止するための品質
2) 貯蔵及び施用に際しての取扱いに配慮した品質
3) 製品コンポスト中に含まれる重金属等が土壌、作物等へ問題を生じさせないための品質（関連規制値の遵守）

製品コンポストに要求される主要な品質基準値を**表 8.2** に示す。

表 8.2 製品コンポストの品質基準値

項 目	諸 元
含水率	30 – 40 %
pH	6 - 8.5
C(炭素)／/N(窒素)比	20 以下
BOD_5	30mg/g･DS 以下

8.2　建設資材利用

汚泥の利用方法としては、脱水汚泥・焼却灰等をそのままの状態であるいは加工して利用するもので、建設資材、土質改良材等への利用が考えられる。

建設資材への利用では、脱水汚泥・焼却灰の組成が従来の建設資材と類似していることから、建設資材又はその原料等として評価され、各種の有効利用が考えられている。

土質改良材への利用では、石灰系の焼却灰が建設残土等を改良するのに有効であることから、その利用が図られているものである。

2006年にNEDO（独立行政法人新エネルギー･産業技術総合開発機構）が実施した「セメント工場におけるバイオマス及び廃棄物の有効利用モデル事業実施可能性調査」においても、下水汚泥は化石燃料の代替燃料としての可能性が示唆されている。

使用方法の選定に当たっては、地域の状況等を調査し十分に考慮するとともに、建設資材利用の方法が確立するまでは、1つの方法に限定せず複数の方法を検討し、柔軟な対応が可能なようにしておくことが望ましい。

8.3 埋立

下水汚泥は、下水道施設の運転を続ける間は、常に発生し続けるものであるため、可能な限り資源化し、有効利用を図ることが望ましい。

したがって、有効利用が図れず、当面は埋立を行う場合においても、汚泥の有効利用の技術動向を常にチェックし、その事業主体に適した有効利用の方策が見出された場合は、速やかに有効利用へと転換すべきである。

参考

汚泥処理施設の配置例を**表 8.3** に示す。

表 8.3 処理施設配置の例

番号.	処理場名	場所	概　要		備考
			Q: 計画汚水量 (m^3/d) P: 計画人口 (人)	処理方式 上段 ： 水処理 下段 ： 汚泥処理	
1	Pantai STP	Kuala Lumpur	Q=93,000 P=377,000	標準活性汚泥法 濃縮 + 消化 + 脱水	浄化槽汚泥投入あり (256m^3/d)
2	Bundar Tun Razak STP	Kuala Lumpur	Q=25,000 P=100,000	回分式活性汚泥法 機械濃縮 + 脱水	
3	Puchong STP	Kuala Lumpur	Q=37,000 P=150,000	標準活性汚泥法 濃縮 + 脱水	
4	Kota Setar CSTP* *) 汚泥集約処理施設	Kedah	Q= - P= -	担体投入型硝化脱窒法 濃縮 + 脱水	浄化槽汚泥投入あり (210m^3/d)
5	Damansara STP	Kuala Lumpur	Q=25,000 P=100,000	オキシデーションディッチ 濃縮 + 脱水	
6	Kuala Sawah STP	Negeri Sembilan	Q=89,000 P=360,000	オキシデーションディッチ 濃縮 + 脱水	浄化槽汚泥投入あり (260m^3/d)

STP：下水処理場、CSTP：統合下水処理場

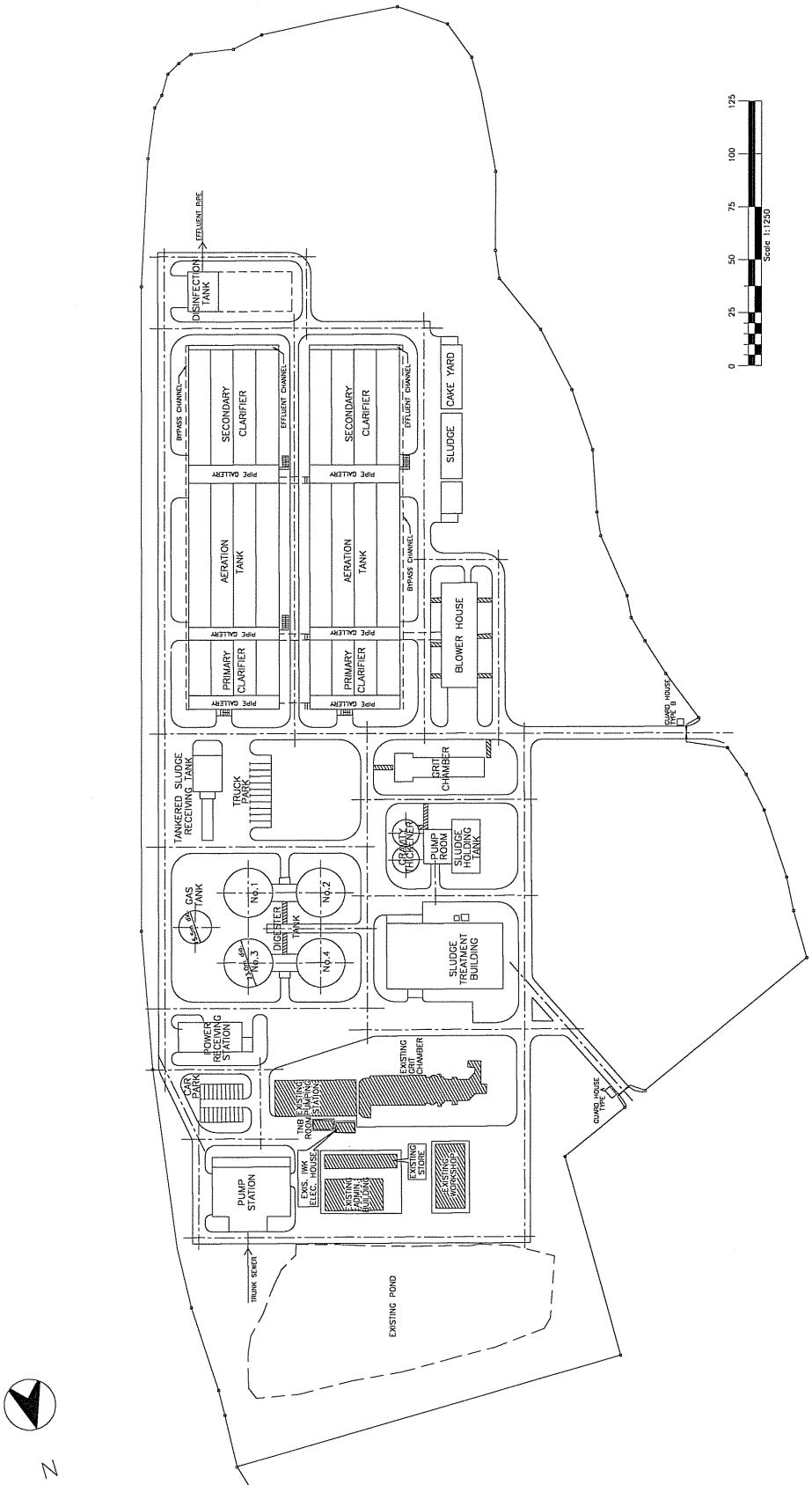


図 8.1 Pantai STP (Kuala Lumpur)

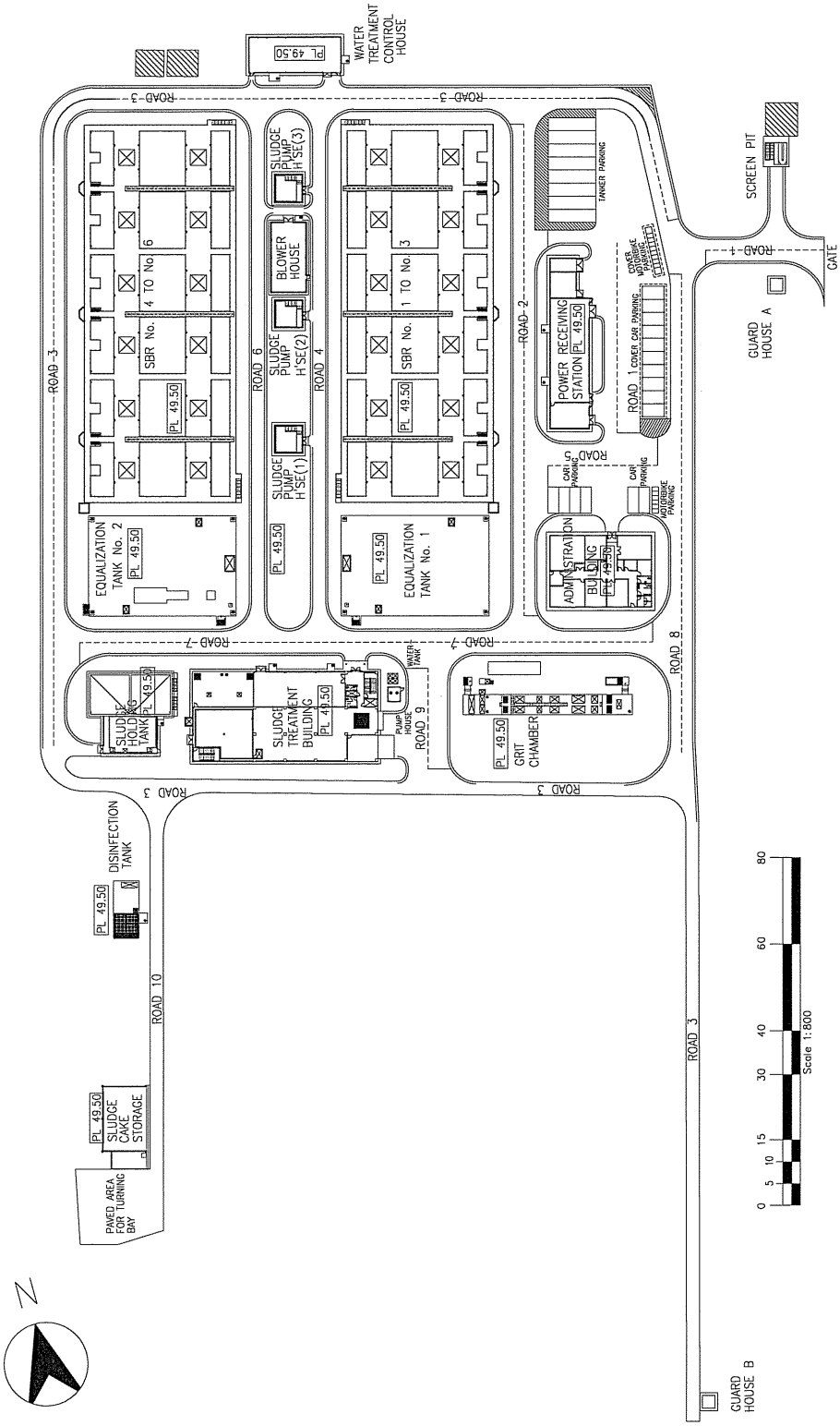


図 8.2 Bundar Tun Razak STP (Kuala Lumpur)

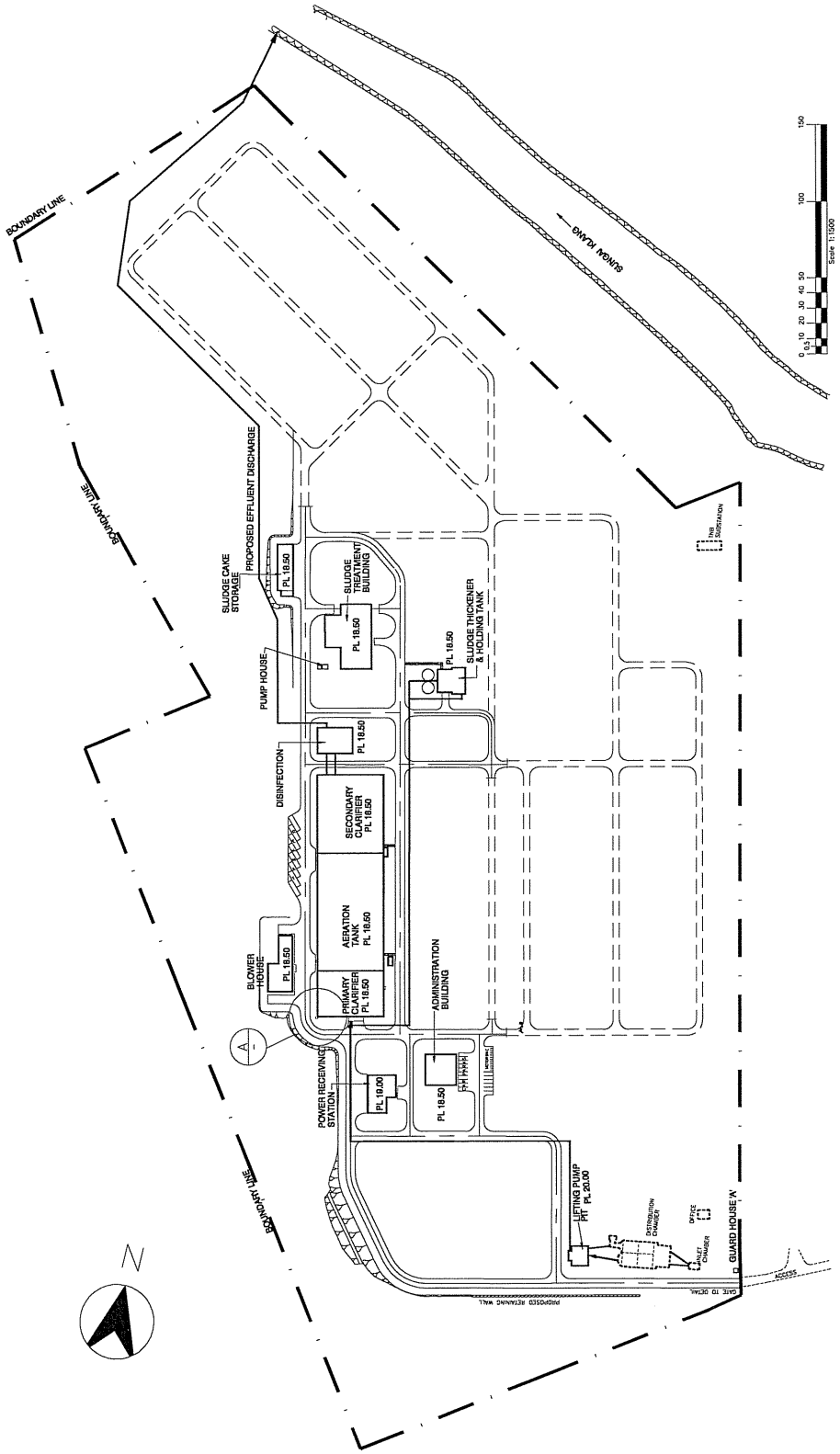


図 8.3 Puchong STP (Kuala Lumpur)

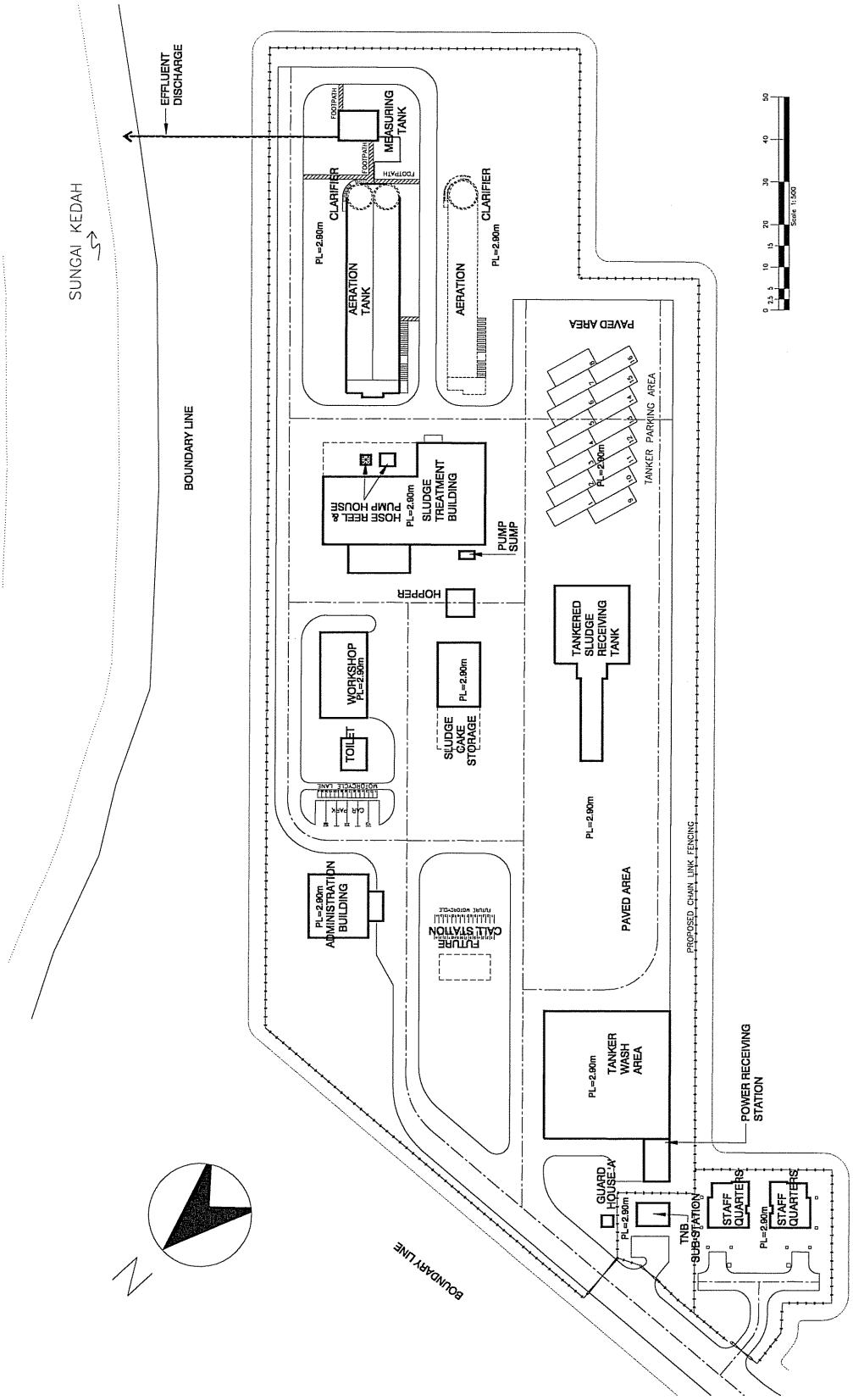


図 8.4 Kota Setar CSTP (Kedah)

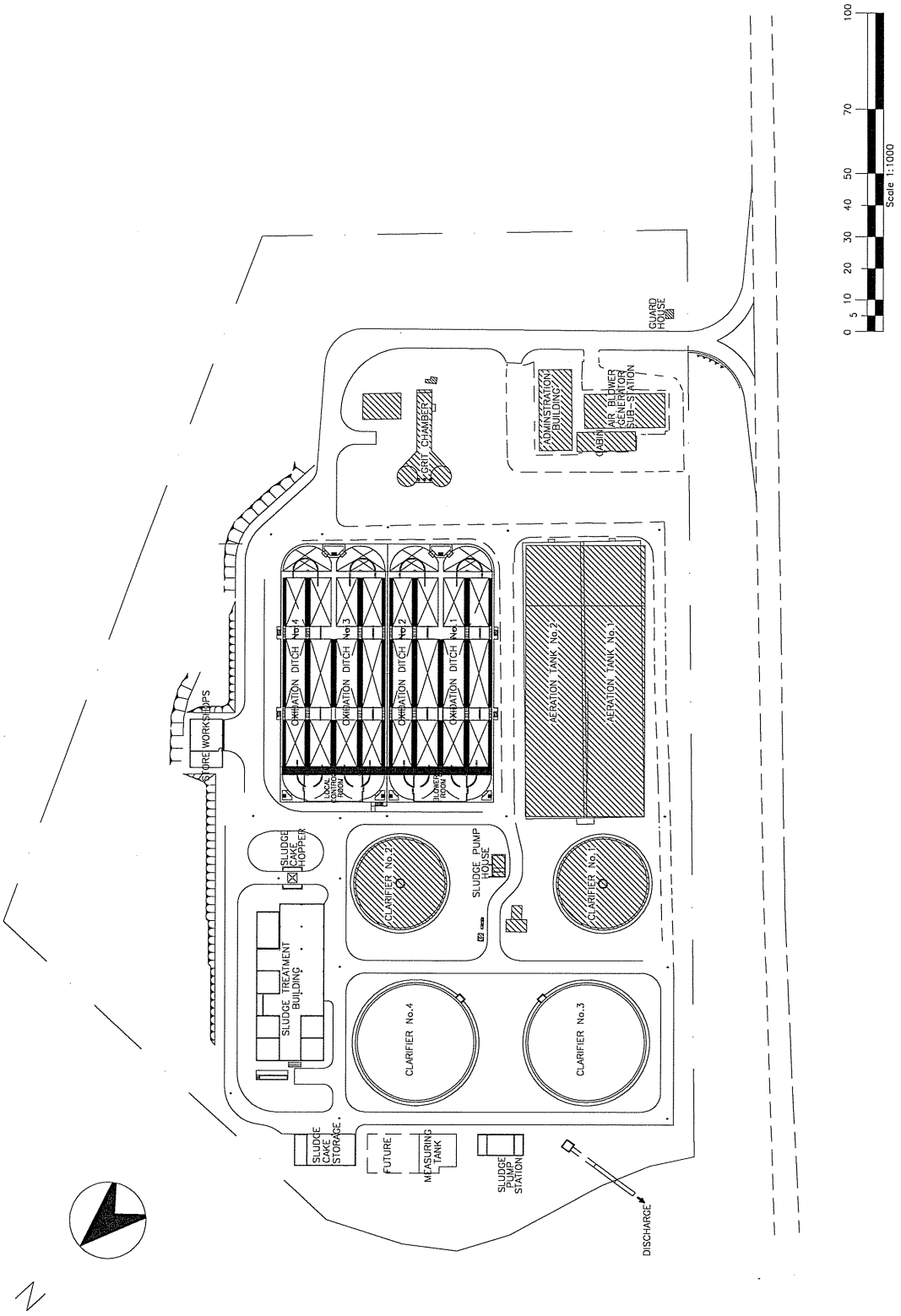


図 8.5 Damansara STP (Kuala Lumpur)

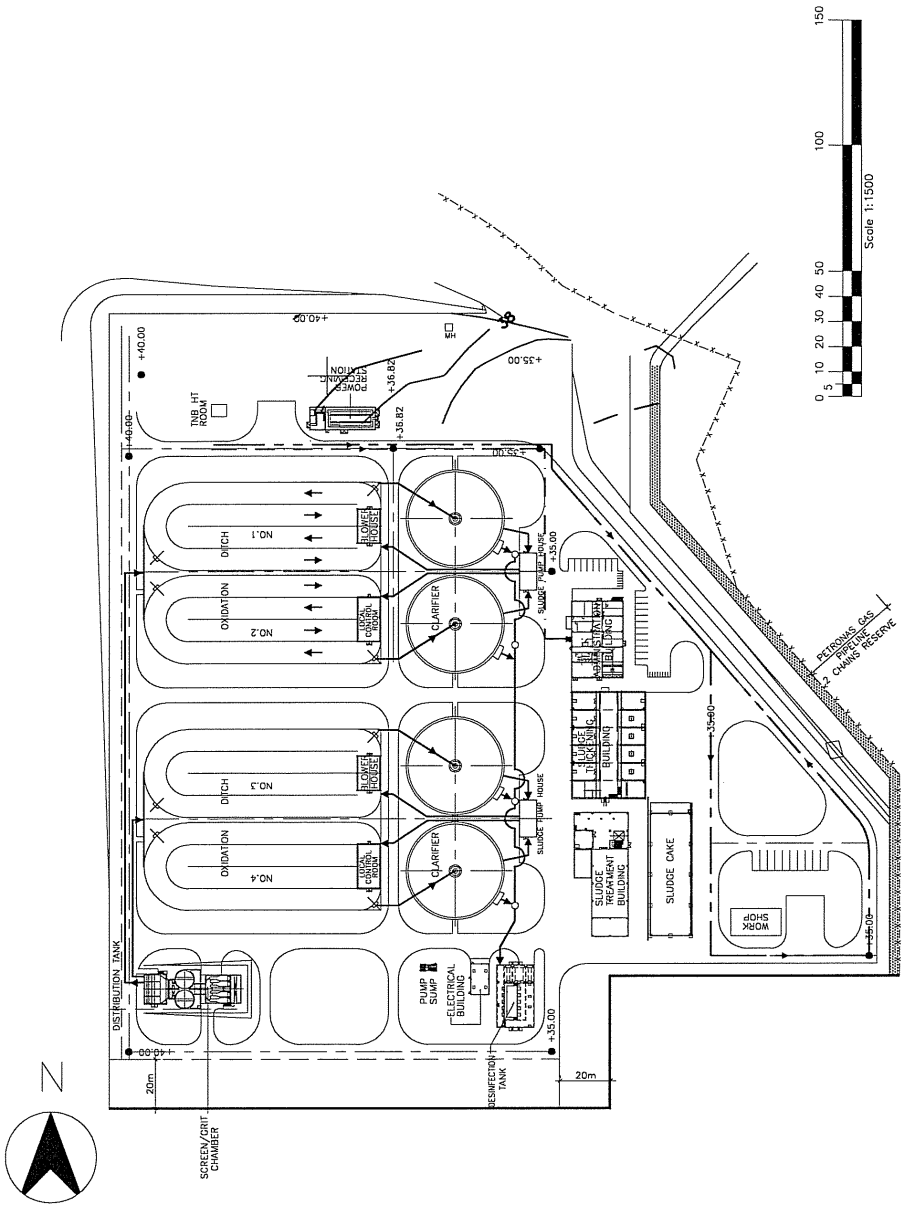


図 8.6 Kuala Sawah STP (Negeri Sembilan)

付属資料6

建設費及び維持管理費曲線（例）

付属資料 6　建設費用及び維持管理費曲線の例

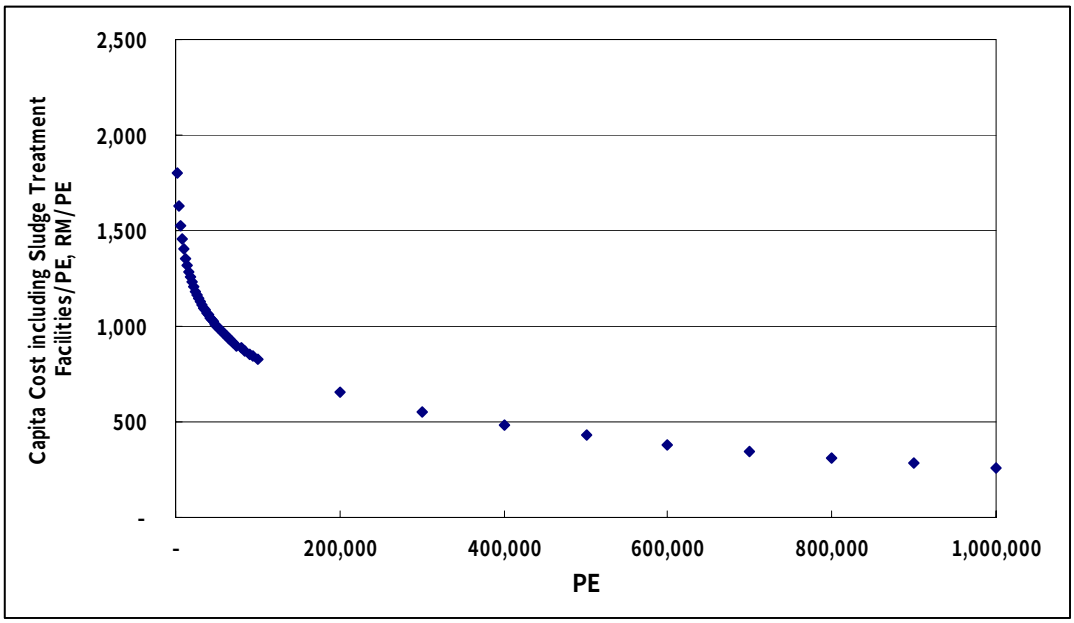


図 1　PE 当たりの下水道処理場建設費（汚泥処理施設を含む場合）

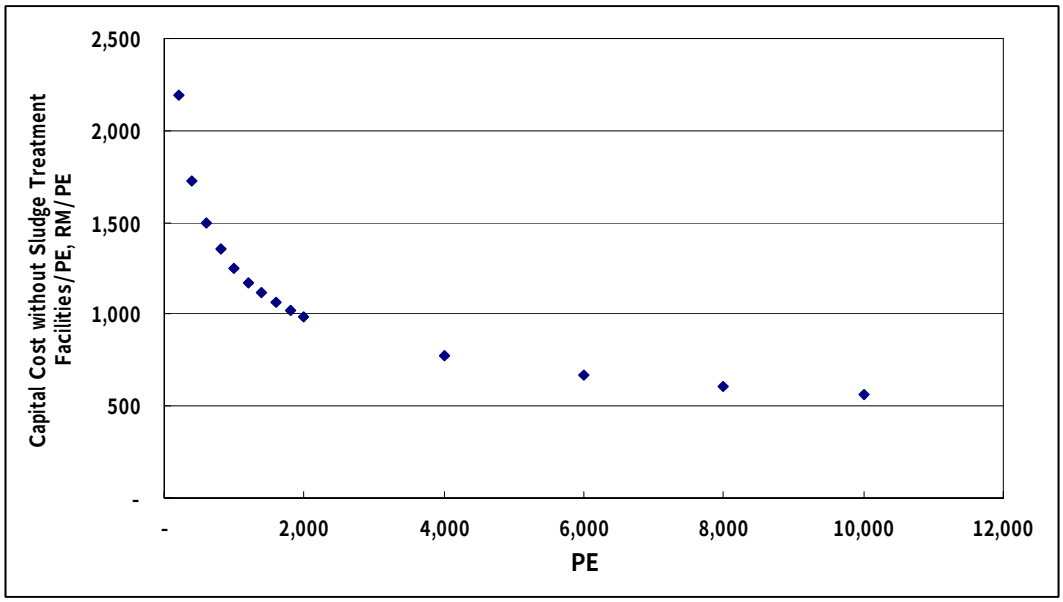


図 2　PE 当たりの下水道処理場建設費（汚泥処理施設を含まない場合）

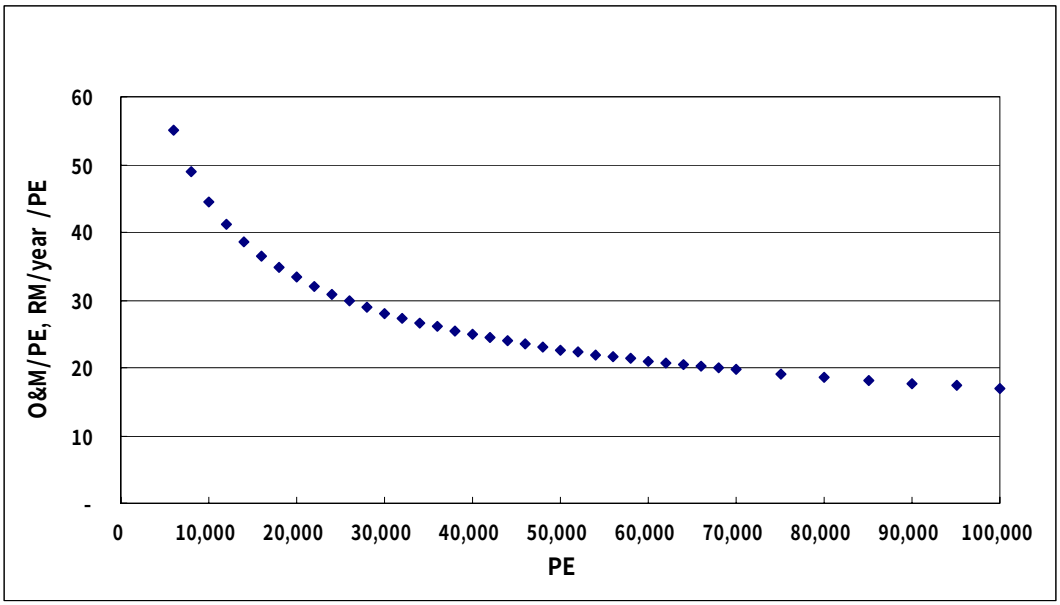


図 3　PE 当たりの下水道処理場維持管理費（機械式処理の場合）

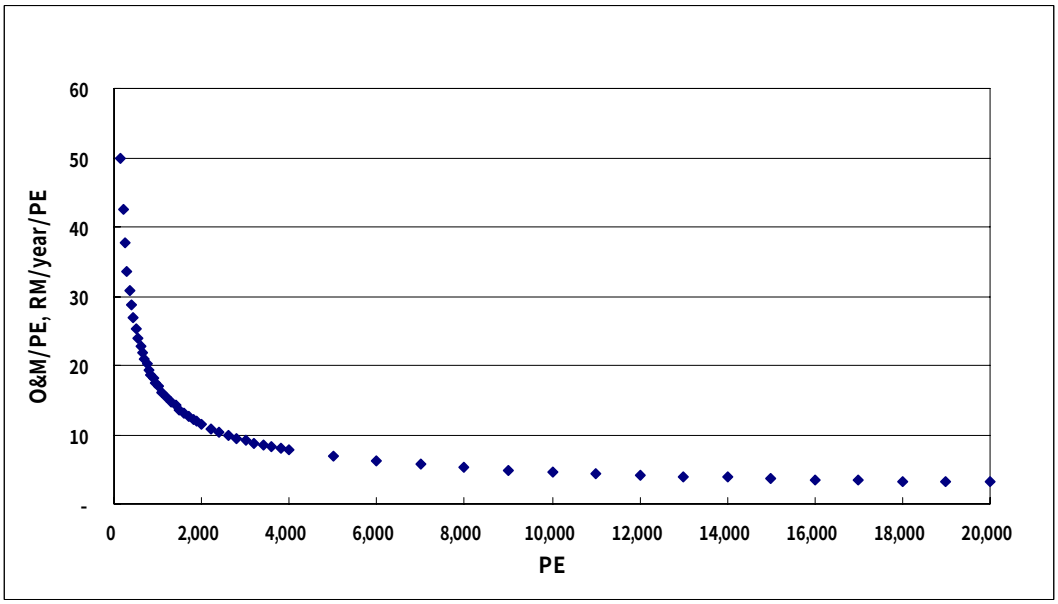


図 4　PE 当たりの下水道処理場維持管理費（オキシデーションポンド法の場合）

付属資料７

社会配慮及び初期環境調査

付属資料 7　社会配慮及び初期環境調査(IEE)

7.1 Outline of the Study

7.1.1 Objectives

To strengthen the sewerage planning capability of Sewerage Services Department in Malaysia and related agencies through the following interventions:

- To prepare a manual for reviewing/evaluation/prioritising catchment strategies and sewerage projects
- To revise the Guidelines for Developers Vol.1 and Vol.4 (Section 4 and 5, only concerning sludge treatment and disposal)
- To recommend measures for the improvement of planning capability in the sewerage sector in Malaysia

To evaluate the effectiveness of the manual and guidelines prepared in this JICA project, the trial application of the draft manual and guidelines was conducted.

The manual is to be applied to the Hulu Langat Catchment Area, while for the application of the revised guidelines, two areas of interest was selected. They are as follows:

1) Ipoh
2) Kota Kinabalu

IEE is conducted only within the sewerage catchment planning phase, specifically targeted towards the recommended option, while the manual is to be utilised for the prioritisation of projects identified within the recommended option and other needs as specified within the manual, for example; to review, evaluate and prioritise all identified projects from various catchment studies towards creation of a national sewerage projects list.

The results of these trial applications at Ipoh and Kota Kinabalu Catchments are reflected in the environmental and social consideration aspects of the guidelines.

7.1.2 Justification of the Study

In urbanized areas of Malaysia, private developers are obligated to provide sewerage facilities including private systems, individual septic tanks, etc. to serve the area being developed. After the completion of the facilities, they are normally handed over to the Government and to be maintained by the national company, Indah Water Konsortium Sdn. Bhd (hereinafter referred to

as “IWK”). IWK also provides operation and maintenance (O&M) services of the sewerage facilities taken over from the local authorities after the privatisation of the National Sewerage Industry in 1993, within its capacity as the National Concessionaire.

Currently, there are more than 9,000 existing treatment plants. These facilities comprise a wide range of capacities and treatment processes, and the wide diversity of the facilities complicates the O&M process. Consequently, a large proportion of the treated wastewater might not meet the effluent discharge standards.

To overcome and mitigate possible future compliance issues, centralization and rationalization of existing sewerage facilities should be given due considerations. Since the concept of centralization and rationalization is a part of planning, the improvement of planning capability through the revision of the existing guidelines and creation of a manual is necessary to improve this sewerage situation in Malaysia.

7.1.3 Location

Trial areas for guidelines were selected among cities having the following characteristics:

1) deteriorating river water quality
2) actively developing areas
3) large number of small STPs.

For confirming effectiveness of the revised guidelines, trial areas were determined based on the following two distinct characteristics as requested by Sewerage Services Department, Ministry of Energy, Water, and Communications and JICA.

1) Trial area which had already sewerage catchment strategies and need to be revised them.
2) Trial area which did not have sewerage catchment strategies.

Based on the above two characteristics, the following two places were identified for conducting the trial application of the manual and revised guidelines.

1) Ipoh - trial area having already sewerage catchment strategies
2) Kota Kinabalu - trial area not having sewerage catchment strategies

7.1.4 Proposed Activities

The proposed study activities were as follows:

1) Preparation of a manual for reviewing/evaluation/prioritizing catchment strategies and sewerage projects
2) Revision of the Guidelines for Developers Vol.1 and Vol.4 (Section 4 and 5, only concerning sludge treatment and disposal)
3) Trials using the manual and revised guidelines
4) Improvement and finalisation of the manual and revised guidelines

7.1.5 Scope of the trial study of the revised guidelines

The scopes of the trial study were:

1) To apply the revised guidelines in reviewing existing catchment strategies that were previously carried out for Ipoh, while for Kota Kinabalu, it was utilised for producing new catchment strategies and,
2) To evaluate the effectiveness of the proposed revised guidelines based on the quality of the catchment study produced and acceptance of the recommended option by common stakeholders.

7.2 Description of the Trial application Site

The trial application sites are shown in Figure 7.2.1.

7.2.1 Ipoh

Ipoh is the capital city of Perak State and one of the fastest growing cities in Malaysia. The city was founded on mining and much of the city's area has been the site of open cast tin mines. However over the past 20 years most of the mines have closed and reclamation and development of ex-mining lands are well under way.

Ipoh is located in a generally flattish valley sited between high limestone hills. The land falls towards the south. The valley bottom has a number of isolated limestone pinnacles and ridges rising up to several hundred feet from the valley floor. The Sungai Kinta flows north to south through the centre of Ipoh.

Historically Ipoh developed around the railway, with the commercial centre near to the railway station and industry to the north and south, also adjacent to the railway. The other main axis of older development is the road to Tambun, bordered by low density housing, government and military areas, and educational institutions. Tin mining took place over much of undeveloped area.

Over the past 10 years major, new highways have been constructed around Ipoh. They run around the eastern side of Ipoh from Pulai in the south east, to the north of Jelapang (North of

Ipoh). The airport is sited 2 km south of the city centre and includes a military base. The city's development then moved outwards with extensive development in Bercham, Gunung Rapat, and between the centre and airport.

The population of Ipoh recently increases from 468,765 in 1991 (census data) to 574,041 in 2000 (Census data).

7.2.2 Kota Kinabalu

Kota Kinabalu, is the capital of the Malaysian State of Sabah occupying the northern part of the land of Borneo which incidentally was called North Borneo before the State gained its independence from the British and joined Malaysia in 1963. Kota Kinabalu is also currently the one and only local authority in the State that is a city. It thus comes under the jurisdiction of the Chief Ministers Department even though its Town Planning roles still remains under the control of the Minister of Local Government and Housing under the Town and Country Planning Ordinance Sabah.

Kota Kinabalu is located on the west coast of Sabah. The city lies on a narrow flatland, being enveloped by the mountains known as the Crocker Range in the east, and by the South China Sea in the west. The city itself contains several hills which are mostly covered with tropical rainforest. The flat areas are mostly built up commercial, industrial or residential areas. The northeast part of the city around Likas Bay used to contain an extensive mangrove forest, but most of it has disappeared (following the development of the Likas Sprots Complex) leaving only a 10 hectare sanctuary designated as Kota Kinabalu City Bird Sanctuary in 2000.

Kota Kinabalu's Central Business District (CBD) is located on a narrow strip of land bordered by Signal Hill and the sea. Because of swampy ground where the land is relatively flat and steep slopes where lands are hilly, most of the CSD had to be built on reclaimed land.

The climate of Kota Kinabalu can be characterised as tropical monsoon, marked by high a degree of humidity, and high rainfall alternating with lesser periods of dry spells. Temperatures generally range from 21 to 29 degree Celsius. Average annual rainfall is of the order of 2540 mm. Most intense rainfalls occur from December to February.

Recently the population growth and urbanization and industrial development have been particularly rapid. The Kota Kinabalu District population grew from 60,382 in 1970 to 108,725 in 1980 to 209,175 in 1991 and 355,435 in year 2000.

Figure 7.2.1 Location of Trial Places

7.3 Legal Frame and Related Agencies

7.3.1 Legal Frame

The followings are all the laws and regulations that need to be considered for the production of a comprehensive EIA report in Malaysia

1) Environmental Quality Act, 1974
   This act requires the person intending to carry out any prescribed activity to submit the report on the impact on the environment.
2) Environmental Quality (Amendment) Act, 1985
3) Environmental Quality (Amendment) Act, 1996
4) Environmental Quality (Amendment) Act, 1998
5) Environmental Quality (Amendment) Act, 2001
6) Environmental Quality (Sewerage and Industrial Effluents) Regulations, 1979
7) Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order, 1987
   This order describes the prescribed activities as follows. The prescribed activities on sewerage are described on Schedule 18 (c).

LIST OF PRESCRIBED ACTIVITIES
〔 EXTRACT FROM THE ENVIRONMENTAL QUALITY (PRESCRIBED ACTIVITIES) (ENVIRONMENTAL IMPACT ASSESSMENT) ORDER 1987〕

(1) Agriculture

(a) Land development schemes covering an area of 500 hectares or more to bring forest land into agriculture production.
(b) Agriculture programmes necessitating the resettlement of 100 families or more.
(c) Development agricultural estates covering an area of 500 hectares or more involving changes in type of agricultural use.

(2) Airport

(a) Construction of airports (having an airstrip of 2,500 meters or longer).
(b) Airstrip development in state and national parks.

(3) Drainage And Irrigation

(a) Construction of dams and man-made lakes and artificial enlargement of lakes with surface areas of 200 hectares or more.
(b) Drainage of wetland, wild-life habitat or of virgin forest covering an area of 100 hectares or more.

(c) Irrigation schemes covering an area of 5,000 hectares or more.

(4) Land Reclamation

Coastal reclamation involving an area of 50 hectares or more.

(5) Fisheries

(a) Construction of fishing harbours.
(b) Harbour expansion involving an increase of 50 per cent or more in fish landing capacity per annum.
(c) Land based aquaculture projects accompanied by clearing of mangrove swamp forests covering an area of 50 hectares or more.

(6) Forestry

(a) Conversion of hill forest land to other land use covering an area of 50 hectares or more.
(b) Logging or conversion of forest land to other land use within the catchment area of reservoirs used for municipal water supply, irrigation or hydropower generation or in areas adjacent to state and national parks and national marine parks.
(c) Logging covering an area of 500 hectares or more.
(d) Conversion of mangrove swamps for industrial, housing or agricultural use covering an area of 50 hectares or more.
(e) Clearing of mangrove swamps in islands adjacent to national marine parks.

(7) Housing

Housing development covering an area of 50 hectares or more.

(8) Industry

(a) Chemical - Where production capacity of each product or of combined products is greater than 100 tonnes/day
(b) Petrochemicals - All sizes.
(c) Non-ferrous - Primary smelting:
Aluminium - all sizes
Copper - all sizes
Others - producing 50 tonnes/day and above of product.
(d) Non-Metalic - Cement - for clinker through put of 30 tonnes-hour and above.
- Lime - 100 tonnes/day and above burnt lime rotary kiln or 50 tonnes/day and above vertical kiln.
(e) Iron and Steel - Require iron ore as raw materials for production greater than 100 tonnes/day; or Using scrap iron as raw materials for production greater than 200 tonnes/day

(f) shipyards - Dead Weight Tonnage greater than 5000 tonnes.
(g) Pulp and Paper Industry - Production capacity greater than 50 tonnes/day.

(9) Infrastructure

(a) Construction of hospitals with out fall into beachfronts used for recreational purposes.
(b) ndustrial estate development for medium and heavy industries covering an area of 50 hectares or more.
(c) Construction of expressways.
(d) Construction of national highways.
(e) Construction of new townships.

(10) Ports

(a) Construction of ports
(b) Port expansion involving an increase of 50 per cent or more in handling capacity per annum.

(11) Mining

(a) Mining of minerals in new areas where the mining lease covers a total area in excess of 250 hectares.
(b) Ore processing, including concentrating for aluminium, copper, gold or tantalum.
(c) Sand dredging involving an area of 50 hectares or more.

(12) Petroleum

(a) Oil and gas fields development.
(b) Construction of off-shore and on-shore pipelines in excess of 50 kilometers in length.
(c) Construction of oil and gas separation, processing, handling, and storage facilities.
(d) Construction of oil refineries.
(e) Construction of product deports for the storage of petrol, gas or diesel (excluding service stations) which are located within 3 kilometers of any commercial, Industrial areas and which have a combined storage capacity of 60,000 barrels or more.

(13) Power Generation And Transmission

(a) Construction of steam generated power stations burning fossil fuels and having a capacity of more than 10 megawatts.
(b) Dams and hydroelectric power schemes with either or both of the following:
    (i) dams over 15 meters high and ancillary structures covering a total area in excess of 40 hectares;

(ii) reservoirs with a surface area in excess of 400 hectares.

(c) Construction of combined cycle power stations.

(d) Construction of nuclear-fueled power stations.

(14) Quarries

Proposed quarrying of aggregate, limestone, silica quartzite, sandstone, marble and decorative building stone within 3 kilometers of any existing residential, commercial or industrial areas, or any area for which a licence, permit or approval has been granted for residential, commercial or industrial development.

(15) Railways

(a) Construction of new routes.

(b) Construction of branch lines

(16) Transportation

Construction of Mass Rapid Transport projects.

(17) Resort And Recreational Development

(a) Construction of coastal resort facilities or hotels with more than 80 rooms.

(b) Hill station resort or hotel development covering an area of 50 hectares or more.

(c) Development of tourist or recreational facilities in national parks.

(d) Development of tourist or recreational facilities or islands in surrounding waters which are gazetted as national marine parks.

(18) Waste Treatment And Disposal

(a) Toxic and Hazardous Waste

(i) Construction of incineration plant (on-site)

(ii) Construction of recovery plant (off-site)

(iii) Construction of wastewater treatment plant (off-site)

(iv) Construction of secure landfill facility

(v) Construction of storage facility (off-site)

(b) Municipal Solid Waste

(i) Construction of incineration plant

(ii) Construction composting plant

(iii) Construction of recovery/recycling plant

(iv) Construction of municipal solid waste landfill facility

(c) Municipal Sewage

(i) Construction of wastewater treatment plant

(ii) Construction of marine out fall.

(19) Water Supply

(a) Construction of dams, impounding reservoirs with a surface area of 200 hectares or more.

(b) Groundwater development for industrial, agricultural or urban water supply of greater than 4,500 cubic meters per day.

According to Environmental Impact Assessment (EIA) - Procedure and Requirements in Malaysia, the steps in the EIA procedure are shown in **Figure 7.3.1**. The EIA procedure consists of three major steps which are a Preliminary assessment step, a detailed assessment step, and a review step.

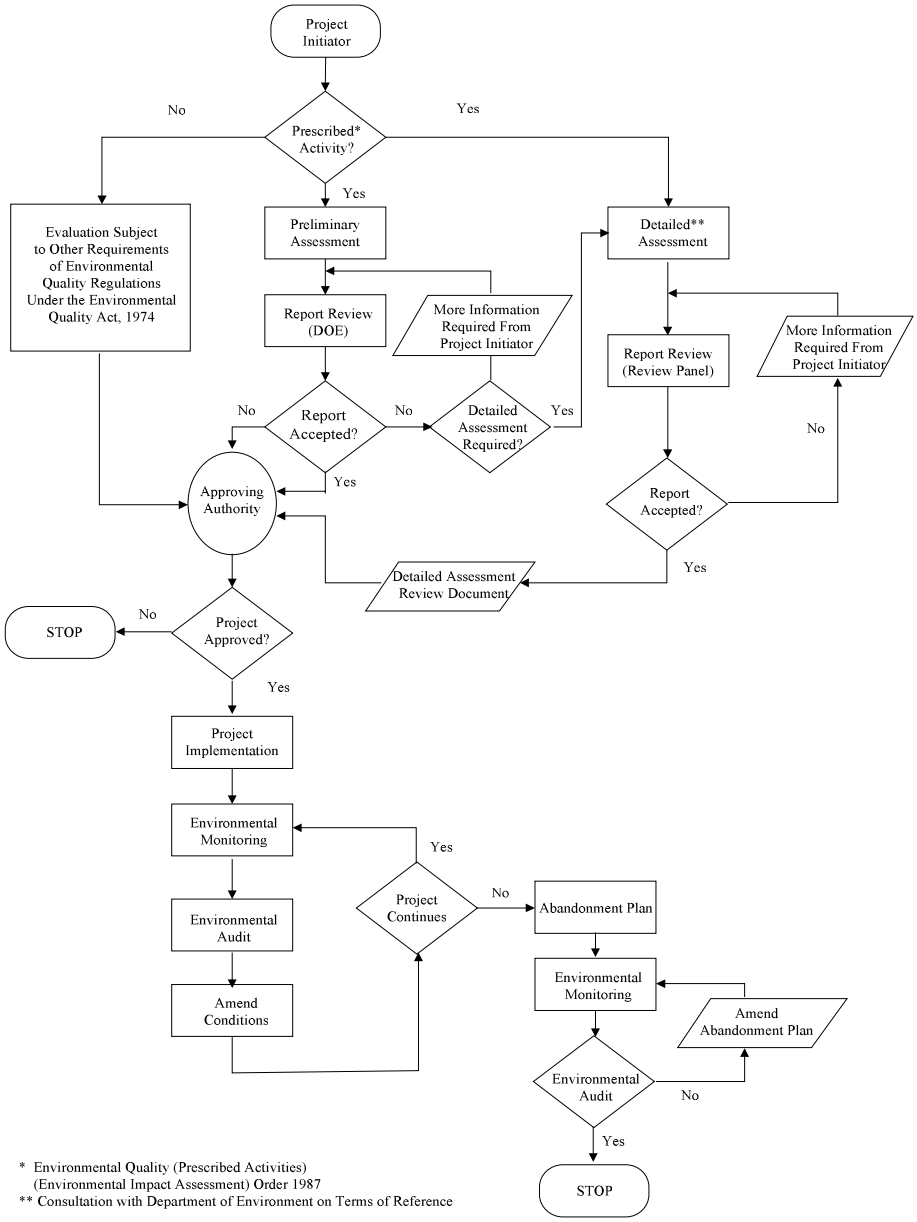


Figure 7.3.1 Outline of Environmental Impact Assessment Procedure in Malaysia

With reference to the order highlighted above, please take note that the current JICA Study only addresses the need of sustainable sewerage planning, which does not include the construction of any sewerage facilities. Therefore, no submission of an EIA study based on the Malaysian Environmental Act is required or expected out of the trial study. The above regulations were only reviewed at a desktop level towards the preparation of the IEE report.

Other related regulations that were taken into consideration for the IEE study are as follows:

1) Malaysian Standard 1228, 1991
   This code of practice deals with the planning design, construction and installation and testing of sewerage system.
2) Handbook of Environmental Impact Assessment Guidelines
   This handbook describes the normalized project planning sequence. Public participation and information disclosure on the detailed assessment stage are required.
   The following figure showed the relationship between the JICA Study and Malaysian project planning sequence. The trial application studies conducted in the JICA Study were the upper planning than Malaysian project planning required to do environmental impact assessment. Therefore, these trial application studies were not subject to Malaysian EIA process.
3) National Land Code, 1965 and Land Acquisition Act, 1960
   This code describes national policy and procedure pertaining to land acquisition within Peninsular Malaysia.
   The land acquisition procedures are as given below.

Department/Applicant's Agency
↓
Approval By State Authority
↓
Gazette Notification under Section 4 of the Land Acquisition Act
(that land is likely to be acquired)
↓
Gazette Notification under Section 8 of the Land Acquisition Act
(the declaration of intended acquisition for public purpose)
↓
Valuation Report by JPPH
↓
Enquiry by Land Administrator under Section 12 of the Land Acquisition Act
↓
Written Award by Land Administrator in Form G
↓
Notice of Formal Possession of the Land in Form K

Figure 7.3.2 Land Acquisition Flow Chart (Reference: Brochure of Valuation for Land Acquisition, Valuation and Property Services Department, Ministry of Finance, Malaysia)

4) Land ordinance (Sabah Cap. 68), 1950
This ordinance describes the policy and procedure for land acquisition within the state of Sabah.

7.2.2 Related Agencies to the IEE Report

1) National Water Services Commission (SPAN)
2) Indah Water Consortium (IWK)
3) Town and Rural Planning Department (JPBD)
4) Department of Environment (JAS)
5) Ministry of Tourism, Culture & Environment
6) Land & Survey Department
7) Road Works Department
8) Ministry of Housing & Local Covernment
9) Drainage & Irrigation Department
10) Ipoh City Council (MBI)
11) Kota Kinabalu City Hall

7.4 Outline of trial Catchment Studies

7.4.1 Ipoh

The basic data of sewerage catchment strategy is shown in Table 7.4.1, and a sewerage catchment plan is shown in Figure 7.4.1.
Study areas are about 40,800 ha which is same as 70% of special wards in Tokyo. They consist of five catchments, Ipoh City Centre, Menglembu, Gunung Rapat, Bercham, and Chemor catchments. Presently 60% of the population equivalent is connected to public sewerage networks including 222 STPs. In devising the strategy, a regionalised approach is advocated due to the high density of population and land availability. After realisation of the recommended strategy, the number of STPs is expected to be reduced from 222 to 3 in 2035, due to rasionalisation. Discharged BOD pollution load seems to be reduced from 23.8 t /d to 9.1 t/d (60 % reduction) in 2035. As the identified/proposed three regional STP sites had already been acquired and also currently being used for sewerage and sludge treatment, no future acquisition or requirement of land is anticipated. In sewerage catchment area there is no significant historic preservation area and national park.

Table 7.4.1 Basic Data in Ipoh Sewerage Catchment Strategy

Contents	Data
Target year for planning	2035
Study area	About 40,800 ha
Sanitary system	Regionalised System
Design population	About 2,015,000 (About 1,123,000 in 2007)
Average Flow	454,000 m^3/d (253,000m^3/d in 2007)
Design effluent quality	BOD = 20mg/L SS = 50 mg/L
Number of STPs	3 Sites (Papan, Tanah Hitam, Meru Raya) (222 sites in 2007)
STP land status	Three sites are owned by government. No expansion of STP sites.
Sludge production	About 160 m^3/d

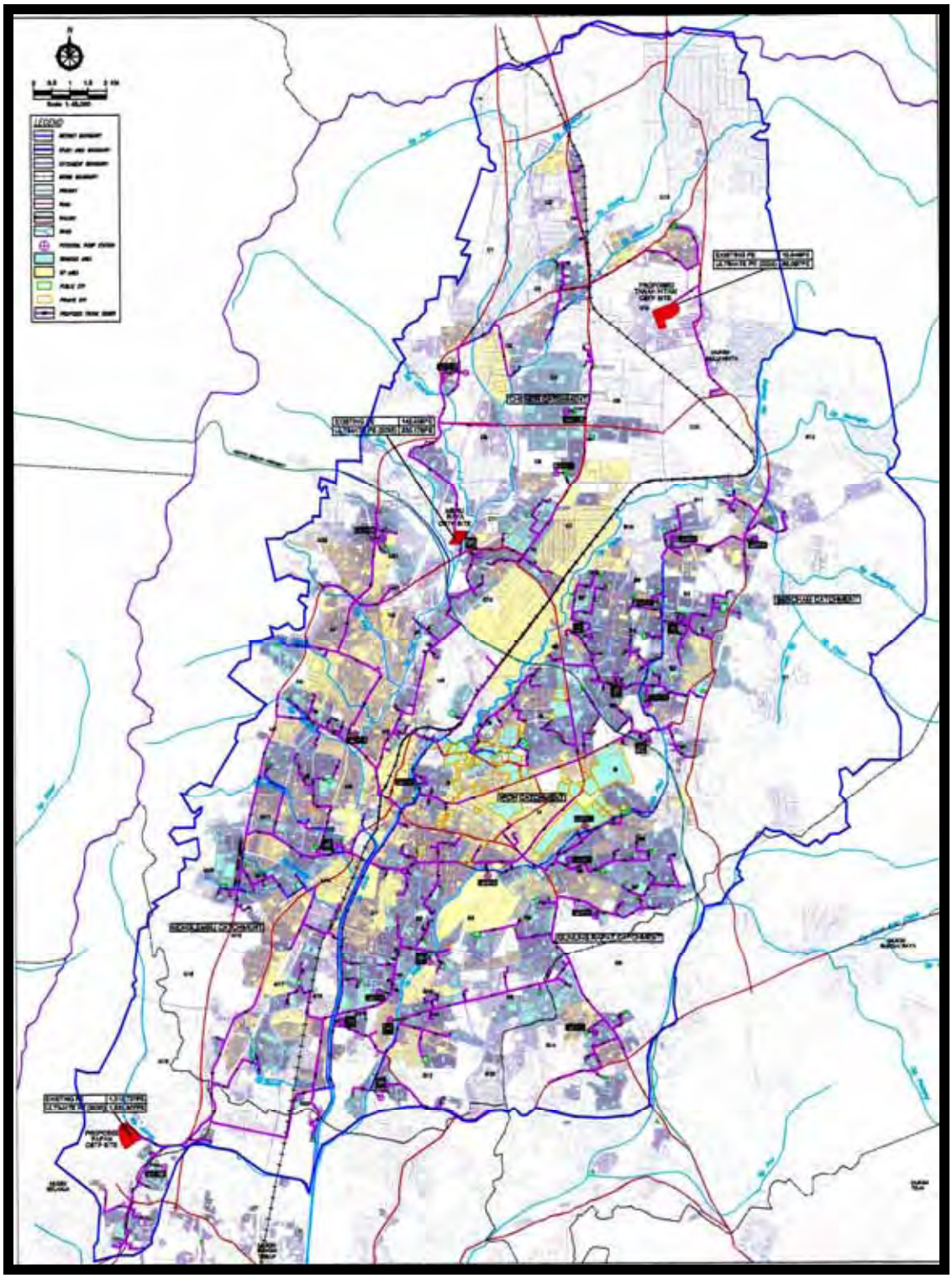


Figure 7.4.1 Ipoh Sewerage Catchment Strategy

7.4.2 Kota Kinabalu

The basic data of sewerage catchment strategy is shown in **Table 7.4.2**, and a sewerage catchment plan is shown in **Figure 7.4.2**.

The Study area concentrates on the northern catchment of Kota Kinabalu and covers an area of about 13,500 ha. The Study area consists of eight sub-catchments, Inanam, Kuala Inanam, Menggatal, Menggatal North, Kuala Menggatal, Telipok, KKIP, and Karambunai.

Presently, 34% of the population equivalent is connected to public sewerage networks including 29 STPs. In devising the strategy, a regionalised approach is considered for all sub-catchments with exception to Karambunai, where a decentralised system such as multipoint or septic tanks is to be considered due to low population density. After realisation of the recommended strategy, the numbers of STPs are expected to be reduced from 29 to 3 in 2035, due to rasionalisation. Discharged BOD pollution load seems to be reduced from 8.86 t /d to 3.72 t/d (60 % reduction) in 2035.

As the identified/proposed three regional STP sites had already been approved or owned by the state government and also currently being used for sewerage treatment, no future acquisition or requirement of land is anticipated, except for Kuala Mengatal STP, where extra land would need to be acquired for future expansions.

In sewerage catchment area there is no significant historic preservation area and national park. Kinabalu City Bird Sanctuary is located out of the catchment area and is about 5 km distant.

Table 7.4.2 Basic Data in Kota Kinabalu Sewerage Catchment Strategy

Contents	Data
Target year for planning	2035
Study area	About 13,500 ha
Sanitary system	Regionalised System for Inanam, Kuala Inanam, Menggatal, Menggatal North, Kuala Menggatal, Telipok catchments Decentralised system for Karambunai catchment
Design population	About 586,000 (About 201,000 in 2007)
Average Flow	132,000 m^3/d (46,000 m^3/d in 2007)
Design effluent quality	BOD = 20mg/L SS = 50 mg/L
Number of STPs	3 Sites(Inanam, Kuala Menggatal, KKIP) (29 sites in 2007)
STP land status	Three sites are owned by government. Kuala Menggatal STP will need for an expansion area.
Sludge production	About 57 m^3/d

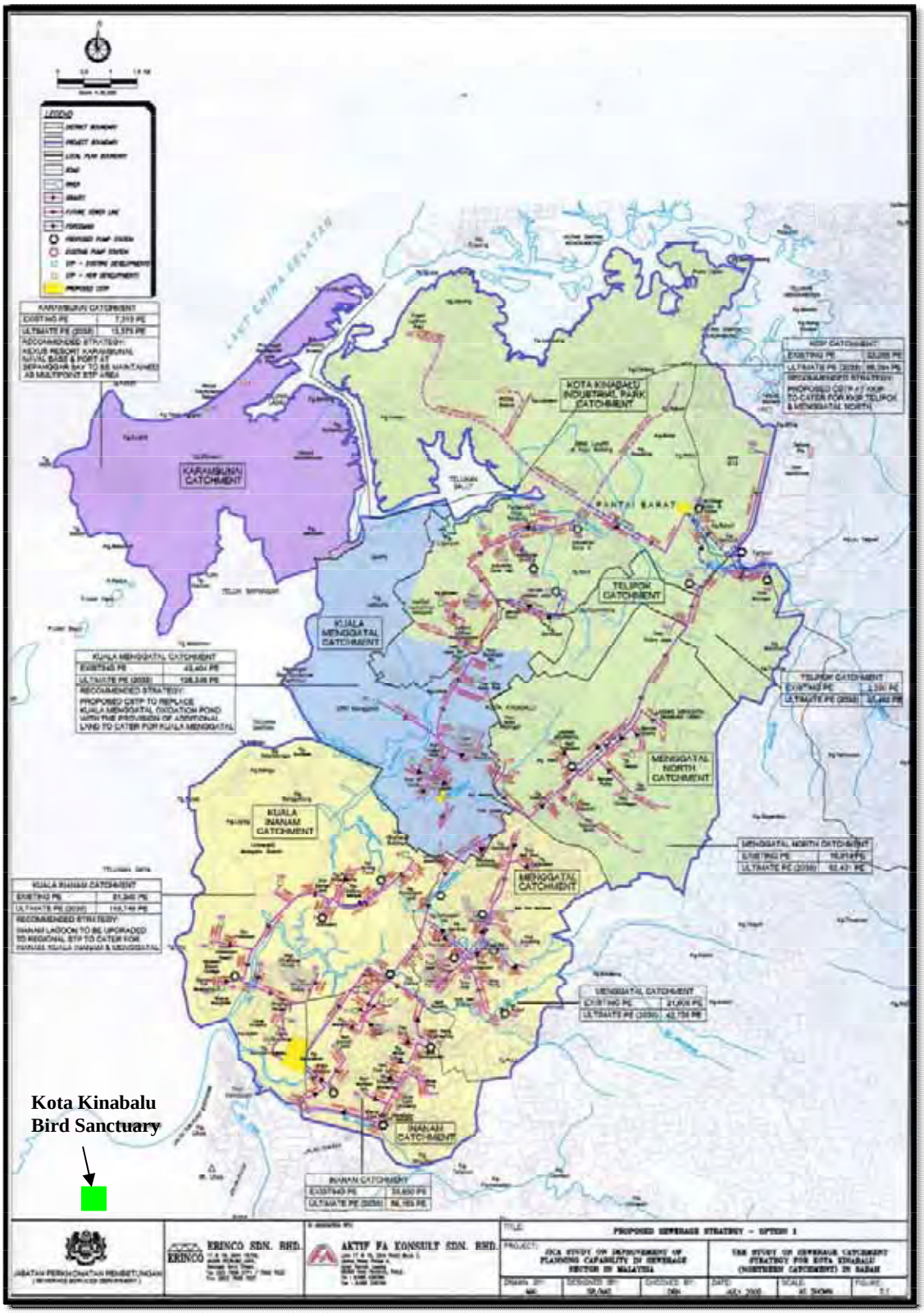


Figure 7.4.2 Northern Kota kinabalu Sewerage Catchment Strategy

7.5 Environmental and Social Considerations

The following figure shows the schedule of the JICA Main Study, its outputs and its relationship to the process of environmental and social considerations (where the decision to carry out an IEE study is made).

An IEE can be defined as that a study including analysis of alternative plans, prediction and assessment of environmental impacts, and preparation of mitigation measures and monitoring plans on the basis of secondary data and simple field surveys.

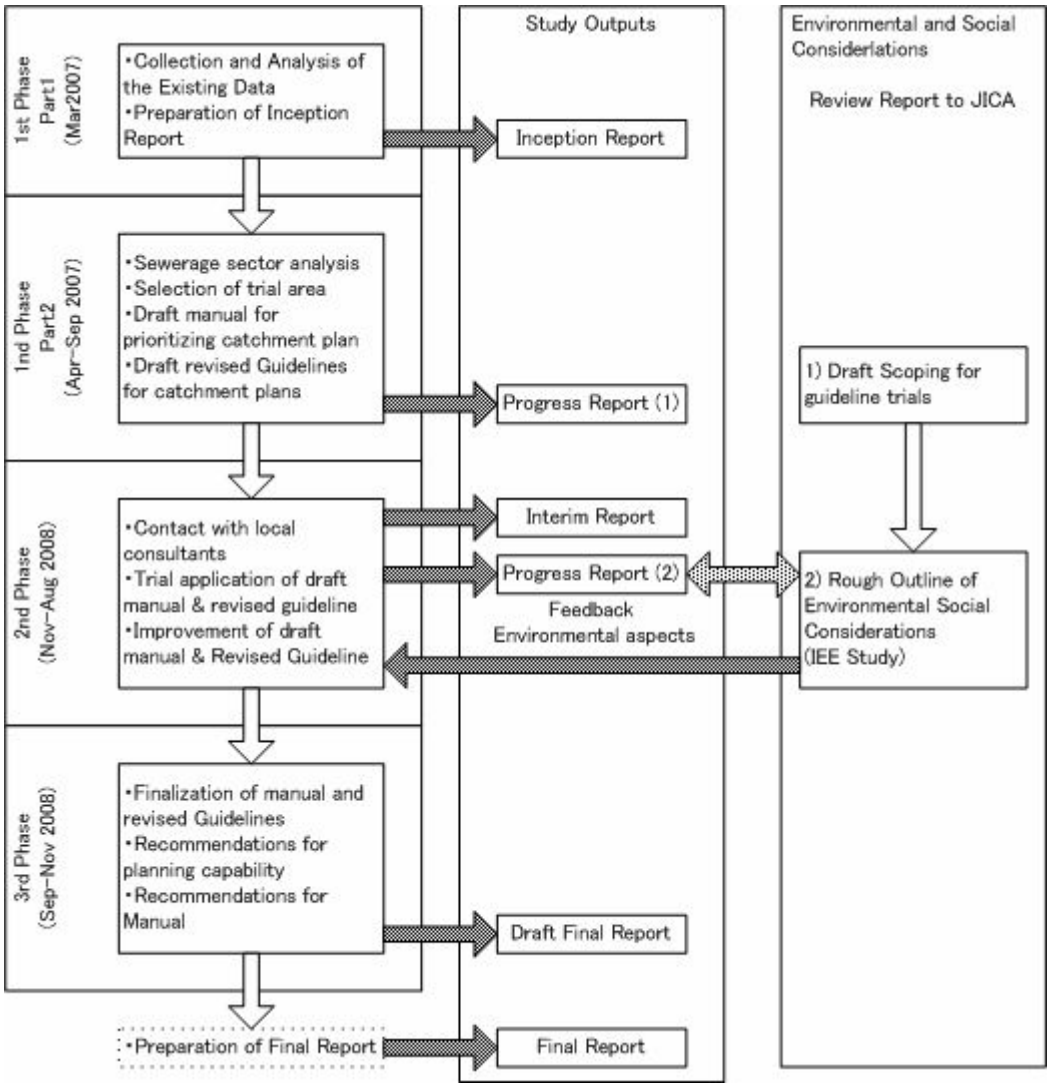


Figure 7.5.1 Processes of Environmental and Social Considerations

The draft revision of the guidelines and a draft manual was created in the 1st phase. During the 2nd phase, trial application of the manual and guidelines was conducted. At the end of the 3nd phase, the results from the trial applications will be used for the finalisation of the manual and

guidelines.

The IEE study is an integral part of the JICA study, which is conducted during the Environmental and Social Consideration stage and done upon the result of draft scoping for guideline trials. ***Findings of an IEE determine if an EIA would be required.***

7.6 Scoping of Environmental and Social Impact Study

A draft scoping covering environmental and social factors in trial studies was conducted before IEE (Initial Environmental Evaluation). For the draft scoping covering environmental and social factors, a total of 22 Environmental Items are taken into consideration and an evaluation grading ranging from A-D (details are as highlighted at the bottom of each Tables) is assigned to each of the items. A distinction on the decision to carry out an EIA can be made based on the results of IEE study. When serious impacts are expected based on an IEE study, EIA should be carried out.

The results of scoping and examination for both Ipoh and Kota Kinabalu are as summarized in **Tables 7.6.1 and 7.6.2** below.

Table 7.6.1 Scoping Checklist for Ipoh

No	Environmental Items	Evaluation	Reason
1	Resettlement	C	Land acquisition for expanding sewerage treatment plants may be necessary depending on the Catchment Strategy. Some proposed sites might need to be acquired.
2	Local Economy such as employment and livelihood	C	Ditto.
3	Existing social infrastructures and services	B	Some form of traffic congestion can be expected during the construction stage.
4	Land use and utilization of local resources	D	No impact is expected.
5	Cultural Property	D	No impact is expected.
6	Water Rights and Rights of Common	D	Water rights problem is not expected.
7	Public Health Condition	C	During blockage, untreated wastewater discharge may be expected.
8	Waste	B	Treatment of sludge may be necessary.
9	Hazards (Risk)	D	No large scale construction is expected.
10	Topography and geology	D	No large scale construction is expected.
11	Soil erosion	D	No large scale construction is expected.
12	Groundwater	C	During the excavating work, pumping out of groundwater may be expected in order to lower groundwater level.
13	Lake/River	C	During blockage, untreated wastewater discharge to river may be expected.
14	Sea/Coastal zone	D	There is no sea and coastal zone.
15	Flora and Fauna	D	No conservation areas around the site
16	Climate	D	No large scale construction is expected
17	Landscape	D	No large scale construction is expected
18	Air pollution	D	No impact is expected
19	Water contamination	C	During blockage, untreated wastewater discharge may be expected.
20	Soil contamination	D	No impact is expected
21	Noise and vibration	B	Noise and vibration during the construction period are expected.
22	Offensive odor	C	Possible offensive odor can be expected, if failure in operations or maintenance occurred.

Reference*: "Environmental Guidelines for Infrastructure Projects", JICA, 1992 (some modifications)*

Note: Evaluation classification A: Expected serious impact B: Expected somewhat impact
C: Not clear D: IEE or EIA is not necessary (no expected impact)

Table 7.6.2 Scoping Checklist for Kota Kinabalu

No	Environmental Items	Evaluation	Reason
1	Resettlement	C	Land acquisition for expanding sewerage treatment plants may be necessary depending on the Catchment Strategy. Some proposed sites might need to be acquired.
2	Local Economy such as employment and livelihood	C	Ditto.
3	Existing social infrastructures and services	B	Some form of traffic congestion can be expected during the construction stage.
4	Land use and utilization of local resources	D	No impact is expected.
5	Cultural Property	D	No impact is expected.
6	Water Rights and Rights of Common	D	Water rights problem is not expected.
7	Public Health Condition	C	During blockage, untreated wastewater discharge may be expected.
8	Waste	B	Treatment of sludge may be necessary.
9	Hazards (Risk)	D	No large scale construction is expected.
10	Topography and geology	D	No large scale construction is expected.
11	Soil erosion	D	No large scale construction is expected.
12	Groundwater	C	During the excavating work, pumping out of groundwater may be expected in order to lower groundwater level.
13	Lake/River	C	During blockage, untreated wastewater discharge to river may be expected.
14	Sea/Coastal zone	B	Mangrove forest designated as Kota Kinabalu City Bird Sanctuary exists. The treatment of sewage would have a positive effect for mangrove, but the negative effect of the discharge of collected treated water at the discharge point can be expected. The discharge point may be necessary to be constructed away from sanctuary.
15	Flora and Fauna	B	A 10 hectare sanctuary designated as Kota Kinabalu City Bird Sanctuary exists near coast. The discharge point may be necessary to be constructed away from sanctuary.
16	Climate	D	No large scale construction is expected
17	Landscape	D	No large scale construction is expected
18	Air pollution	D	No impact is expected
19	Water contamination	C	During blockage, untreated wastewater discharge may be expected.
20	Soil contamination	D	No impact is expected
21	Noise and vibration	B	Noise and vibration during the construction period are expected.
22	Offensive odor	C	Possible offensive odor can be expected, if failure in operations or maintenance occurred.

Reference: *"Environmental Guidelines for Infrastructure Projects", JICA, 1992 (some modifications)*
Note: Evaluation classification A: Expected serious impact B: Expected somewhat impact

C: Not clear D: IEE or EIA is not necessary (no expected impact)

7.7 Initial Environmental Examination (IEE)

7.7.1 Ipoh

Based on the scoping on the IEE level study, eight (8) items concerning social environment, natural environment and pollution aspects are checked and the results of the IEE level study are summarized in **Table 7.7.1**. Based on the existing information and the results of the field survey, no precious fauna and flora in/around the proposed STP sites are identified. In addition, the proposed STP sits are not located at preservation area of wildlife, wetlands, national park and culture heritage.

Table 7.7.1 Results of IEE Level Study on Ipoh

No	Environmental Items	Evaluation	Reason
		With Project	
1	Resettlement	D	The proposed STP sites (Papan, Tanah Hitam, Meru Raya) had already been acquired for sewerage purposes. Squatter was no found. The space of each area is also adequate for the constructions of the proposed STPs.
2	Local Economy such as employment and livelihood	D	The proposed STP sites had already been acquired for sewerage purposes. No impact on local economy is expected.
3	Existing social infrastructures and services	C	Some sewers are planned for construction within city area. Traffic congestion during the construction period can be expected. However, the period of impacts will be short.
7	Public Health Condition	C	During blockage due to improper maintenance, untreated wastewater discharge can be expected.
8	Waste	C	Sludge is produced continuously. It may be necessary to reduce the sludge disposal volume in order to reduce the impact of disposing sludge to landfill sites.
12	Groundwater	C	A leachate monitoring system is not commonly built in an existing dumping site. Although sludge can be mechanically dewatered, leachate from dewatered sludge may be expected.
13	Lake/River	C	Water quality will be improved by a project. However, discharging untreated wastewater to river can be expected due to blockage caused by improper maintenance in sewers.
19	Water contamination	C	Water intake points are located on upward of the catchment area. There is no effect expected from implementation of proposed projects on drinking water. However, discharging untreated wastewater to river can be expected by blockage due to improper maintenance.
21	Noise and vibration	B	There is no residential area around STPs of Tanah Hitam and Meru Raya. At Papan STP, there is only one access road to Papan STP. This road is located in front of a residential area. During transportation of waste sludge, some vibration and noise is to be expected.
22	Offensive odour	B	There is only one access road to Papan STP. This road was located in front of a residence area. During transportation of waste sludge, some emission of odour is to be expected.

Reference: "Environmental Guidelines for Infrastructure Projects", JICA, 1992 (some modifications)

Note: Evaluation classification A: Serious impact B: Some impact
C: Light impact D: Negligible impact

In order to mitigate these negative impacts, some countermeasures and recommendations from an environmental viewpoint were given in **Table 7.7.2**.

Table 7.7.2 Recommendations for Ipoh

No	Environmental Items	Recommendations for Mitigation Measures on Negative Impact
3	Existing social infrastructures and services	① To prepare a proper construction plan for sewers and STPs to reduce traffic conjunction.
7	Public Health Condition	① To prepare a sewer maintenance plan. ② To establish a monitoring system to check sewage flow.
8	Waste	① To prepare a stage wise installation plan of sludge treatment facilities to cater for increasing sludge production. ② To prepare a reuse plan of sludge such as agricultural uses and promote the reuse of sludge to public.
12	Groundwater	① To check the water content of dewatered sludge for preventing leachate from sludge. ② To select proper dumping site operators following DOE regulations. ③ To monitor groundwater and river water frequently to detect the occurrence of leachate quickly. ④ To prepare a reuse plan of sludge such as agricultural uses for reducing dumping sludge.
13	Lake/River	① To prepare a O&M plan on STPs to meet the required treated water quality regulations. ② To prepare a sewer maintenance plan to prevent blockage.
19	Water contamination	① To prepare a O&M plan on STP to meet the required treated water quality regulations. ② To prepare a sewer maintenance plan to prevent blockage.
21	Noise and vibration	① To plant a tree belt around STP sites to mitigate noise. ② To set buffer zone around STP sites ③ To prepare an operation schedule for avoiding nighttime noise and vibration. ④ To make a diversion route for a Papan STP to reduce traffics in front of residences.
22	Offensive odor	① To plant a tree belt around STP sites to mitigate odour. ② To set buffer zone around STP sites. ③ To make a diversion route for a Papan STP to reduce the emission of odour by reducing traffics in front of residences.

7.7.2 Kota Kinabalu

Based on the scoping on the IEE level study, eight (8) items concerning social environment, natural environment and pollution aspects are checked and the results of the IEE level study were summarized in **Table 7.7.3**. Based on the existing information and the results of the field survey, no precious fauna and flora in/around the proposed STP sites were identified. The Kota Kinabalu City Bird Sanctuary is located out of the catchment area and is about 5 km distant from Inanam STP, which is the only closest STP to it. There is no negative impact of STPs on the sanctuary. In addition, none of the proposed STP sites are located at preservation area of wildlife, wetlands, national park and culture heritage.

Table 7.7.3 Results of IEE Level Study on Kota Kinabalu

No	Environmental Items	Evaluation	Reason
		With Project	
1	Resettlement	D	Land acquisition for expanding sewerage treatment plants is necessary for Kuala Menggatal STP. Currently, the proposed land is used as an agricultural land, no resettlement is expected due to expansion of STP site (about0.5ha) for buffer zone.
2	Local Economy such as employment and livelihood	C	Three sites (Inanam, KKIP, and Kuala Menggatal) are already having existing sewerage facility or approved by the state government. Inanam and KKIP STP's site is adequate and no impact is expected. However, the expansion of Kuala Menggatal site is necessary and some impact is expected as proposed site is currently used as an agricultural land.
3	Existing social infrastructures and services	C	Some sewers are planned for, within the city area. However, the road in which proposed trunk sewers are located has four or six lanes. The road has enough space for traffic during construction. The period of impacts will be short.
7	Public Health Condition	C	During blockage due to improper maintenance in sewers, discharging untreated wastewater may be expected.
8	Waste	C	Present dumping site has an enough volume (46 ha). However, sludge is produced continuously. It may be necessary to reduce the sludge disposal volume in order to reduce the impact of disposing sludge to landfill sites.
12	Groundwater	C	Although sludge is mechanically dewatered in a project, leachate from dewatered sludge may be expected.
13	Lake/River	C	Water intake points are located at upstream of discharge point to rivers. There is no effect on drinking water. However, discharging untreated wastewater to river may be expected by blockage due to improper maintenance.
14	Sea/Coastal zone	D	Mangrove forest designated as Kota Kinabalu City Bird Sanctuary is out of catchment area. The nearest STP site (Inanam) is 5 km away from the Sanctuary. The treated water will be discharged to ocean through a river. No treated water flows directly into the sanctuary.
15	Flora and Fauna	D	The sanctuary designated as Kota Kinabalu City Bird Sanctuary is 5 km away located from a STP site. No destruction of flora and fauna around the sanctuary is expected due to construction activities..
19	Water contamination	C	Water intake points are located at upstream of the catchment area. There is no effect on drinking water. However, discharging untreated wastewater to river may be expected by blockage due to improper maintenance.
21	Noise and vibration	C	There are residential areas near Menggatal STP. During transportation of waste sludge, some vibration and noise can be expected.
22	Offensive odour	C	There are residential areas near Menggatal STP. During transportation of waste sludge, emission of odour can be expected.

Reference: "Environmental Guidelines for Infrastructure Projects", JICA, 1992 (some modifications)

Note: Evaluation classification A: Serious impact B: Some impact
C: Light impact D: Negligible impact

In order to mitigate these negative impacts, some countermeasures and recommendations from an environmental viewpoint were given in **Table 7.7.4**.

Table 7.7.4 Recommendations for Kota Kinabalu

No	Environmental Items	Recommendations for Mitigation Measures on Negative Impact
2	Local Economy such as employment and livelihood	① To acquire the land for proposed STP site following Malaysia land acquisition procedures and make consultation with land owners
3	Existing social infrastructures and services	① To prepare a proper construction plan of sewers and STP, traffic control plan during construction period
7	Public Health Condition	① To prepare a sewer maintenance plan. ② To establish a monitoring system to check sewage flow.
8	Waste	① To prepare a stage wise installation plan of sludge treatment facilities to cater for increasing sludge production. ② To prepare a reuse plan of sludge such as agricultural uses and promote the reuse of sludge to public.
12	Groundwater	① To check the water content of dewatered sludge for preventing leachate from sludge. ② To select proper dumping site operators following DOE regulations. ③ To monitor groundwater and river water frequently to detect the occurrence of leachate quickly. ④ To prepare a reuse plan of sludge such as agricultural uses for reducing dumping sludge.
13	Lake/River	① To prepare a O&M plan on STP to meet the required treated water quality regulations. ② To prepare a sewer maintenance plan to prevent blockage.
19	Water contamination	① To prepare a O&M plan on STP to meet the required treated water quality regulations. ② To prepare a sewer maintenance plan to prevent blockage.
21	Noise and vibration	① To plant a tree belt around STP sites to mitigate noise. ② To set buffer zone around STP sites ③ To prepare an operation schedule for avoiding nighttime noise and vibration.
22	Offensive odor	① To plant a tree belt around STP sites to mitigate odour. ② To set buffer zone around STP sites.

7.8 Presentation on the outline of the IEE study

7.8.1 External Meeting

An external meeting with related stakeholders was conducted to present and explain the

proposed catchment strategies for both Ipoh and Kota Kinabalu. In this meeting, the IEE's study results were also explained based on its environmental and social consideration. **Table 7.8.1** shows the details and contents of the external meetings.

Table 7.8.1 Contents of External Meetings

External Meeting	Ipoh	Kota Kinabalu
Date	29th July 2008 9:30-12:30	30th July 2008 10:00-13:00
Place	Hotel Casuarina, Ipoh	Promenade Hotel, Kota Kinabalu
Attendants	Relevant government agencies	
Contents of Presentation	1) Outline of JICA Study on Improvement of Planning Capability in Sewergae Sector in Malaysia 2) Results of sewerage catchment strategies in Ipoh and Kota Kinabalu 3) Results of IEE level study	

Participants of the external meetings are as shown in **Tables 7.8.2 and 7.8.3**. As the objectives of the trial studies were solely to confirm the effectiveness of the revised guidelines and no further implementation is planned, attendees for the external meetings are confined to related government agencies only.

Table 7.8.2 Participants for External Meeting at Ipoh

Participants	Ipoh
SSD (Sewerage Services Department)	Mr. Hazmi Bin Ramli
SPAN (National Water Services Commission):	Mr. Wan Sallehuddin
IWK (Indah Water Consortium):	Mrs. Hartini Binti Ali Mr. Mohd Shariman Bin mohd Shariff Mr. Tiah Oon Han Mr. Sri Ruthira Kumar
LAP (Perak Water Board):	Mr. Hj. Abu Bakar Bin Othman
JPBD (Town and Rural Planning Department):	Mr. Faizulzila Mohammad
MBI (Ipoh City Council):	Mrs. Jaslina Shaidin Mrs. Zuraina Kamarul Ariff Mr. Mustaffa Albasre Harun
JAS (Department of Environment):	Mrs. Nisah Muhd @ Hanafi
JICA Team:	Mr. Tetsuo Wada Mr. Thanapalan Kanapathippillai

Table 7.8.3 Participants for External Meeting at Kota Kinabalu

Participants	Kota Kinabalu
JICA Malaysia	Hideo Tsukamoto
JICA Study Team JICA Study Team	Tetsuo Wada Thanapalan Kanapathippillai
DG of DBKK	Chua Kim Hing
Ministry of Tourism, Culture & Environment	William Baya
Land And Survey Department	Joseph Lim
Tuaran District Council	Tang Yang Ming
Environmental Protection Department	Elin Empan
Department of Environment	Zuraini Siam
Road Works Department	Paul Thien
JPBIW (Town & Planning Department)	Terence Chia
Drainage & Irrigation Department	Yap Siew Fah
KKIP Sdn. Bhd	Lam Kin Yee
Ministry of Housing & Local Government	Nor Isham Narawi
Drainage & Irrigation Department	Joseph Dinor
DBKK DBKK DBKK DBKK DBKK	Ir. Lee Tet Fon Beddu Ahmad Jack Lo Poon Chee Kong Victor Wong
Erinco Sdn Bhd Erinco Sdn Bhd Erinco Sdn Bhd	Ir. Dr. Dhileepan Nair Nor Akmal Tarmizi Sharmini Ramanathan
Aktif FA Konsult	Mr. Fung Yin Khun

Programs of each external meeting are as shown in **Tables 7.8.4 and 7.8.5**.

Table 7.8.4 Program of External Meeting at Ipoh

Program	Oranization in Charge
Opening statment	Mr. HJ. Abu Baicar B. Othman
Part I: Outline of JICA Study on Improvement of Planning Capability in Sewergae Sector in Malaysia	Mr. T. WADA, JICA Study Team
Part II: Outline of Sewerge Catchment Strategy for Ipoh	Dr. Dhileepan Nair, Local Consultant for Trial Study
Coffee break	
Part III: Explanation of Result of the IEE Level Study	Mr. T. WADA, JICA Study Team
Part V: Questions and answers	All Attendances
Closing remarks	Mr. HJ. Abu Baicar B. Othman

Table 7.8.5 Program of External Meeting at Kota Kinabalu

Program	Oranization in Charge
Opening statment	Dr. Chua Kim Hing, Director General of Kota Kinabalu City Hall
Part I: Outline of JICA Study on Improvement of Planning Capability in Sewergae Sector in Malaysia	Mr. T. WADA, JICA Study Team
Part II: Outline of Sewerge Catchment Strategy for Ipoh	Dr. Dhileepan Nair, Local Consultant for Trial Study
Coffee break	
Part III: Explanation of Result of the IEE Level Study	Mr. T. WADA, JICA Study Team
Part V: Questions and answers	All Attendances
Closing remarks	Mr. Hideo TSUKAMOTO, JICA Malaysia Assistant Resident Representative

7.8.2 Main Topic Discussed

The main topics discussed in External Meetings at Ipoh and Kota Kinabalu are provided in the form of a comment sheet as summarized in **Tables 7.8.6 and 7.8.7**, respectively.

Table 7.8.6 Main Topics Discussed at Ipoh

	Question and Comments	Answer
1	Will the strategy incorporate treatment of leachate from the sludge disposed at the proposed dumping site?	The study advocates that proper leachate treatment must be provided for, but the decision would be based on the jurisdiction of concerned agency. For example, if the sludge is to be sent to a sanitary landfill area, then the jurisdiction on provision of treatment lays with the Ministry of Housing and Local Government, not MEWC. Commonly, every sanitary landfill will have its own leachate treatment for solid waste, therefore it is advised to direct the leachate produced by the sludge to the existing facility. The facility might need to be upgraded to cater for increased flow. Furthermore the sludge leachate is also a good stabiliser. It was also advised that in future planning of new landfill sites, all the concerned agencies/department should discuss and make a decision on the above issue.
2	Does CSTPs provide leachate treatment?	In design of CSTP, wastewater from sludge treatment is retuned to sewage treatment facility and is further treated.

	Question and Comments	Answer
3	Can proposed STP provide for treatment of leachate from a solid waste dumping site?	Certainly not. It was never a practise to treat leachate from a dumping site at a STP due to the characteristics of the leachate.
4	Can the effluent from STPs be used for other industries?	Yes but it is dependant of many factors. It was proposed that if the need arises, at the stage of implementation, reuse of treated water could be further studied in terms of demand and costs benefits.

Table 7.8.7 Main Topics Discussed at Kota Kinabalu

	Question and Comments	Answer
1	What will be the mitigation measures for offensive odour related to sewage treatment plants?	Anaerobic conditions are one of the primary causes of odour. Therefore, the solution is to have aerobic systems. Another solution would be to have covered treatment systems and enclosures at points where odour is to be expected. Providing adequate buffer zones and odour treatment facilities is to be considered too.
2	Although there are no water intake points within the Study Area, the discharge will eventually drain into the sea. Will the effluent be treated to Standard A as there are recreational areas in coastal zones?	The plant will be designed to meet 20mg/L BOD effluent discharge based on DOE's Standard A. Provided the effect is severe or it is a requirement.
3	What is the basis used for PE projections?	The PE projections were based on the future land use method and also structure plan. These projections are just an approximation as both the land use plan and structure plan are being formulated by DBKK.
4	Will the STP be designed to treat oil and grease and is this taken into account in terms of cost?	It is not standard practice to design STPs to treat oil and grease. This has to be tackled at source by installing grease traps and effective enforcement by local authorities to ensure that measure is complied with.
5	Will reuse of sludge be included in the strategy?	Reuse of sludge such as compositing is planned in the strategy.
6	The approval from the DOE in terms of a feasibility study for site suitability will have to be obtained prior to this project being carried out.	The relevant authorities will be consulted in the event this catchment study is be implemented by the local government or any other agencies concerned.

7.9 Feedback on IEE of trial studies to Revised Guideline

Based on the social consideration and initial environmental examination that was carried out during the trial studies of Ipoh and Kota Kinabalu, the draft Guideline was partly revised.

From the examination and feedbacks received, it was concluded that it is best to include two addition items in the summary sheet of Sewerage Catchment Strategies. The summary sheet is a new introduction that is currently being proposed for the revised guideline Vol.1 Part B. The two additional items are Land Status of STPs and Special Conditions (e.g. National Heritage Area, Sanctuary and etc).

These two items was introduced to assist in confirming the extent of impact to local economy and the possibility of damage to natural environment during the stage of construction.

These items are expected to be effective information for ensuring smooth implementation of sewerage projects that were proposed within a strategy.